NAVIGATION CREWS

D.T1.1.3: REPORT ON TRANSNATIONAL TPA-FOCUSED CERIS3 NAVIGATION CREWS	VERSION 1 01 2020

TABLE OF CONTENTS

1. Introduction

The aim of this document is to show the current status of the work of the ten TPA focused CERIS3 Navigation Crews. The report should give an overview of the activities so far and show the next activities in the near future. The report is divided in two main sections. The first section gives an overview about the navigation crews and the project. Therefore, each description of the specific Navigation Crew is divided in five sections:

- Description of topics
- Navigation crew goals
- Planned pilot actions
- RIS3 stakeholder relationships
- Navigation crew members

The second part includes a conclusion and final recommendations for further steps in the Navigation Crew development.

2. Navigation Crews Overview

Within the S3HubsinCE project, ten partner organisations from Central Europe (AT, DE, HU, IT, HR, PL, SI) are creating a digital innovation network. In the project region there is a high potential for the implementation of regional innovation strategies (RIS3). Therefore, this project aims to support companies and organisations in the programme area in their innovation projects.

In this respect, 10 working groups (navigation crews) on various innovation topics have been formed within the project, which offer services for interested companies and organisations:

<table>
<tr><th colspan="4">CERIS3 Navigation Crews</th></tr>
<tr><td rowspan="3">Intellimech</td><td>Data Analytics, Complex Simulation and Modelling</td><td>Advanced & Smart Materials</td><td rowspan="2">Fraunhofer IWU</td></tr>
<tr><td>Machine Vision</td><td>Industrial IoT</td></tr>
<tr><td>Predictive Maintenance</td><td>Digital Marketing</td><td>Forschung Burgenland</td></tr>
<tr><td rowspan="2">TECOS</td><td>Factory & Process Automation</td><td>Innovation in a Circular Economy</td><td rowspan="2">Carinthian University of Applied Sciences</td></tr>
<tr><td>DI&I: Machinery</td><td>Design & Engineering for Additive Manufacturing</td></tr>
</table>

The main objective of the project partnership is to establish a transnational innovation network in Central Europe.

2.1. Data Analytics, Complex Simulation and Modelling

DESCRIPTION OF THE TOPIC

DATA ANALYTICS	COMPLEX SIMULATION	MODELLING

The creation of innovative technological solutions requires the use of advanced methods and tools to support their entire life cycle. In this context, the techniques and tools of modelling and simulation are of fundamental importance as they allow to create virtual representations of the physical systems and to be able to exploit them to simulate the behaviour of the system in the face of specific conditions of use.

There are different approaches to modelling and simulation that are adopted based on the information you want to get about the modelled system:

- The first approach concerns the discrete event simulations, in which the behaviour of the system is determined by the unleashing of events and their interrelations. Discrete event modelling is usually used to validate functional aspects and verify their evolution over time. This kind of approach allows to predict the production performance of a particular machine or plant and to plan the product mix in line with the production and profit objectives.
- The second approach involves the development of more articulated mathematical and numerical models that allows us to represent and focus the analysis on the physical behaviour of more complex processes, such as the distribution of forces and the dynamics of moving systems, the transmission of heat , the velocity and directions of fluid propagation. This kind of approach is used to support the design and prototyping phases in order to validate and verify the performance of solutions obtained through complex design choices.

Simulation is one of the enabling technologies of Digital twins that are virtual models of the physical world. Digital Twins use the Internet of Things, artificial intelligence and complex data in simulation models in order to create insights and support decision making.
Digital Twins connect the real and virtual world by collecting real-time data from the installed sensors. The data is evaluated and simulated in a virtual copy of the assets. After receiving the information from the simulation, the parameters are applied to real assets. The integration of data in real and virtual representations helps in optimizing the performance of real assets.

GOALS OF THE NAVIGATION CREW

GOAL 1	GOAL 2	GOAL 3
establish a transnational network/support system of companies and experts in the field	enhance the knowledge on data analytics and modelling in the project region	to raise awareness about this topic and the application possibilities

PLANNED PILOT ACTIONS

- creation of a network
- best practive exchange
- transfer events
- support Start-ups
- develop use cases
- connect to European entitites
- exchange knowledge with partners

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

IMECH

- Lombardy Intelligent Factory Association - AFIL
- Italian national intelligent factory cluster – CFI
- Lombardy Digital Innovation Hub

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment – European commission (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana

PBN

- DIHs in Hungary
- Ministry for National Economy
- National Research, Development and Innovation Office
- Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties
- Future Internet LivingLab Association (SME)
- 3D Printing Zrt LTD (R&D Center)
- iQor Global Services Hungary Kft. (Large enterprise)
- BPW-Hungária Kft.(Large enterprise)
- Széchenyi University (Győr;)
- BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
- PBN's currently running EU projects can be considered as synergic ones:
- 4STEPS: Interreg Central Europe
- DIH2: Horizon 2020 http://www.dih-squared.eu/
- CHAIN REACTIONS: (CE)
- Innopeer AVM: (CE):

HGK

- The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3
- Faculty of organization and informatics: https://www.foi.unizg.hr/en
- Faculty of Geotechnical Engineering: http://www.gfv.unizg.hr/en/index.html

BWCON

- Ministerium für Wirtschaft, Arbeit und Wohnungsbau
- de:hub Stuttgart (Future Industries)
- Digital Hub Südbaden (DIGIHUB Südbaden)
- Wirtschaftsregion Stuttgart

KTP

- Poland's Future Industry Platform
- Ministry of Entrepreneurship and Technology
- Marshall Office of Malopolska Region, Department of Corporate Governance and Economy
- Malopolska Regional Development Agency
- KTP DIH
- Interreg CE Projects:
- ECOS4inCE: Cross-border ecosystem for Industry 4.0

ECIPA

- Region of Veneto (managing the regional RIS3)
- Unismart
- Uni PD (competence center)
- CNA Digital Innovation Hub network at national level
- Fablab network in Veneto
- Veneto Innovazione
- Labs4sme project (INTERREG IT-AT)
- Talentjourney project (Erasmus KA2)

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
INTELLIMECH® CONSORZIO PER LA MECCATRONICA	bwcon TECOS Slovenian Tool and Die Development Centre Pannon Business Network PBN KRAKOW TECHNOLOGY PARK	Ecipa HUB 4.0 CNA Nordest HGK 1852 HRVATSKA GOSPODARSKA KOMORA

2.2. Machine Vision

DESCRIPTION OF THE TOPIC

COMPUTER VISION

Computer vision refers in broad terms to the capture of images and automation of their analysis with an emphasis on the extraction of pieces of information from images to make sense of them. So, for example through the use of Image Processing techniques (techniques primarily used to improve the quality of an image, convert it into another format, or otherwise change it for further processing) an image is converted to grayscale and then analyzed through Computer Vision to detect objects within that image.

In some ways, it is possible to think about Machine Vision as a child of Computer Vision, because it uses techniques and algorithms for Computer Vision and Image Processing, but the focus is more on specific applications.

In fact, Machine vision traditionally refers to the use of computer vision in an industrial or practical application or process where it is necessary to execute a certain function or outcome based on the image analysis done by the vision system.

The target is to extract information from an image on an automated basis. The information extracted can be a simple good-part/bad-part signal, or more a complex set of data such as the identity, position and orientation of each object in an image. It differs from image processing, where the output is another image. The information can be used for such applications as automatic inspection and robot and process guidance in industry, for security monitoring and vehicle guidance.

The components of a basic computer vision and machine vision system are the generally the same:

- An imaging device, usually a camera that contains an image sensor and a lens.
- An image capture board or frame grabber may be used (in some digital cameras that use a modern interface, a frame grabber is not required).
- Lighting appropriate for the specific application.
- A computer, but in some cases, as with “smart cameras” where the processing happens in the camera, a computer may not be required.
- Image processing software.

GOALS OF THE NAVIGATION CREW

GOAL 1	GOAL 2	GOAL 3
establish a transnational network of companies and experts in this field of research	identify the needs of companies at European level	start new collaborations in the machine vision field

PLANNED PILOT ACTIONS

- awareness raising
- network creation
- exchange best practice examples
- foster cooperation

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

IMECH

- Lombardy Intelligent Factory Association – AFIL
- Italian national intelligent factory cluster – CFI
- Lombardy Digital Innovation Hub

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment – European commission (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana

MEMBERS OF THE NAVIGATION CREW

LEADER	LEARNER
INTELLIMECH® CONSORZIO PER LA MECCATRONICA	TECOS Slovenian Tool and Die Development Centre

2.3. Predictive Maintenance

DESCRIPTION OF THE TOPIC

PLANNED MAINTENANCE	CONDITION-BASED MAINTENANCE	PREDICTIVE MAINTENANCE

Maintenance approach has changed in the last years, moving from Repair Maintenance to Preventive Maintenance: the first one is run-to-failure maintenance which takes place only when a breakdown occurs, while the second one expects to carry out maintenance intervention before the fault occurs, in order to avoid long unscheduled downtime.

Preventive maintenance can be declined according to different approaches:

- Planned maintenance, which expects periodic maintenance interventions based on the average life of the system. This is time-based preventive maintenance, which sets a periodic interval to perform maintenance intervention regardless of the health status of a physical asset.

- Condition-based maintenance, which expects to carry out maintenance interventions according to need indicated by condition monitoring, which aims at promptly detecting, diagnosing, signalling and highlighting any deviation from the nominal operations of machines. Condition-based maintenance refers to diagnostic as the process of detection, isolation and identification of faults when they occur by monitoring the weak signals of a physical asset.

