CATALYSING SMART ENGINEERING AND RAPID PROTOTYPING
Generally, there is a solid knowledge base in the CE area, however, not enough structured and connected. This affects efficiency of regional development ecosystems. To tackle these challenges, 3DCentral project strives for establishing and anchoring a practicable, user-friendly, replicable and future robust system of new strong structures – so called Knowledge Axes for the Central Europe (KACE), repeatable processes (CE Brain Base) and leading-edge demonstration cases in format of CE flagship projects.

The main structures, processes and outputs are all transnationally oriented. 3DCentral unites highly competent partners with strong networks & capitalisation to guarantee appropriate “money for value” as well as to tighten and boost the linkages and capacities amongst the relevant technology and innovation actors of smart engineering and rapid prototyping in CE area.

The 3DCentral project aims to connect "islands of innovation" into a stable network of regions for innovation. It is focused on smart engineering & rapid prototyping where a substantial, current & future emerging market for Central Europe (CE) cooperation partners is visible.
BUILDING A TRANSNATIONAL HUB FOR COMMON KNOWLEDGE

3DCentral brings together Project Partners who represent technology hubs and expertise across Central Europe. All of these partners have an extensive network of organisations, companies, clusters, research institutions, who carry knowledge and expertise related to smart engineering and rapid prototyping.

All the good practices and associated lessons learnt are derived from real-life examples to which the Project Partner has been exposed. This ultimately means that Project Partners have good access to the organisations involved in the good practice and can more easily facilitate cooperation and the aforementioned competence enhancement that makes up a key output of this project. The methodology behind is composed of two major steps:

1st step

identification of Smart engineering & rapid prototyping solutions offered by SMEs and research institutions in each region.

2nd step

out of identified regional solution providers Good Practices and lessons learnt were selected and described by each partner.
The good practice examples also include innovative network approaches for knowledge transfer in certain regions, which demonstrates that certain Partners are recognising the importance of early development of knowledge architecture structures within their regions to enhance their market response capabilities.

Idea behind the concept was to identify possibilities which could be transferred via pilot actions and in later stages as follow up project.
1. **Process optimization** - multinational company supported by solution of a start-up company
2. **Manual and machine assisted wood carving of sacral art** - from traditional to smart services
3. **Textile SMART Monitoring** - remote monitoring of the test machines among customers
4. **Additive Manufacturing Robot** - for Continuous Fibers Composites / easy up / down scaling
5. **Development of an education robot cell** - for the Talent Center- Graz / adopted to be used by pupils between the ages of 13 and 15.
6. **Driverless transport Automotive** - memory based navigation system with pre-programmed paths; more efficient than optical sensors and AR tags.
7. **Live Video Remote System** - the opportunity for an expert to support and guide the process via Live-broadcasting
8. **Robot cell inclusive test bench** - which automatically assembles the locking systems and then quality checks this system in the test bench (used in rail transport).
9. **Smart³** - an innovation network, connecting over 100 members from science and research, art and design, social sciences, production companies, architecture and construction, the automotive industry, medical engineering and more, for improving product design and development by smart materials.
10. **FiberCheck** - a sensor system for continuous detection and monitoring of damages within fibre-reinforced plastics.
11. **Laserscan data analysis with virtual reality** - a new IT product was created that is able to treat 3D laserscan data in immersive virtual reality environments by cooperation of two companies.
12. **Virtual trade fair for special purpose machine manufacturer** - feasibility of using a virtual reality (VR) presentation for exhibiting a machine
13. **Perception Analytics** - a social-media analytics solution that provides insights into real-time public perception trends by following several social media networks
14. **Development of sail system** with inhibition of induced drag effect for radical improving of aerodynamic performance.
15. **Power quality improvements in production process** - a modular system engineered to effectively and economically optimize power quality, providing guaranteed energy savings, through reductions in power demand and power consumption
16. **Automobile chassis welding** line which consists of four separate devices.
17. **Using of 3D printing in production process** - a new separate development lab inside the production area which allows to the students to visit and learn the processes and practicing the new technologies and also manage research activities for PHD students
18. **Robotised welding line** - Process of production of compressed air tanks is fully automated from the delivery of components to the moment when the final products reach the station for marking the finished products; use of 5 robots that weld the tanks and clean the welds
19. **Mechanical Engineering in Railway Production**
20. **SLS application for preparation elements for medicine / clamp used for vain closure during surgical operations**
22. **Rapid Prototyping for society** - educational project “3D Printing in Schools” where pupils can learn the basics connected with using a 3D printer, design their own, first model and create an object by using 3Doodler.
Through the consolidation of regional and national strategies in the area of Smart Engineering and Rapid Prototyping as well as partners’ competences, 11 content-related Knowledge Axes for Central Europe (KACE) were identified. The KACE is conceived as modular system or the management of knowledge, cooperation and transfer involving a critical mass of target groups and stakeholders.

Each KACE topic is divided into subtopics by partners of the project, after which different cooperation actions were identified in order to help partners prepare for further activities of the project. On the other hand, the modular system approach also helps Associated partners and external stakeholders to identify opportunities related to R&D projects, trainings or/and strategic actions.
<table>
<thead>
<tr>
<th>KACE Topic</th>
<th>KACE description</th>
<th>Partner Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additive Manufacturing</td>
<td>Technologies for additive manufacturing and hybrid technologies for production</td>
<td>PK, IWU</td>
</tr>
<tr>
<td></td>
<td>systems</td>
<td></td>
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<tr>
<td>3D Design Engineering Scanning Simulation</td>
<td>Technologies and process optimisation for 3D design and engineering, including</td>
<td>IDM, PBN</td>
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<td></td>
<td>tools and methodologies</td>
<td></td>
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<tr>
<td>Smart and functional materials</td>
<td>New materials exploration such as nano-materials as well as integrated computational</td>
<td>IWU, PK</td>
</tr>
<tr>
<td></td>
<td>materials engineering</td>
<td></td>
</tr>
<tr>
<td>Digital life</td>
<td>New technologies and production processes for personalisation and low volume</td>
<td>TPL, EVO</td>
</tr>
<tr>
<td></td>
<td>manufacturing of health-improving products</td>
<td></td>
</tr>
<tr>
<td>Technologies for sustainable manufacturing</td>
<td>Development and implementation of sustainable manufacturing systems reducing total</td>
<td>AFIL, TPL</td>
</tr>
<tr>
<td></td>
<td>resource and circular economy</td>
<td></td>
</tr>
<tr>
<td>Virtual and augmented reality for manufacturing</td>
<td>Factory and product planning, prototype development, acceleration and implementation</td>
<td>WRS, IDM</td>
</tr>
<tr>
<td>Value-added virtual supply chains</td>
<td>Digital and virtual factory, technologies 4.0, cyber-physical systems, Internet</td>
<td>PTP, AFIL</td>
</tr>
<tr>
<td></td>
<td>of Things, Big Data and the e-Eloud</td>
<td></td>
</tr>
<tr>
<td>Smart Services</td>
<td>The development of value-added services to support the smart engineering and rapid</td>
<td>PBN, CAM</td>
</tr>
<tr>
<td></td>
<td>prototyping, e.g. smart maintenance</td>
<td></td>
</tr>
<tr>
<td>Robotics (components, monitoring and intelligent</td>
<td>Use of flexible robots augments intelligence, automates certain processes and</td>
<td>KPT, WRS</td>
</tr>
<tr>
<td>robots)</td>
<td>creates new forms of worker-robot interaction</td>
<td></td>
</tr>
<tr>
<td>Mechatronics (sensor)</td>
<td>Synegistic combination of mechanical engineering, electronic control and systems</td>
<td>CAM, PTP</td>
</tr>
<tr>
<td></td>
<td>thinking in design of products and manufacturing processes</td>
<td></td>
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<tr>
<td>Brain Base</td>
<td>Anchoring best practice knowledge transfer through shared tools, methodologies</td>
<td>EVO, KPT</td>
</tr>
<tr>
<td></td>
<td>and training</td>
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</tr>
</tbody>
</table>
In order to effectively develop a transnational roadmap, each project partner contributed with information on EU level as well as trends and regional situation for each KACE Topic. The information gathered allowed the project partners to generate KACE Action plans reflecting partners and regions interested as well as transfer potentials. Moreover, KACE Action plans are representing the solid ground for joint activities as R&D projects which present the basis for capitalization, trainings in the format of Moodle platform and strategic actions in format of workshops with key stakeholders.