- Predictive Maintenance, which aims at predicting the future trend of the equipment health conditions, according to prognostics approach. Predictive maintenance refers to prognostic as the process that attempts to predict faults or failures before they occur and projects the Remaining Useful-Life of a physical system through the use of automated methods.

GOALS OF THE NAVIGATION CREW

GOAL 1	GOAL 2	GOAL 3
creation of a transnational network of companies and experts	identifying the needs of companies at European level and defining strategies for helping them	develop knowledge and skills in this area

PLANNED PILOT ACTIONS

- networking
- exchange best practice examples
- Inform policy stakeholders
- awareness raising

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

IMECH

- Lombardy Intelligent Factory Association - AFIL
- Italian national intelligent factory cluster - CFI
- Lombardy Digital Innovation Hub

PBN

- DIHs in Hungary
- Ministry for National Economy
- National Research, Development and Innovation Office
- Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties
- Future Internet LivingLab Association (SME)
- 3D Printing Zrt LTD (R&D Center)
- iQor Global Services Hungary Kft. (Large enterprise)
- BPW-Hungária Kft.(Large enterprise)
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- Innopeer AVM: (CE)

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- Fablab network in Veneto
- Veneto Innovazione
- Labs4sme project (INTERREG IT-AT)
- Talentjourney project (Erasmus KA2)

FB

- Provincial government
- Industrial Association
- Economic Chamber
- DIH-Ost
- Haus der Digitalisierung
- DIH-Ost
- Haus der Digitalisierung: https://www.virtuell-haus.at/
- FH Burgenland
- Akademie Burgenland
- Wirtschaft Burgenland
- Initiative "Start Up Burgenland"
- Energie Burgenland
- Project "Smart Up", Interreg

HGK

- The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3
- Faculty of organization and informatics
- Faculty of Geotehnical Engineering
- **Current EU project:** Greenomed (Interreg MED) https://greenomed.interreg-med.eu/
- Mediterranean Trans-Regional Cooperation for green manufacturing innovation

CUAS

- Part of 1 DIH to be established in Carinthia
- BABEG
- University Klagenfurt
- KNOW Center Graz

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
INTELLIMECH® CONSORZIO PER LA MECCATRONICA	Pannon Business Network PBN KÄRNTEN University of Applied Sciences	Ecipa HUB 4.0 CNA Nordest FORSCHUNG Burgenland RESEARCH & INNOVATION HGK 1852 HRVATSKA GOSPODARSKA KOMORA

2.4. Factory & Process Automation

DESCRIPTION OF THE TOPIC

FACTORY AUTOMATION	PROCESS AUTOMATION

Factory automation (FA) is defined as the use of control systems for operation of machinery and processes. Factory automation applications have evolved greatly in the recent past, growing in size and complexity. Today, industrial devices such as robots, programmable logic controllers (PLCs), and industrial PCs (IPCs) embed powerful logic capabilities that allow modification of their behaviour, depending on an evaluation of the surrounding environment and on interactions with other devices. FA is widely employed in the manufacturing of chemicals, plastics, fertilizers, paper products, automobile assembly, aircraft production, and food processing as some examples. The benefits of automation include increased productivity, improved quality and consistency, and reduced human labour costs.

A **Process automation** or Process automation system (PAS) is used to automatically control a process. Process automation involves using computer technology and software engineering to help power plants and factories in industries as diverse as paper, mining and cement operate more efficiently and safely. The PAS often uses a network to interconnect sensors, controllers, operator terminals and actuators. A PAS is often based on open standards in contrast to a DCS (distributed control system), which is traditionally proprietary. In the absence of process automation, plant operators have to physically monitor performance values and the quality of outputs to determine the best settings on which to run the production equipment. Maintenance is carried out at set intervals. This generally results in operational inefficiency and unsafe operating conditions. Process automation simplifies this with the help of sensors at thousands of spots around the plant that collect data on temperatures, pressures, flows and so on. The information is stored and analyzed on a computer and the entire plant and each piece of production equipment can be monitored on a large screen in a control room. Plant operating settings are then automatically adjusted to achieve the optimum production. Plant operators can manually override the process automation systems when necessary.

GOALS OF THE NAVIGATION CREW

GOAL 1

to improve national and international cooperations

GOAL 2

identify ways on how to make Factory & Process Automation more accessible

GOAL 3

to enhance the knowledge on Factory & Process Automation

PLANNED PILOT ACTIONS

- exchange best practices
- organize tailored events
- establish cooperations
- increase awareness of the automation possibilities
- provide support for SMEs

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

IMECH

- Lombardy Intelligent Factory Association - AFIL
- Italian national intelligent factory cluster - CFI
- Lombardy Digital Innovation Hub

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment - European commis-sion (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana
- Urząd Marszałkowski Województwa Małopolskiego (engl. Marshal Office of Malopolska Region, Department of Corporate Governance and Economy)

BWCON

- Ministerium für Wirtschaft, Arbeit und Wohnungsbau
- de:hub Stuttgart (Future Industries)
- Digital Hub Südbaden (DIGIHUB Südbaden)
- Wirtschaftsregion Stuttgart

KTP

- Poland's Future Industry Platform
- Ministry of Entrepreneurship and Technology
- Marshall Office of Malopolska Region, Department of Corporate Governance and Economy
- Malopolska Regional Development Agency
- KTP DIH
- Interreg CE Projects:
- ECOS4inCE: Cross-border ecosystem for Industry 4.0
- InNOW InnoEnergy Central Europe
- H2020 projects:
- BOWI: Boosting Widening Digital Innovation Hubs

FB

- Provincial government
- Industrial Association
- Economic Chamber
- DIH-Ost
- Haus der Digitalisierung
- DIH-Ost
- Haus der Digitalisierung: https://www.virtuell-haus.at/
- FH Burgenland
- Akademie Burgenland
- Wirtschaft Burgenland
- Initiative "Start Up Burgenland"
- Energie Burgenland
- Project "Smart Up", Interreg

HGK

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- Faculty of organization and informatics
- Faculty of Geotehnical Engineering
- **Current EU project:** Greenomed (Interreg MED) https://greenomed.interreg-med.eu/
- Mediterranean Trans-Regional Cooperation for green manufacturing innovation

CUAS

- BABEG

MEMBERS OF THE NAVIGATION CREW

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2.5. DI&I Machinery

DESCRIPTION OF THE TOPIC

INDUSTRIAL MACHINERY	DATA INTEGRATION

Industrial machinery and equipment is by definition machinery and equipment used by a manufacturer in a manufacturing establishment. Machinery is any mechanical, electrical or electronic device designed and used to perform some function and to produce a certain effect or result. The word includes not only the basic unit of the machinery but also any adjunct or attachment necessary for the basic unit to accomplish its intended function. The word also includes all devices used or required to control, regulate or operate a piece of machinery, provided such devices are directly connected with or are an integral part of the machinery and are used primarily for control, regulation or operation of machinery. Jigs, dies, tools, and other devices necessary to the operation of or used in conjunction with the operation of what would be ordinarily thought of as machinery are also considered to be machinery.
Industrial machinery and equipment also represents tangible personal property or other property that has a depreciable life of at least 3 years or more and that is used as an integral part in the manufacturing, processing, compounding, or production of tangible personal, i.e. commercial property for sale. A building and its structural components are generally considered as not being industrial machinery and equipment

For machine learning to be effective and analysis to be comprehensive, enterprises must utilize data from the greatest possible variety of sources, which is called **Data Integration**. A machine learning algorithm is only as good as the data used to train it. Although there is an abundance of enterprise data, much of it is still not easy to find or use. This type of data is called dark data. Enterprises are struggling to throw light on this dark data and make use of it.

Data integration systems are increasingly looking to use machine learning-based approaches for finding and highlighting the islands of useful data in the vast ocean of dark data (and thus improve analytics). Metadata is gaining a stronger emphasis and is being captured explicitly or inferred with help of machine learning. Some examples are the use of machine learning in the inference of schema, data distribution, and common value patterns.