For discussing complex issues, visualisation is essential. Therefore, the KACE Action plan is in a visual format in order to keep the overview on the various actions proposed or already defined.
SUBTOPIC 1: F.E DEVELOPMENT OF 3D PRINTING TECHNOLOGY

- SME CUSTOMISATION OF 3D PRINTING
- CHAMBER INVOLVEMENT
- SPECIAL ENGINEERING SKILLS
- IMPROVING 3D TECHNOLOGY FOR METALS
- FLAGSHIP PROJECT

2017 Q2 Q3 Q4 Q1 2018 Q2 Q3 Q4 Q1 2019 Q2 Q3 Q4 Q1 2020 Q2
### KACE TOPIC 2: 3D DESIGN/ENGINEERING/SCANNING/SIMULATION

**Lead Partner:** IDM  
**Supporting Partner:** PBN

- 3D Design for SMES
- Support for 3D Design für 3D Printing
- 3D Simulation
- Developing Simulation Laboratories
- 3D Scanning
- Quality Assessment Projects
- Implementation of 3D Design Culture
- Increasing Usage of CAE Tools
- Improve Quality Control in the Manufacturing Sector

### KACE TOPIC 3: SMART AND FUNCTIONAL MATERIALS

**Lead Partner:** IWU  
**Supporting Partner:** PK

- Broader Usage of Smart Materials
- New Technological Communication
- Smart and Functional Materials for Medical Usage
- Smart Health
- Pooling Expertise in the Field of Smart Materials
- Enhance Market Abilities of Smart Materials
- Enabling Improved Medical Treatment
- Push Paradigm Shift in Products
# KACE Topic 4: Digital Life

**Lead Partner:** TPLJ  
**Supporting Partner:** EVO

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Digital Life / Digital Health Network of Hubs</td>
<td>Enabling SMEs/Startups Commercialisation and Access to Prototype Series Manufacturer</td>
</tr>
<tr>
<td>Identification of Main Challenges / Service Development by Open (Collaborative) Innovation Principles</td>
<td></td>
</tr>
<tr>
<td>Digital Life / Digital Health User Center &amp; Smart Learning</td>
<td></td>
</tr>
<tr>
<td>Standardisation and Dev. Protocols, IPR/Branding in Digital Life</td>
<td></td>
</tr>
</tbody>
</table>

# KACE Topic 5: Technologies for Sustainable Manufacturing

**Lead Partner:** AFIL  
**Supporting Partner:** TPLJ

<table>
<thead>
<tr>
<th>Circular Economy</th>
<th>Raise Awareness on the Topic of Circular Economy and Regional Excellences</th>
<th>Foster the Establishment of New Interregional Initiatives or Partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Materials and Production Technologies</td>
<td>Raise Awareness on the Topic of Circular Economy and Regional Excellences</td>
<td>Foster the Establishment of New Interregional Initiatives or Partnership</td>
</tr>
</tbody>
</table>

*Note: The table structure and content reflect the given text and align with the requirements.*
### KACE Topic 6: Virtual and Augmented Reality for Manufacturing

**Lead Partner:** WRS  
**Supporting Partner:** IDM

- Operator 4.0
- Wearable Computing for Shopfloor Workers
- Virtual Acceptance
- Product Acceptance on the Basis of 3D Models
- Virtual Training
- Establishing Virtual Training Methods

### KACE Topic 7: Value-Added Virtual Supply Chains

**Lead Partner:** PTP  
**Supporting Partner:** AFIL

- Lean Supply Chain
- Implementation of Lean Supply Chain Methods / Solutions
- Smart Supply Network
- Cloud Based / Mobile Technology / Predictive Analytics
- Responsive Manufacturing
- Big Data and Predictive Analytics