GOALS OF THE NAVIGATION CREW

GOAL 1	GOAL 2	GOAL 3
to define deliverables, tangible and intangible (products and/or technologies), towards integrated 3D design, concurrent workflows, total data compatibility and management	to raise awareness of the companies to overcome the digitalization gap	to establish new cooperations and exchange

PLANNED PILOT ACTIONS

to exchange best practices	to build strong cooperations	to offer support for start-ups
to organise tailored events	to learn from other partners	to spread new values

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment – European commis-sion (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana
- Urząd Marszałkowski Województwa Małopolskiego (engl. Marshal Office of Malopolska Region, Department of Corporate Governance and Economy)

KTP

- Poland's Future Industry Platform
- Ministry of Entrepreneurship and Technology
- Marshall Office of Malopolska Region, Department of Corporate Governance and Economy
- Malopolska Regional Development Agency
- KTP DIH
- Interreg CE Projects:
- ECOS4inCE: Cross-border ecosystem for Industry 4.0
- InNOW InnoEnergy Central Europe
- H2020 projects:
- BOWI: Boosting Widening Digital Innovation Hubs

IMECH

- Lombardy Intelligent Factory Association - AFIL
- Italian national intelligent factory cluster - CFI
- Lombardy Digital Innovation Hub

HGK

- The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3
- Faculty of organization and informatics
- Faculty of Geotehnical Engineering
- **Current EU project:** Greenomed (Interreg MED) https://greenomed.interreg-med.eu/
- Mediterranean Trans-Regional Cooperation for green manufacturing innovation

PBN

- DIHs in Hungary
- Ministry for National Economy
- National Research, Development and Innovation Office
- Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties
- Future Internet LivingLab Association (SME)
- 3D Printing Zrt LTD (R&D Center)
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- BPW-Hungária Kft.(Large enterprise)
- Széchenyi University (Győr;)
- BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
- PBN's currently running EU projects can be considered as synergic ones:
- 4STEPS: Interreg Central Europe
- DIH2: Horizon 2020 http://www.dih-squared.eu/
- CHAIN REACTIONS: (CE)
- Innopeer AVM: (CE)
- IFKA Public Benefit Non Profit Ltd. for the Development of the Industry

CUAS

- Part of 1 DIH to be established in Carinthia
- BABEG
- University Klagenfurt
- KNOW Center Graz

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
TECOS Slovenian Tool and Die Development Centre	Pannon Business Network PBN	INTELLIMECH CONSORZIO PER LA MECCATRONICA KRAKOW TECHNOLOGY PARK HGK 1852 HRVATSKA GOSPODARSKA KOMORA KÄRNTEN University of Applied Sciences

2.6. Advanced & Smart Materials

DESCRIPTION OF THE TOPIC

PIEZOCERAMICS	Shape MEMORY ALLOYS	RHEOLOGICAL FLUIDS

Materials technology is a key technology for the future and calls for a paradigm shift in the product: The fusion of functions and structures. Our particular focus is on smart materials that combine these elements. “Appropriate smart materials include piezo ceramics, shape memory alloys or electromagnetically activated fluids and polymers.

The direct piezoelectric effect consists of the ability of certain crystalline materials (ceramics) to generate an electrical charge in proportion to an externally applied force. The direct effect is used in force transducers. According to the inverse piezoelectric effect, an electric field parallel to the direction of polarization induces an expansion of the ceramic.

Thermal shape memory alloys are materials which offer the special ability to “remember“ and re-assume their original shape following permanent plastic distortion below a specific critical temperature by means of heating up above this temperature. A reversible austenite-martensite phase transformation is required for the development of the shape memory effect. Analogous to steel the high temperature phase of the material is also described as austenite and low temperature phase as martensite. In an ideal situation the austenite ▫ phase is converted into the martensite phase as a result of shear. Due to diffusion-free rearrangement processes in relation to the atoms this generates a change in the stacking sequence of the crystal lattice levels and therefore a change in the structure of the crystal lattice.

One of the advantages to using shape-memory alloys is the high level of recoverable plastic strain that can be induced. The maximum recoverable strain these materials can hold without permanent damage is up to 8% for some alloys (compared with a maximum strain 0.5% for conventional steels).

Rheological fluids are generally a dispersion composed of a base fluid (usually a type of oil) and particles. These particles can be either polymer- in electrorheological fluids (ERF) or iron based in magnetorheological fluids (MRF). If a field is applied so-called particle chains are built and the fluid changes its viscosity to the point of becoming a viscoelastic solid.

That causes a blockage in the flow cross-section, and thus increases the fluid flow resistance. Hence the fluid is able to transmit forces. The yield stress and so the transmittable forces can be controlled very accurately by varying the field intensity. Rheological fluids are thus considered valuable for manipulating viscosity over a wide range without consuming or degenerating the substance.

GOALS OF THE NAVIGATION CREW

GOAL 1

Co-create a robust support network based on knowledge exchange to achieve new innovative applications of advanced & smart materials on a European Level.

GOAL 2

Improve the knowledge regarding Advanced and smart materials e.g. take part in relevant (international) conferences and meetings

GOAL 3

Contact experts to establish new co-operations in the field of advanced materials and improve our knowledge as well as experience of good practices

PLANNED PILOT ACTIONS

Workshops	Examples smart network	Promote transfer events
Support regional network	Best practice examples	Field audits

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

IWU

- Saxony is Vanguard region and Fraunhofer IWU is leading this region
- Staatsministerium für Wirtschaft, Arbeit und Verkehr (= state ministry of economy, work and transport) Looking for relevant actors and stakeholders in the field and establish new cooperations with them

BWCON

- Ministerium für Wirtschaft, Arbeit und Wohnungsbau

PBN

- 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)
- Ministry for National Economy
- National Research, Development and Innovation Office
- Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties Looking for relevant actors and stakeholders in the field and establish new cooperations with them

CUAS

- Silicon Austria Labs (SAL), Infineon Technologies, Material Center Leoben
- CISMAT, Talente Pipeline – both are research initiatives resp. projects of CUAS.
- BABEG, KWF

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR
Fraunhofer IWU	Pannon Business Network (PBN); bwcon; Kärnten University of Applied Sciences

2.7. Industrial IOT

DESCRIPTION OF THE TOPIC

INDUSTRIAL INTERNET OF THINGS (IIOT)	INTERNET OF THINGS (IOT)

The term *Internet of Things (IoT)* evolved a lot in the last decade. For the purpose of this Navigation Crew (NC) it simply denotes the interconnection of heterogeneous (computing) devices, such as mobile phones, machines or humans, over a network beyond physical limitations like companies, buildings or a Local Area Network (LAN).

The term *Industrial IoT (IIoT)* considers the IoT in an industrial context. This means that systems in manufacturing and production environments communicate with each other and use industrial communication channels and technology, e.g. OPC-UA[1] or PROFINET[2].

IIoT targets at connecting different manufacturing data sources, such as sensors, business logic for making decisions based on sensor data, machines to be controlled and other actuators (e.g. industrial robots) in order to increase efficiency of production and make manufacturing smarter. This approach implies the architecture in the following figure.

[1] https://industrie40.vdma.org/en/viewer/-/v2article/render/16617359 (visited 15th October 2019)

[2] https://www.profibus.com/technology/profinet/overview/ (visited 15th October 2019)

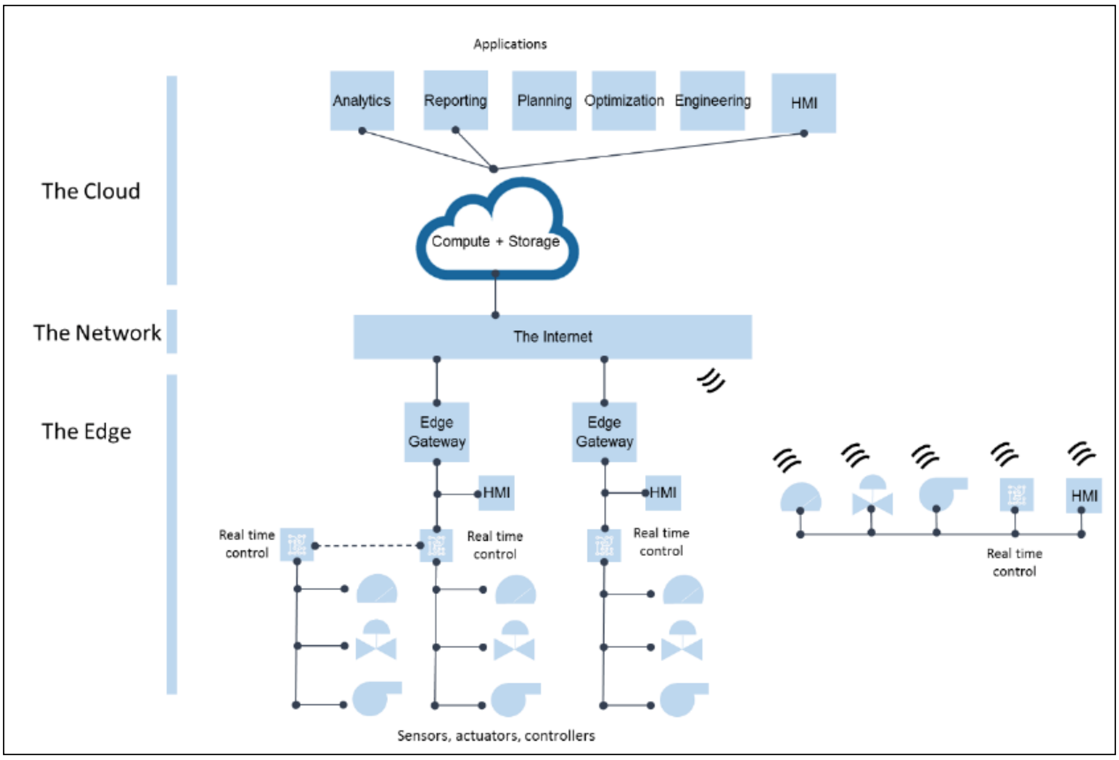

Figure 1 General IIoT Architecture (by Paul McLaughlin, Rohan McAdam - The Undiscovered Country: The Future of Industrial Automation)

This architecture shows the separation into multiple specific layers, whereas the *Cloud* layer needs not to be connected necessarily via the internet. All of the depicted layers may reside in the same company-wide IT infrastructure like a private cloud. This kind of computing architecture is called *Fog Computing*[3] which significates to build up a hierarchical architecture where every layer has a specific purpose and data is processed further as near at the data source as possible in order to decrease the throughput of data and to minimise latency.

According to **Figure 1** pre-processing data, e.g. filtering or aggregating, is realised at the edge of the whole architecture.

[3] Bonomi, F., Milito, R., Natarajan, P. and Zhu, J., "Fog Computing: A Platform for Internet of Things and Analytics", Bessis, N. & Dobre, C. (ed.), Big Data and Internet of Things: A Roadmap for Smart Environments, Springer, Cham, 2014, Vol. 546, pp. 169-186

GOALS OF THE NAVIGATION CREW

GOAL 1	GOAL 2	GOAL 3
creation of a thematic European network	identifying the current state of potential SMEs regarding the implementation of IIOT competencies	spreading culture/knowledge on this topic in order to raise awareness

PLANNED PILOT ACTIONS

- workshops
- show best practice examples
- develop use cases
- network

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

IWU

- Saxony is Vanguard region and Fraunhofer IWU is leading this region
- Staatsministerium für Wirtschaft, Arbeit und Verkehr (= state ministry of economy, work and transport)
- EU project TRINITY
- Regional Saxonian DIH Smart Systems Hub
- Regional Saxonian DIH InnoSax

IMECH

- Lombardy Intelligent Factory Association - AFIL
- Italian national intelligent factory cluster - CFI
- Lombardy Digital Innovation Hub
- IOTTY project
- BALLUFF project

ECIPA

- Region of Veneto (managing the regional RIS3)
- Unismart
- Uni PD (competence center)
- CNA Digital Innovation Hub network at national level
- Fablab network in Veneto
- Veneto Innovazione

PBN

- DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)
- IFKA Public Benefit Non Profit Ltd. for the Development of the Industry
- Future Internet LivingLab Association (SME)
- 3D Printing Zrt LTD (R&D Center)
- iQor Global Services Hungary Kft. (Large enterprise)
- BPW-Hungária Kft.(Large enterprise)
- Széchenyi University (Győr;)
- BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
- PBN's currently running EU projects can be considered as synergic ones:
- 4STEPS: Interreg Central Europe https://www.interreg-central.eu/Content.Node/4STEPS.html
- DIH2: Horizon 2020 http://www.dih-squared.eu/

FB

- Provincial government
- Industrial Association
- Economic Chamber
- DIH-Ost
- Haus der Digitalisierung
- DIH-Ost
- Haus der Digitalisierung: https://www.virtuell-haus.at/
- FH Burgenland
- Akademie Burgenland
- Wirtschaft Burgenland
- Initiative "Start Up Burgenland"
- Energie Burgenland
- Project "Smart Up", Interreg

HGK

- The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3
- Faculty of organization and informatics https://www.foi.unizg.hr/en
- Faculty of Geotehnical Engineering http://www.gfv.unizg.hr/en/index.html
- **Current EU project:** Greenomed (Interreg MED) https://greenomed.interreg-med.eu/
- Mediterranean Trans-Regional Cooperation for green manufacturing innovation

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment - European commis-sion (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana
- Urząd Marszałkowski Województwa Małopolskiego (engl. Marshal Office of Malopolska Region, Department of Corporate Governance and Economy)

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
Fraunhofer IWU	INTELLIMECH® CONSORZIO PER LA MECCATRONICA Pannon Business Network PBN Ecipa HUB 4.0 CNA Nordest TECOS Slovenian Tool and Die Development Centre	HGK 1852 HRVATSKA GOSPODARSKA KOMORA FORSCHUNG Burgenland RESEARCH & INNOVATION

Interreg CENTRAL EUROPE European Union European Regional Development Fund
S3HubsinCE

2.8. Innovation in a Circular Economy

DESCRIPTION OF THE TOPIC

OPEN INNOVATION COMMUNITY	ADDITIVE MANUFACTORING	PROTOTYPING PROCESSES

The term open innovation community is used to promote an awareness of innovation in the information age. This helps to maintain the secrecy and silo mentality of traditional research laboratories. The InnoCentive Open Innovation Platform is used to publish calls of companies.

Innovative ideas related to these calls can be submitted by organizations or individuals. Furthermore, they are rewarded based on the quality of the results.

A circular economy is an economic system that reduces waste and targets the continued use of resources. Circulatory systems use sharing, repair, reclamation, recycling and recycling. The circular economy is to create a closed system that minimizes the use of resources and the generation of waste, pollution and emissions.

There is an Internet-based platform for connecting organizations or individuals which provides services for the design and engineering of products. Furthermore, the product systems are operated for the production of prototypes.

Modern technologies of product design and production, such as additive manufacturing (3D printing), allow individuals and businesses to significantly reduce production costs. It also improves product planning and prototyping processes, as well as the quality and precision of products themselves. This means that individuals and small businesses can outsource to additive manufacturing in order to manufacture their prototypes and products cost-effectively and professionally.

The aim is to convert the ecosystem in the production of consumer goods to sustainability and a circular economy is to be created. The circular economy creates an adapted form of innovation management, recycling strategies or upcycling strategies.

The topic is of high relevance at regional and national level, as the use of targeted knowledge to accelerate internal innovation. In this context, businesses and individuals need real-time access to information and democratized production.

GOALS OF THE NAVIGATION CREW

GOAL 1

to develop a digital platform which connects fab lab infrastructure, manufacturing service providers, design experts and product engineering experts and the broad public

GOAL 2

to raise knowledge in the region

GOAL 3

to develop options on how to effectively use digital technologies to enhance inter-regional cooperation within the EU to reach a significantly higher state of development of circular economies

PLANNED PILOT ACTIONS

- to exchange best practices
- to foster cooperations
- to carry out pilot actions
- implementation of research results at university

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment – European commis-sion (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana

HGK

- The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3
- Faculty of organization and informatics https://www.foi.unizg.hr/en
- Faculty of Geotehnical Engineering http://www.gfv.unizg.hr/en/index.html
- **Current EU project:** Greenomed (Interreg MED) https://greenomed.interreg-med.eu/
- Mediterranean Trans-Regional Cooperation for green manufacturing innovation

FB

- Provincial government
- Industrial Association
- Economic Chamber
- DIH-Ost
- Haus der Digitalisierung
- DIH-Ost
- Haus der Digitalisierung: https://www.virtuell-haus.at/
- FH Burgenland
- Akademie Burgenland
- Wirtschaft Burgenland
- Initiative “Start Up Burgenland”
- Energie Burgenland
- Project “Smart Up”, Interreg

CUAS

- Kärntner Wirtschaftsförderungsfonds (KWF)
- Kärntner Betriebsansiedelungs- und Beteiligungsgesellschaft (BABEG)
- Interreg IT AT - E-Edu4.0 - engineering education
- Talente Pipeline - technical education of first level and secondary level students by the use of fab lab infrastructure
- AMAViS2 - Additive manufacturing in agile virtual systems for engineering of products and production processes

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
FH Kärnten University of Applied Sciences	TECOS Slovenian Tool and Die Development Centre; HGK 1852 Hrvatska Gospodarska Komora	Forschung Burgenland Research & Innovation

2.9. Digital Marketing

DESCRIPTION OF THE TOPIC

SOCIAL-MEDIA MARKETING	SEARCH ENGINE OPTIMISATION	ONLINE MARKET RESEARCH

Digitalization leads to changes in several divisions of a company. Therefore, marketing is not only a specific business tool anymore, it needs to be included in the overall business strategy. The boundaries between the fields of operation of a company (e.g. production, customer service, logistics, etc.) blur and the digitalization in marketing helps to optimize the link between those fields. Furthermore, researchers have identified that the relationship between digital technology and marketing is a key asset for the growth of SMEs. This highlights the importance of the topic "digital marketing".

Although digital marketing is a very broad term, this navigation crew focusses on three topics more in detail:

- Social Media Management / Marketing

  Social Media is a communication and marketing tool. The main concept is the direct "interaction with the customer. Social Media Marketing includes several social platforms like Instagram, Facebook, Youtube and co. (Amoako, Okpattah and Arthur 2019).

- Search Engine Optimisation (SEO)

  "SEO is the procedure to improve the ranking of websites for particular searching terms on search engines by managing incoming links and characteristics of websites." (Hung-Jia et al 2018 cited from Malaga 2010).

- Online Market Research.

  Online market research also belongs to the topic of digital marketing. It is used to obtain information from digital sources about customers and/or markets. Due to the increased usage of the internet, it is a common method in today's economy (Poynter 2010).

GOALS OF THE NAVIGATION CREW

GOAL 1

The main goal is to help SMEs in the progam area to carry out online marketing activities. The stakeholders are available to use the tools according to their needs and to participate in the offered pilot actions.

GOAL 2

Another goal is to enhance national platforms for digital innovation and to connect relevant stakeholders / RIS3 players.

GOAL 3

In additon, one goal is to raise the awareness of the importance of digital marketing.