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**LEAD PARTNER: WRS**

**SUPPORTING PARTNER: IDM**

- Increasing Competitiveness for European SMES
- New Application Field of Virtual Techniques
- Public Awareness and Understanding of Virtual Training

**LEAD PARTNER: PTP**

**SUPPORTING PARTNER: AFIL**

- Identification Areas Using Unnecessary Resources
- Enabling Companies to Implement Smart Supply Network
- Implementation of Responsive Manufacturing
### KACE TOPIC 8: SMART SERVICES

**Lead Partner:** PBN  
**Supporting Partner:** CAM

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Twinning</td>
<td></td>
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<tr>
<td>Customization of Digital Twinning</td>
<td>Toward Regional SMES</td>
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<tr>
<td>Application Service Based on AM and Sensor-Technologies</td>
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<tr>
<td>Process Monitoring of Various Technologies</td>
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</tbody>
</table>

### KACE TOPIC 9: ROBOTICS (COMPONENTS, MACHINES AND INTELLIGENT ROBOTS)

**Lead Partner:** KPT  
**Supporting Partner:** WRS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Robotics for SMES</td>
<td></td>
</tr>
<tr>
<td>Theses and Engineering Works in Collaboration with Industry</td>
<td></td>
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<tr>
<td>Development &amp; Dissemination of Service Robotics</td>
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<tr>
<td>Developing Robotics Laboratories</td>
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<tr>
<td>Popularisation and Use of Customer Robotics</td>
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<tr>
<td>Robotic Contests and Hackathons</td>
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<tr>
<td>Implementation of Robotic Solutions in SMES</td>
<td></td>
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<tr>
<td>Increasing Presence of Robotics in Civil Services</td>
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<tr>
<td>Improve Quality of Life, Health and Well-Being of the Society</td>
<td></td>
</tr>
</tbody>
</table>
### KACE TOPIC 10: MECHATRONICS

**LEAD PARTNER:** CAM  
**SUPPORTING PARTNER:** PTP

- **MECHATRONICS FOR SMES**
- **MECHATRONICS EVO-LABS FOR SMES**
- **PROCESS MONITORING IN AM**
- **PROCESS MONITORING OF VARIOUS AM TECHNOLOGIES**

### KACE TOPIC 11: CE BRAIN BASE

**LEAD PARTNER:** TPLJ  
**SUPPORTING PARTNER:** EVO

- **TRANSFER MANAGEMENT**
- **KNOWLEDGE MANAGEMENT**
- **INNOVATIONS MANAGEMENT**
The perfect way to enhance knowledge on rapid Prototyping is to join online training courses. On the 3DCentral e-learning tools platform you can find courses in smart engineering and rapid prototyping: the most important technologies of the future. The content of the courses has been developed by all the partners of the consortium which established a network of regions of innovation active in rapid prototyping and smart engineering technologies. Methodological courses cover subtopics as knowledge management, transfer management, and tools. Each of Thematical courses is devoted to a specific technology: additive manufacturing, 3D design, engineering, scanning and simulation, smart and functional materials, digital life, technologies for sustainable manufacturing, virtual and augmented reality for manufacturing, value added virtual supply chains, smart services, robotics, mechatronics - and focused on practice.
Core activities of the project are reflected in cooperative knowledge to boost the linkages and capacities amongst technology and innovation actors. Hypertree – an IT based tool supporting identification and mapping of transfer and innovation processes was developed. Due to its main advantage - visualisation of competences and technology fields within the regions of the project consortia – it helped to connect »islands of innovation« into a stable network of regions for innovation.
3D CENTRAL

MECHATRONICS

ADDITIONAL MANUFACTURING

CE BRAINBASE

ROBOTICS

3D DESIGN/ENGINEERING/SCANNING

SMART AND FUNCTIONAL MATERIALS

VIRTUAL REALITY FOR MANUFACTURING

VALUE-ADDED VIRTUAL SUPPLY CHAINS

SMART SERVICES

DIGITAL LIFE
A model »knowledge and innovation transfer process« was developed in order to elaborate the identified applications, to find potentials for knowledge transfer and collaboration and support the creation of partnership system. Several transfer applications have been identified or initiated at physical meetings between project partners on Tech & Inno Camps and conferences, with all together 33 applications for transnational transfer and innovation processes elaborated.
NETWORK OF KNOWLEDGE INNOVATION TECHNOLOGY TRANSFER SCOUTS TO FOSTER TECH AND INNO COOPERATION