PLANNED PILOT ACTIONS

- Workshops (for starters and professionals)
- information events
- initial consultations / consulting sessions
- blended learning sessions
- open lectures
- marketing guides
- best practice examples

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

FB

- Provincial government
- Industrial Association
- Economic Chamber
- DIH-Ost
- Haus der Digitalisierung
- DIH-Ost
- Haus der Digitalisierung: https://www.virtuell-haus.at/
- FH Burgenland
- Akademie Burgenland
- Wirtschaft Burgenland
- Initiative "Start Up Burgenland"
- Energie Burgenland
- Project "Smart Up", Interreg

KTP

- Cooperation with media & promotion agencies and media houses
- Cooperation with start-ups and SMEs from IT & ICT sector
- Cooperation with chambers of industry and commerce and SMEs organisations
- KTP DIH
- Universities: AGH University of Science and Technology, Cracow University of Technology, Jagiellonian University, University of Economy
- SMEs: Autenti, Kangur Electronics, Astor, Protech, ES-System, Game Desire, Velis
- LE: Comarch, Fideltronik, EC Group, Woodward Poland, Transition Technologies, Merit Poland, Wisniowski
- Małopolska Regional Development Agency
- Municipality of Krakow, Marshall Office of Malopolska Region

IWU

- Sächsisches Staatsministerium für Wirtschaft und Arbeit
- Innosax
- TRINITY
- Wirtschaftsförderung Sachsen
- Kompetenzzentrum Mittelstand 4.0

HGK

- The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3
- Faculty of organization and informatics https://www.foi.unizg.hr/en

BWCON

- Ministerium für Wirtschaft, Arbeit und Wohnungsbau
- Digital Hub Südbaden (DIGIHUB Südbaden)
- Stuttgart Media University
- MFG Baden-Württemberg
- Special Interest Groups (SIG)
- Wirtschaftsregion Stuttgart

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
FORSCHUNG Burgenland RESEARCH & INNOVATION	bwcon	KRAKOW TECHNOLOGY PARK; Fraunhofer IWU; HGK 1852 HRVATSKA GOSPODARSKA KOMORA

2.10. Design & Engineering for Additive Manufacturing

TOPICS OF THE NAVIGATION CREW

ADDITIVE DESIGN	PRINTING TECHNIQUES	PRODUCT INNOVATION PROCESS

Companies have to take due account difficulties the principles of additive manufacturing in their product development process. Therefore, the economic benefits of 3D printing are not sufficiently understood and used. Regional manufacturing companies are unwilling to tolerate the significant costs because 3D printing is not suitable for all purposes. However, including these experts in the internal product innovation process is not affordable or have violates IP issues. In addition, the problem case is not limited to the product innovation process but also useful in terms of process innovation.

There is already education in the field of additive design. Introduction of programmes for students, teachers and staff. The focus is on the printing techniques Fused Deposit Material (FDM), Stereolithography (STL), Selective Laser Melting (SLM) on polymers, ceramics, metals and mixed material approaches.

The roll-out knowledgebase of design methods to 3D printed structures includes functional grouping of components, topology optimization, combination of electrical conductors and mechanical elements. The Knowledgebase supports designers and engineers in the development of new products.

A network of services provides services in terms of contract manufacturing, engineering and simulation, research laboratories and fab laboratories for self-service activities. Existing 3D printing hubs will also be integrated.

GOALS OF THE NAVIGATION CREW

GOAL 1

Developing a digital platform which connects fab lab infrastructure, manufacturing service providers, design experts and product engineering experts together with the broad public.

GOAL 2

new cooperations among experts in the field

GOAL 3

improve the knowledge of the project partners on this topic

PLANNED PILOT ACTIONS

- cooperations
- workshops

CURRENT RIS3 STAKEHOLDER RELATIONSHIPS

CUAS

- Kärntner Wirtschaftsförderungsfonds (KWF)
- Kärntner Betriebsansiedelungs- und Beteiligungsgesellschaft (BABEG)
- Interreg IT AT – E-Edu4.0 – engineering education
- Talente Pipeline – technical education of first level and secondary level students by the use of fab lab infrastructure
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- Economic Chamber
- DIH-Ost
- Haus der Digitalisierung
- DIH-Ost
- Haus der Digitalisierung: https://www.virtuell-haus.at/
- FH Burgenland
- Akademie Burgenland
- Wirtschaft Burgenland
- Initiative "Start Up Burgenland"
- Energie Burgenland
- Project "Smart Up", Interreg

IMECH

- Lombardy Intelligent Factory Association - AFIL
- Italian national intelligent factory cluster - CFI
- Lombardy Digital Innovation Hub
- IOTTY project
- BALLUFF project

PBN

- DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)
- IFKA Public Benefit Non Profit Ltd. for the Development of the Industry
- Future Internet LivingLab Association (SME)
- 3D Printing Zrt LTD (R&D Center)
- iQor Global Services Hungary Kft. (Large enterprise)
- BPW-Hungária Kft.(Large enterprise)
- Széchenyi University (Győr;)
- BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
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- DIH2: Horizon 2020 http://www.dih-squared.eu/

TECOS

- Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)
- ADMA assessment – European commission (http://www.adma.ec/)
- Jožef Stefan Institute Ljubljana (IJS)
- ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/)
- Slovenian Government office for development and European cohesion policy (SVRK)
- Technology Park Ljubljana

MEMBERS OF THE NAVIGATION CREW

LEADER	CONTRIBUTOR	LEARNER
KÄRNTEN University of Applied Sciences	INTELLIMECH CONSORZIO PER LA MECCATRONICA TECOS Slovenian Tool and Die Development Centre	Pannon Business Network PBN FORSCHUNG Burgenland RESEARCH & INNOVATION

3. Conclusions

The project partners have a lot of experience in different CE significant Technology Priority Areas (TPAs). The partners are currently active in various innovative technology areas and have already gained a considerable amount of experience. The project partner structure and the participation of supporters and learners in the Navigation Crews gives a good mixture of different know-how and thematic knowledge. The respective lead partners of the individual navigation crews have the necessary expertise in the technology area to coordinate and structure the activities of the partners, set thematic priorities and give support in the planned activities.

The navigation crew members have contacted and exchanged with each other several times. The "T1.1.1_01.Handbook & Concrete Guidance for CERIS3 Navigation Crew Competency & Cooperation Matrix" was developed by the partners and finalized to a large degree. The concrete content will change to a small extent through the experience and knowledge gained by the stakeholder interviews which will be carry out in WP T1.

At the moment the specific topics of the respective navigation crews have been identified and described in detail. The chosen topics of the navigation crews are related to innovative technology fields and highly relevant at regional level in order to increase the competitiveness of the stakeholders in the programme regions. The partners highlighted the priorities of their planned work and agreed on the common goals.
Thematically almost all topics of the navigation crews are located in technical technology areas. Therefore, it offers the possibility to find and apply synergies within the navigation crews. This would not only benefit the participating companies, but also the navigation crews, as events can be used jointly.

All partners already have a strong network with regional RIS 3 stakeholders. There are many strengths and cooperation possibilities in the project consortium. The main objective of S3HubsinCE is to create a common support structure based on Digital Innovation Hubs (DIHs). Most partners already established a cooperation to existing regional DIHs. Access to the DIHs and their infrastructures should help the regional industry, and SMEs in particular, to make progress and facilitate digitization. This will also improve the networking of transnational networks and promote cooperation between the individual institutions.

In addition, it is suggested that at each partner meeting, all navigation crews will present their current work and their pilot actions that they carry out at the moment. This will help the project partners to stay up to date and also to find even more thematic synergies.

3.1. Next Steps

In a next step, the planned activities for possible pilot actions have to be defined in detail. It is important to generate quality benefits for regional stakeholders through these activities. The final actions will be finalized after the stakeholder interviews have been carried out. This should help to discuss the needs of enterprises in the programme region in order to carry out targeted pilot actions. Once the obstacles and challenges have been identified, a common strategy how to overcome them can be developed.

Likewise, content-related links to existing or similar projects must be identified. Crew members should list other synergic projects that could be connected to the crew. This leads to use as many synergies as possible and to force the efforts in the respective thematic areas.

4. Annexes

On the next pages all full handbooks of each navigation crews are inserted.

NAVIGATION CREW

DATA ANALYTICS, COMPLEX SIMULATION AND MODELLING

INTELLIMECH®
CONSORZIO PER LA MECCATRONICA

Content

Introduction

Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	
1.0.3	Fraunhofer IWU Info added	Melanie Kießner	20.12.2019

Table 1: Release history of this document.

Crew: definitions and examples

NAVIGATION CREW – DATA ANALYTICS AND ARTIFICIAL INTELLIGENCE

SPECIFIC TOPICS

Data Analytics, Complex Simulation and Modelling

DEFINITION

The creation of innovative technological solutions requires the use of advanced methods and tools to support their entire life cycle. In this context, the techniques and tools of modeling and simulation are of fundamental importance as they allow to create virtual representations of the physical systems and to be able to exploit them to simulate the behavior of the system in the face of specific conditions of use.

There are different approaches to modeling and simulation that are adopted based on the information you want to get about the modeled system:

- The first approach concerns the discrete event simulations, in which the behavior of the system is determined by the unleashing of events and their interrelations. Discrete event modeling is usually used to validate functional aspects and verify their evolution over time. This kind of approach allow to predict the production performance of a particular machine or plant and to plan the product mix in line with the production and profit objectives.
- The second approach involves the development of more articulated mathematical and numerical models that allow us to represent and focus the analysis on the physical behavior of more complex processes, such as the distribution of forces and the dynamics of moving systems, the transmission of heat , the velocity and directions of fluid propagation. This kind of approach is used to support the design and prototyping phases in order to validate and verify the performance of solutions obtained through complex design choices.

Simulation is one of the enabling technology of Digital twins, that are virtual models of the physical world. Digital Twins use the Internet of Things, artificial intelligence and complex data in simulation models in order to create insights and support decision making.
Digital Twins connect the real and virtual world by collecting real-time data from the installed sensors. The data is evaluated and simulated in virtual copy of the assets. After receiving the information from the simulation the parameters are applied to real assets. The integration of data in real and virtual representations helps in optimizing the performance of real assets

EXAMPLE

Discrete Event Simulation for production mangement

The creation of digital models of production systems enables the exploration of the characteristics of the systems and the optimization of their performance. These digital models allow experiments and hypothetical scenarios to be carried out without interfering with existing production systems. Comprehensive analysis tools, such as analysis of bottlenecks, statistics and graphs allow to evaluate the various production scenarios. The results provide the information needed to make quick and reliable decisions from the preliminary stages of planning.

Introduction

Motivation

<Motivate why the above described topic area/s is relevant at regional / national level? Motivation should be provided by each crew member and ideally supported by quantitative / qualitative evidence> Relevance can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.000 characters / member.

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
IMECH	Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of data analytics and complex simulation to monitor status of production and to improve design of products will become a question of competitiveness. In terms of business change, the key outcomes will be: • To study the behavior of a system in the design phase as if it were already in an operational condition • To have a decision making tool to reduce the possibility of making the wrong choice • Reduction of time to market, thanks to the reduction of design time and product optimization	Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in manufacturing fields concerning innovation, economic growth and development.
BWCON	Baden-Württemberg is currently setting priorities that correspond to the particular strengths of the state, production is one of them. Baden-Württemberg relies above all on its industrial strength, i.e. on	Germany is aware of its excellent starting conditions. It is the No. 1 mechanical engineering country in Europe, with over 150 years of production and innovation experience, a high-quality education

	digitization in mechanical engineering and automotive engineering (Industry 4.0). The HPC (High Performance Computing) state strategy is unique in Germany and has been rated as exemplary and innovative by the German Science Council and the German Research Foundation (DFG). The HPC infrastructure in Baden-Württemberg is mainly used for engineering simulations.	system and an excellent scientific and research landscape. Germany is also aware that the technologies of today cannot conquer the markets of tomorrow. That's why it is important for SMEs to reorient themselves, to review their own business models and, if necessary, to renew them. However, this is linked to an entrepreneurial and innovative mindset. At no other time do founders have such great opportunities as in times of technological revolution.
ECIPA	"Smart manufacturing" is one of the RIS3 four areas of regional specialization; these areas have been identified by the Veneto Region as the result of the expression of its productive system, of its scientific and technological excellences and of the innovative potential towards local and global markets. Among these four areas of regional specialization, "smart manufacturing" is the one with strongest incidence (39%) in terms of projects submitted at ERDF 2014-2020 calls. In 2018, the manufacturing sector represented the 11,8% of enterprises in Veneto (Rapporto Statistico Regione del Veneto, 2019). The socio-economic fabric of the Region is characterized by small and medium enterprises; there is still a broad gap between large and small businesses in the level of digitalization (Digital intensity indicator): high levels are present in 44.0% of companies with at least 250 employees and only in 12.2% of companies with 10 to 49 employees (Rapporto Statistico Regione del Veneto,	Veneto is one of the most competitive regions in Italy; it accounts for 9.25% of the national GDP. However, it shows a relatively low level of investment in RTDI and a de-specialisation in high technology sectors. The R&D intensity of Veneto is lower than the Italian average (1.34%) and the European one (2.04%). In 2017, about 2,6% of the employed population worked in high-tech sectors, below the Italian average (3.4%) and the European one (4%). Also due to its specialisation in traditional manufacturing, Veneto experiences difficulties in carrying out more intensive investments in innovation and in entering high added-value product markets. However, the percentage of its enterprises with innovative activities in 2014 was 53% (the highest rate in Italy), above the Italian average (45%). The Region also performs well in the patenting activity. Veneto is classified as an "Advanced Manufacturing and Clustering Region with no specialization in knowledge

	2019). This entails critical issues in terms of competitiveness for smaller companies. Among the macro trajectories set for RIS3 fine-tuning, specifically for what concerns “smart manufacturing”, special attention is devoted to data analytics, modelling and simulation. These are specifically mentioned among the tools which will allow to reach new organizational and productive models, sustainable productions and processes, advanced design and technologies for production, cognitive systems and automation.	activities". It has a high degree of specialization in high craftsmanship, a good presence of KIBS, a high rate of informal relationships that allow to make use of external expertise to generate a high rate of innovation activities. Therefore, advanced manufacturing is strategic for this territory which strongly contributes to the country economy and which needs to be sustained in gaining efficiency and stronger competitiveness at the global level, especially if considering the prevalence of small and medium sized manufacturing firms, often organized according to the most traditional systems. As an example: the Big Data Analytics market in Italy is worth 1.4 billion euros, and it is growing; however it is greatly concentrated in large companies (88% of spending), while SMEs are at 12%. The creation of efficient production processes should be pursued combining traditional know-how (at the basis of high quality), with digitalization, energy efficiency and organizational innovation.
PBN	The goal is to support the re-industrialization process in Western Hungary. Currently, the region is located at a relatively low end of the manufacturing value chain, and the goal is to realize its upgrade. Since mechatronics is decisive in the region, material science related to that, new material and composited development, additionally power train improvements are important.	One of the horizontal priorities of the Hungarian National RIS 3 Strategy is ICT and Services. Besides, advanced technologies in the vehicle and other machine industries are listed as sectoral priorities in the national strategic document. These priorities (horizontal + sectoral as well) include lot of subtopics, among others they are dealing with data analysis, simulation and modelling too. As a result these topics can be considered as national priorities.

	Autonomous vehicle drive testing and its applications are also in the focal point of the developments. SMEs and large enterprises located in the region must keep abreast of the technological development of the market, therefore the exploitation of Data Analytics, Simulation and modelling will be crucial fields of the near future in the region.	
TECOS	The topic is highly relevant at regional and national levels since the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and, expand the markets for external use of innovation, must clearly be an economic and societal priority. Within this context companies and individuals must get real-time access to information and democratized production… TECOS can provide broad expertise in the field of data analytics, complex simulation and modelling. Therefore these technical fields (topic 1) remain highly relevant for us as we would like to actively contribute, not only as a national player, but also above that – inter-regionally - as this navigation crew is set up… Knowledge provision and information transfer must be accelerated on all levels…	
HGK VZ	The Varaždin region is already recognized as a rather agile new industry centre in the Continental Croatia (NUTS 2), with an emerging regional economy, a promising technological and scientific infrastructure and a new university in its region. A rather distinctive feature of Varaždin-cantered region is the share of industry in its economy, reaching nearly 40 %, nearly 15 % points higher than the runner-up region. On the other hand, there is a significant lack in innovation in SMEs. The innovation value chain is not functional due to incoherent eco-system and difficulty to adopt and apply current technologies.	ICT sector in Croatia represent one of the key factors of the economic and social development and it is a key precondition to follow global technological advancement of all industry segments, research areas and niches. ICT development in Croatia covers 3 related segments of the global value chain: Internet of Things (communication software and platforms for interconnected objects), Big Data (acquisition, processing and analysis of data originating from physical and virtual world) and Internet-based services, all for application domains defined by TPAs.

	SMEs and mid-caps in North-Western part of Croatia need upgrading of competencies and performance in the digital economy, especially in setting up hypothesis about the real production problem and creating the large amounts of data and making the right decisions using them.	Croatia ranks 24th in Digital Economy and Society Index (DESI). The use of digital technologies by enterprises is close to average. Digital Public Services are slowly improving. However, Croatia's low performance in Connectivity could slow down the further development of its digital economy and society. All tools and topics which could improve integration of digital technology and business digitisation are of utmost importance at the very moment.
KTP	Artificial intelligence is one of the fields, that has been listed in the 7 smart specialisations of Małopolska region. AI is described detailed in the strategy as part of the larger specialisation – information and communication technologies. Commercial AI is clearly the domain of large metropolitan areas in Poland. These include Warsaw, the Tri-city area (Gdańsk, Gdynia and Sopot), Kraków, Poznań, Wrocław and the Katowice urban area. The two sectors of the economy, in which Polish AI companies offer services the most frequently, are analytics, big data and business intelligence (43%) together with sales, marketing, and advertising (37%). It should be noted that the third most popular sector is finance and insurance (28%). AI companies also often work in the area of internet of things and industry 4.0 (27%). It is a good sign. Manufacturing plays an important role in the Polish economy and makes up 20% of Polish GDP. Bearing this in mind, AI adoption in	Poland is currently in the phase of the transition from data collection to data analysis and AI models creation for implementation in public services and businesses. More and more companies in Poland notice the potential of AI. The research Digital Poland (2018) shows that there are more than 260 AI development companies operating in Poland. The number of companies which provide AI solutions and services has been growing rapidly since 2015. In recent years there has been a clear AI boom in Poland visible – half of the polish companies have introduced AI solution during the last 3 years. AI is clearly the domain of large metropolitan areas (each of them with over half million inhabitants) in Poland – 85% of the companies are located in 6 major polish cities (Warsaw, Wroclaw, Krakow, Poznan, Gdansk, Katowice). Over 30% of AI companies are located in Warsaw. Warsaw, Wrocław an Krakow together cover over 70% of polish competences in the field of AI.

	this area may suggest that the local manufacturing base will be prepared for global competition and better integration with the German industrial base. Definitely, implementation of AI in Industry 4.0 is on horizon of interest for Polish AI companies since Europe is strong in B2B markets and industry in general.	Two services most frequently provided by Polish AI companies are analytics, big data and business intelligence (43%) and sales, marketing and advertisement (37%). Companies often provide also services in the area of internet of things and industry 4.0 (27%). The major application of AI is image processing and recognition (62% of companies), data exploration (55%), recommender systems (52%) an natural language processing (43%).

Problem statement

<Are there any specific challenges that can already be identified by crew members. Please note and remember that a specific need assessment activity will be done under Activity 1.2. therefore, this first overview should ideally provide the main directions that will guide the need assessment activity. Again, each crew member should provide its point of view.