Johannes Brunner, IDM, Automotive and internationalisation

Kurt Matzlert, University Innsbruck, International Management

Michael Riedl, Fraunhofer Italia, Automation and mechatronics

Sarah Hedden, Mind consult & Research GmbH, Cooperation project development expert

Nowak Dominik, Husarion, IOT & Rapid prototyping

Fabio Floreani, Consorzio Intellimech, Scouting and matching of technology partners

Andrea Jester, Neurosubianco Srl, Expert on international R&D project development

Borut Zrim, Pomurje Technology Park, Business modelling and market research expert

Tomaž Zadravec, Pomurje Technology Park, Digital marketing in ICT, tourism and food domain

Agnieszka Żyra, Cracow University of Technology, Management and Production engineering

Dominik Wyszyński, Cracow University of Technology, Mechanical engineering

Anna Boratyńska-Sala, Cracow University of Technology, Production engineering and innovation management
Ferenc Tolner, AM-Lab, Production and innovation manager

Ali Abdallah, Campus02, Expert on rapid prototyping for sensing and microfluidic applications and for simulation of microfluidic systems

Viktoria Ilger, Evolaris, Innovation management expert

Walter Hannes, Evolaris, Innovation management and industry 4.0 expert

Roman Elsner, Fraunhofer IWU, Smart structures and materials

Kenny Pagel, Fraunhofer IWU, Leader Actuators and Sensors for Smart Structures and Materials with a focus on Machine Tool Building

Primož Kunaver, Primum d.o.o., Innovation management and technology transfer expert

Gunther Riegel, Manufature-BW e.V., Project development expert

Mojca Cvirn, expert on EU projects management, Focus on healthcare sector

Mathias Stickel, Innovationhouse Deutschland GmbH, Knowledge and technology transfer expert

Walter Schrittwieser, Business model innovation and research for future trends and change management

Monika Machowska, Expert on business development and international R&D project development
TRANSNATIONAL HUB FOR PILOT CASES AND CAPITALISATION
Tech & Inno Camps – a result-oriented training concept

- Connecting experts
- Encourage knowledge sharing
- Focused on smart engineering technologies in CE
- Showcasing the solutions
- Hands-on workshops
- Developing new initiatives and projects as a result of moderated networking
- Getting together key stakeholders on transnational level
- Promoting best practices and lessons learnt related to 3DCentral objectives

Throughout the 3DCentral lifetime
14 Tech&Inno Camps were organised

- IDM TIC on Additive Manufacturing, 3D design / Engineering/ Scanning, Bozen, 2016
- AFIL TIC on Technologies for Sustainable Manufacturing, 3D design / Engineering/ Scanning, Milan, 2018
- CAMPUS02 TIC on Additive Manufacturing 3D Design/ Engineering/ Scanning, Mechatronics (sensors, monitoring and control), Graz, 2017
- CAMPUS02 TIC on Additive Manufacturing 3D Design/ Engineering/ Scanning, Mechatronics (sensors, monitoring and control), Graz, 2018
- EVOLARIS TIC on Virtual and Augmented Reality for Manufacturing, Smart services, Graz, 2017
- CAMPUS02 TIC on Additive Manufacturing 3D Design/ Engineering/ Scanning, Graz, 2018
- Fraunhofer IWU TIC on Smart and functional materials, Dresden, 2018
- WRS TIC on Additive Manufacturing, Virtual and Argumented Reality for Manufacturing, Smart services, Value Added virtual supply chains, Stuttgart, 2017
- TPLJ TIC on Digital Life, Ljubljana 2017
- TPLJ TIC on Digital Life, Technologies for sustainable manufacturing, Brain Base, Bled, 2017
- PTP TIC on Value Added virtual supply chains, Murska Sobota, 2017
- PBN TIC on Smart services, 3D design / Engineering/ Scanning, Sombathely, 2018
- KTP TIC on Robotics, Virtual and Augmented Reality for Manufacturing, 3D design / Engineering/ Scanning, Krakow, 2017
- PK TIC on CE Brain Base, Additive Manufacturing, Krakow, 2017
The take-aways from the TICs could be summarised: We can not talk anymore about the digital business optimisation, we should discuss digital business transformation: products and services and new business models. Thus, also financing on the level of SMEs are shifting towards investing more into innovation.