Challenges can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.500 characters / member

Crew Member	Main Challenges
IMECH	• Application and implementation of simulation and modelling technologies to the business processes of our member associated to solve real-work problems. In this way they can improve their competitivity on the market according to Intellimech mission: “An environment where our partners can catch the opportunities offered by new technologies”. • To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of simulation and modelling in italian SMEs. • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.

BWCON	• SMEs in particular require external support due to their limited human and financial resources. To this end, the main goal is to support innovative approaches and formats and use knowledge transfer to make existing knowledge and technologies more applicable in scientific and entrepreneurial fields, especially targeted to SMEs. • In order to exploit opportunities in production 4.0, they also need easier access to applications in the field of virtual reality or augmented reality (VR/AR). The application of Virtual Reality and Augmented Reality technologies enables companies to enhance production processes. Virtual Reality (VR) can be seen as a visualization and simulation technology, among other things, and as such also offers diverse application potentials. At present, however, there are still considerable technical and organizational barriers in the application for small and medium-sized enterprises.
ECIPA	• To spread the awareness of the added value of simulation and modelling technologies to the business processes to face real-work problems (addressing mainly to CNA associated companies and SMEs of the region) • To stress the need of “competence updating” in the specific field spreading an innovation culture in SMEs located in Veneto.
PBN	• The main barrier can be the permanently changing technological background, namely that digitalization processes are so fast that it is very hard to find out what are the real needs of SMEs. Doing a research about the exact needs of SMEs has to be very fast and actions have to be made as fast as possible. • According to the current statistics and analysis of the (Western) Hungarian companies are not developed and competent enough to utilise Data Analytics, Simulation and Modelling, so there is a principal gap between the current status and the desired status of the implementation of these technologies. • Spreading the information of the technology areas to SMEs is challenging
TECOS	• Similarly to the statement of IMECH, TECOS is intended to spread an innovation culture in the SMEs, not only among our cluster members, but broader within the tooling and related industries in Slovenia. It remains clear, that lack of competences represents the principal gap in the implementation of simulation and modelling into industrial use. Therefore we regard this as the main challenge.

	• To raise awareness locally, nationally, and above, of what can be achieved through effective practical use of data analytics, simulation and modelling. • The challenge to offer concrete practical and tangible solutions to SMEs. As we know the later – due to lack of information and other assimilarities – fail to recognize, what the market is able to ofter already in terms of available technology and know-how. This challenge therefore also deals with the concern of effective planning SMEs need to undertake in order to co-create future trends in their niches as opposed to only following them. • Last but not least – another challenge we recognize is directed towards establishing as many Open Innovation Communities as lead best-practice examples as possible – regionally and nationally. This will provide transparency and availability of market and tech information and hence accelerate fair market competition, which shall ideally include all economic subjects.
HGK VZ	• Difficulties to follow technological changes and rapidly introduce recent digital economy tools • Large outflow of highly educated professionals and consequent lack of technological knowledge • Lack of available financial resources for the business sector and as a consequence business sector, especially SMEs, is not ready to adopt the recent changes in technology • Lack of adequate linkages between different types of stakeholders (business sector, academia, R&D institutions …) and inadequate entrepreneurial climate for innovation
KTP	• demand for AI services in Poland is limited and this creates a natural tendency to reach for clients abroad. 73% of companies receive at least some of their revenue from clients abroad. 33% receive most of their revenue from foreign clients. • obstacle faced by companies implementing AI services - potential clients do not understand their own needs and, in effect, do not see the potential benefits arising from AI. • main barrier to the development of the Polish AI sector is not the absence of funding or expertise but still a very limited demand for solutions based on AI. B2B market dominated by state-owned enterprises which function in a conservative, quasi-market logic, and on the other hand, the sector of small and medium-sized enterprises still lag in the process of digital transformation. • lack of understanding of the company's own needs, so it cannot see the potential benefit arising from AI. • lack of AI understanding at the managerial level and poor general preparedness for implementation of AI solutions are among Polish companies and institutions a recurring theme.

	• need to much more educate CEOs and managers about AI and to raise awareness of AI by educating non-experts in order to improve the implementation of the technology • two services most frequently provided by Polish AI companies are analytics, big data and business intelligence (43%), together with sales, marketing and advertisement (37%) • companies often provide services in areas, such as financial services and insurance (28%), internet of things and industry 4.0 (27%). This may reflect the relative competitiveness and openness to innovations in the Polish financial and industrial sectors. • major application of AI is image processing and recognition with 62% of companies using AI in this area. Other popular applications are data exploration (55%), recommender systems (52%) and natural language processing (43%). • lack of necessary structured data to implement AI solutions – 38% of companies list this as an obstacle • lack of understanding the benefits that the implementation of AI solutions can bring. Many entrepreneurs see this, along with insufficient data, as the main obstacle. This may suggest that specific actions should be taken, so that the economy can take full advantage of opportunities offered by AI. One of the key elements is education, including both specialists implementing the technology, as well as potential clients and consumers.

References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
Artificial Intelligence: a European perspective	**JRC**	**Consorzio Intellimech**
Digital Transformation Scoreboard 2018: EU businesses go digital: Opportunities, outcomes and uptake	**European Commission**	**Consorzio Intellimech**
Artificial Intelligenge: on your marks	**Osservatorio A.I.**	**Consorzio Intellimech**

Top 10 Strategic Technology Trends for 2019: A Gartner Trend Insight Report	Gartner	Consorzio Intellimech
A Comprehensive AI-Enabled Predictive Maintenance Plan Starts With Business Understanding	Gartner	Consorzio Intellimech
Statistical Report “Rapporto Statistico Regione del Veneto”, 2019	Regione del Veneto	Regione del Veneto
DGR n. 216, 28/02/2017, all. A - Percorso di “Fine-Tuning”, RIS3 Veneto	Regione del Veneto	Regione del Veneto
RIS3 VENETO LA ROADMAP DI MONITORAGGIO, PRINCIPALI RISULTATI E NUOVE OPPORTUNITÀ (PowerPoint Presentation, Padova, 19/06/2019)	Regione del Veneto	Regione del Veneto
ec.europa.eu/growth/tools-databases/regional-innovation-	European Commission	ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto

monitor/base-profile/veneto		
Comunicato Stampa 21/11/2018	Osservatorio Big Data Analytics & Business Intelligence	www.osservatori.net/it_it/osservatori/comunicati-stampa/big-data-analytics-italia-mercato-2018
100 Radical Innovation Breakthroughs for the future	European Commission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	Available online in national language and in English, but it was downloaded by PBN.
Digitalisierungsstrategie der Landesregierung Baden-Wurttemberg (2017)	Ministerium für Inneres, Digitalisierung und Migration	https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/Digitalisierungsstrategie-BW.pdf
Policy for the Development of AI in Poland in the years 2019-2027		https://www.gov.pl/attachment/0aa51cd5-b934-4bcb-8660-bfecb20ea2a9
Map of the polish AI 2019		https://www.digitalpoland.org/assets/publications/mapa-polskiego-ai/map-of-the-polish-ai-2019-edition-i-report.pdf

Map of Polish Science in the field of AI 2019		https://www.digitalpoland.org/assets/publications/map-of-polish-science-in-the-field-of-ai/2019-map-of-polish-science-in-the-field-of-ai-v2.pdf
Slovenian Smart Specialisation strategy	Government office for development and European cohesion policy	chrome-extension://gphandlahdpffmccakmbngmbjnjiiahp/https://www.eu-skladi.si/sl/dokumenti/kljucni-dokumenti/s4_strategija_v_dec17.pdf
Action plan of Strategic research and development partnership Factories of the Future	SRIP TOP	chrome-extension://gphandlahdpffmccakmbngmbjnjiiahp/http://ctop.ijs.si/wp-content/uploads/file-manager/Dokumenti%20SRIP%20ToP/SRIP_ToP_Akcijski_nacrti_7_7_2017_Povzetek.pdf
Establishing decision by UNESCO on Center for Artificial intelligence research, to be located in Slovenia	Institute Jožef Stefan	http://pmis.ijs.si/sl/2019/11/27/generalna-konferenca-unesco-potrdila-sedez-mednarodnega-raziskovalnega-centra-za-umetno-inteligenco-v-ljubljani/

Table 2: Documents, which are referenced by this document.

Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)
2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)
3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

<Description of methods or tools which are applied in order to achieve the thematic topics are specified here.>

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
IMECH	Test Industria 4.0 – DIH (https://www.testindustria4-0.com/)	Regional Strategic community – AFIL (Work in progress)	ADMA assessment – European commission (http://www.adma.ec/)
BWCON	• Reifegrad Modell • Special Interest Groups (SIG)	• Hightech Summit • SIGs • Allianz 4.0: https://www.i40-bw.de/de/readiness-4-0/ • DIGIHUB Südbaden: https://www.digihub-	Smart Space (Alpine Space)

		suedbaden.de/digitalisierungs-check	
ECIPA	Digital innovation assessment CNA	Regional innovative Networks (Cluster and Industrial Networks): - IMPROVENET http://www.improvenet.it - M3 net https://www.venetoclusters.it/area-reti-innovative-regionali/m3-net - Veneto Innovazione	ADMA assessment - European commission (http://www.adma.ec/)
PBN	In the framework of another EU project of PBN called 4STEPS (further details can be seen here: https://www.interreg-central.eu/Content.Node/4STEPS.html) a transnational tool has been developed which measures RIS3 relevant SMEs in the point of view of needs and the level of adaptation to I4.0 themes. The transnational tool (online questionnaire can be filled here: https://4stepscrm.com/index.php?kitoltesboard&sys=startQuestionnaire The replies from SMEs have been being collected from August-October 2019 in the partnership, including Hungarian SMEs too		ADMA assessment - European commission (http://www.adma.ec/)
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)	Various national and regional strategic communities…	ADMA assessment - European commission (http://www.adma.ec/) (TECOS as an active partner within ADMA)

KTP	Individual meeting Workshop Questionnaires On-site visits	Digital assessment tool https://dojrzalosc40.delabapps.eu The main mission of the Platform of the Future is to act as an integrator of all stakeholders interested in Industry 4.0 as well as an accelerator of the digital transformation of Polish industry.	ADMA assessment – European commission (http://www.adma.ec/)

Table 5: List of available tools / methods.