Following lessons learned, a total of 11 flagship projects and 22 Transfer and Cooperation Actions were initiated during the project duration and realized beyond the end of the project. The flagship projects and transfer and cooperation actions directly serve the overall project goal to connect islands of innovation related to smart engineering and rapid prototyping in Central Europe and are briefly described below.
**HIGH*TECH:*NET** fosters research cooperation on an advanced level and in a transnational manner in Central Europe / Europe-wide / world-wide. Connecting high-tech RTD centres & companies for a joint research agenda.

**DIGITAL*LIFE:*NET** Enabler for innovation & entrepreneurship in Healthcare Tech with a vision to support community as knowledge and reference point.

The goal of **SMART*GROWTH:*NET** is to develop the common transnational support structure (Digital Innovation Hubs from CE) to create links between RIS3 stakeholders and promote stronger strategic collaboration between regions and companies.

CE Brain Base aims to sustain, enrich & enhance the outputs of 3DCentral’s modular learning system and Knowledge Axis in Central Europe regions.

**The Service*Lab:*NET** is converting complex knowledge into smart products and services by applying the latest digital technology to create value for the manufacturing sector.

**A2B:*NET** strengthens cooperation between R&D centres and supports the creation of important solutions for additive manufacturing as well as fields of robotics and automation.

**SMART4REGION:*NET** is about fostering cooperation and transfer for future innovation in the smart engineering arena, starting with applications in the automotive innovation ecosystem and generating transnational ecosystem.

**RMIH:*NET** is a network of Regional Manufacturing Innovation Hubs facilitating the connection and exchange of available knowledge in the Central Europe area.

**CBC:*NET** network of smart engineering CBC projects and strategic partners.

**ADDED*VALUE:*NET** uses a trans-regional model to improve manufacturing efficiency.
SUCCESS STORIES

By implementing 3DCentral project Pannon Business Network gained knowledge about smart factory solutions, smart services & additive manufacturing. Based on this experience and thanks to 3DCentral network Pannon Business Network managed to open his own spin-off tech transfer company with the name amLAB specialised for the application and presentation of most recent manufacturing technologies. The team consists of multidisciplinary professionals with economic, engineering, technological and medical background.

amLAB

All success stories are available
https://www.youtube.com/watch?v=n6RexN1PgZo&
Digital Life Ecosystem – a Dynamic Community

By implementing 3DCentral project Technology Park Ljubljana successfully connected stakeholders in order to boost advantage from interdisciplinary innovation and cross-sector alliances in digital healthcare. The digital healthcare ecosystem has been elevated into a dynamic community promoting positive aspects of digitalisation in healthcare and provide support services to health-tech-based solution providers, including startups. The ecosystem has already transcended into a FabLab TPLJ. In numbers: follow-up projects with funds granted, connected to transnational alliances, +40 SMEs supported, 4 showcase and mobility events, +375 attendees.

VR Expo

The VR Expo demonstrates Virtual Reality applications and use cases for engineering and business solutions. The exhibition addresses professional visitors as well as young talents. Solution providers from 40 technology companies as well as research institutes demonstrate actual VR and AR applications and solutions. The visitors can test large VR installations and VR Labs, Tech Talks and networking events offer opportunities to meet the experts. The VR Expo is designed as an annual event and is part of the action plan of the KACE VA/AR for manufacturing.

In numbers: 15 stakeholders, 41 exhibitors, more than 700 visitors attended the VR Expo at 2 days, several mobility actions with partners AFIL, KTP, TPLJ,...
This project is co-financed by the Interreg CENTRAL EUROPE Programme funded under the European Regional Development Fund.