Structure of the Navigation Crew

Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
IMECH	Contributor	X
BWCON	Contributor	
IWU	Learner	
ECIPA	Learner	
PBN	Contributor	
TECOS	Contributor	
HGK VZ	Learner	
KTP	Contributor	

Table 6: Structure of the Navigation Crew.

Strength and weaknesses

Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
IMECH	• Considerable skills developed in the field of data analytics and modelization thanks to the development of research projects for its members and thanks to its participation in funded projects • Structured network of experts, consisting of universities, consultants and suppliers	• Demo cases related to the work done for associate companies • Network of companies to carry out the development of use cases and their testing
BWCON	• Experience in technology transfer from research to industry and open innovation trainings. • Established network of industry experts and researchers.	• Strong network of companies (including SMS and small companies)
ECIPA	• Network of experts, namely universities, consultants and suppliers • Networking skills in the specific field • Basic skills developed in the field thanks to pilot actions in funded projects	Explore Innospaces platform (tool to match demand and supply of services 4.0 between SMEs and FabLab)
PBN	• With the cooperation of PBN an additive manufacturing center, called AM-LAB was established in 2017, and since then this laboratory has gained the DIH status. • The am-LAB is a service centre specialized on the application and	• In AM-LAB non-conventional and creative product design is realized by our market leader model softwares, in a cost efficient way. Products are featured in a realistic virtual environment during any phase of the development.

	presentation of most recent manufacturing technologies to develop smart end-user product in strong co-operation with our key customers. • In AM-LAB skilled and motivated multidisciplinary team of economists, engineers, medical staff, sales manager and international project coordinators work together who prefer lifelong learning • Advanced knowledge on simulation and modelling • 10 PBN employees attended to Data Analytics course to get to know/improve data analytics skills	• Cost- efficient data access and process are enabled by integration of digital manufacturing solutions • Maximised production capacity, real-time simulation of manufacturing, integration the new machine into production line.
TECOS	• Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. the tooling industry • Excellent expertise in engineering services and applied industrial research • Excellent expertise in product and material development • Very good institutional and political connections (nationally and EU-wide) • Excellent industrial references within the EU: https://www.tecos.si/index.php/en/about-us/references • Experience from dozens of success-fully executed technological projects • Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	• Very good EU-wide connections to European technology partners and customers (product development) • Excellent connections to our tool-and-die cluster members • Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/about-us/equipment • 22 highly skilled professionals employed full time, while also cooperating with many contractual external experts

HGK VZ	• Established connections with regional companies and academic community • The potential of ICT sector in region is high due to a existence of faculty of informatics in Varaždin and available HR can be a booster of the economic development	• Platforms and networks available from other implemented EU projects https://greenomed.interreg-med.eu/
KTP	• Existing Network of DIH partners (T-Mobile, ASTOR, University of Science and Technology in Krakow (largest polish technical university), Krakow University of Technology, Kosciuszko Institute (specialized in cybersecurity), BIMKlaster • Ecosystem of AI companies in Krakow area • Synergic projects • 20 external experts and mentors supporting KTP team	• DIH team (7 people) • Data Center - Cloud Computing Laboratory: 3 IT specialists (cloud computing, software development, security, IT projects management) • Business development: 7 specialists for business support & development (startups, business models, financing, solutions) • ScaleUp Accelerator: 4 specialists (business models, financing, solutions, cooperation between startups and large enterprises, presentations, negotiations, international expansion) • Krakow Living Lab: 2 specialists (living lab approach, products and services testing) • Krakow Living Lab - one of Poland's two living lab centres certified by ENoLL (European Network of Living Labs) where products and services can be tested and co-created with end-users involvement (team, methodology, experience, partners) • Moodle platform for on-line trainings within rapid prototyping, smart engineering & technology transfer areas

Conclusion provided by Crew Leader:

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Partner’s weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
IMECH	• Lack of knowledge related to the needs of EU foreign companies about data analytics and modeling • Lack of links at European level to structure a transnational competence network about data analytics and modeling
BWCON	• Co-create a robust support network based on knowledge exchange to address current challenges and barriers in the fully implementation and further deployment of advance manufactory technologies.
ECIPA	• Lack of applied / demo cases with SMEs • Lack of links at European level to structure a transnational competence network about data analytics and modeling
PBN	• Not sufficient knowledge yet of data analytics to carry out a professional data analytics job for a company • Data analytics knowledge should be improved, now this topic can be considered a perspective for the near future
TECOS	• While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain competences in this context. • Lacking knowledge in practical/technical establishment of Digital innovation plattforms. We would like to gain competences in this context.
HGK VZ	• Lack of knowledge on digital economy, especially how to resolve concrete business problems using data analysis • Incompetence to introduce changes that will lead to targeted improvement • Lack of supporting infrastructure, knowledge and international networking
KTP	• lack of established international connections in the field of AI • insufficient common structure (still in progress) at regional and national level to support SMEs in implementing AI (common platform with best practises, statistics data, reports)

Conclusion provided by Leader:

<1 page maximum>

Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
IMECH	• Create a transnational network of companies and experts in the field of data analytics and modeling • Identify the needs of companies at European level in order to start new collaborations in data analytics and modeling field
BWCON	Co-create a robust support network based on knowledge exchange to address current challenges and barriers in the fully implementation and further deployment of advance manufactory technologies.
ECIPA	• Identify common strategies and approaches in order to better support companies - despite their dimension/size - in the field of data analytics and modelling • Spread culture/knowledge on the topic (eg. Intellimech could share demo case(s) of applied simulation during a workshop carried out with Unismart or during a workshop carried out with CNA) • Enhance the platform Exploreinnospaces increasing demo cases • Identify/train local experts through international network of experts
PBN	• Improve the knowledge of the internal staff regarding data analytics • Leading additive manufacturing technologies will be constantly monitored and followed, enabling the applications of the latest developments in the focus areas. • Cooperation worldwide with the leading manufacturers is a must to be up-to-date with the technologies.
TECOS	• To concretely identify development options on how to effectively use digital technologies to enhance inter-regional cooperation within the EU (technology, society, environment) to reach a significantly higher state of development of circular economies and therefore environmentally friendly and accessible technologies for everyday lives. The later is to be applied to topic 1 in every aspect possible. • To ideally establish a living digital knowledge and innovation platform, which will include a network of SMEs, LEs and individual experts in the fields of data analytics, complex simulation and modelling.

	• To use the knowledge and information gained through project activities and direct the efforts into lowering information assimilarities in general. This is in the interest of better inclusion of all economic subjects into the markets and in the interest of accelerating their inter-regional cooperation.
HGK VZ	• To comprehend the opportunities offered by digital transformation and the changing needs of companies regarding data analytics and modelling • To contribute to creation of an international network which gathers relevant companies and tech experts able to support digital transformation regarding data analytics and modelling • To adopt specific knowledge and necessary skills regarding data analytics and modelling in order to offer the new values through a one-stop shop in the region • To raise awareness of companies to overcome the digitalization gap and improve intra/inter-regional and international collaboration
KTP	• to get deeper understanding and knowledge on AI • to establish international network for exchange of know-how and best practices • to create a system which promotes collaborative exchange, where individuals share their experiences in the field of AI for example by study visit etc.

Conclusion provided by Leader:

<1 page maximum>

Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? <u>Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered</u>.

Crew Member	Actions / initiatives / services
IMECH	• Some pilot actions will be carried on to spread an innovation culture and raise awareness and skills about the main issues of advanced production

	• Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics. • Exchange transnational best practices and foster cooperation with other Project Partners in advance manufactory systems to exchange knowledge and develop joint pilot actions. • Disseminate the project to policy stakeholder in order to create a European awareness concerning digitalization
BWCON	Specifically, bwcon looks forward to: • Organize and promote tailored transfer events, as well as participate in relevant stakeholder events. • Provide support to our regional ecosystem network of small and medium companies in integrating relevant topics of advance manufactory systems to their industries and businesses. • Exchange transnational best practices and foster cooperation with other Project Partners in advance manufactory systems to exchange knowledge and develop joint pilot actions.
ECIPA	We would like to use the pilot action phase to a) showcase concrete examples to our members (would be ideal to identify a small enterprise "champion", to stay close to the nature of our members); b) try to develop a use case to understand the process of introducing data modelling and simulation systems in small enterprise and demonstrate the benefits; c) connect to European entities (for instance Digital Innovation Hubs) that are already supporting small enterprises in this domain
PBN	Strong cooperation with PPs who are experts in the field of data analytics, simulation and modelling to improve our knowledge and might implement pilot action in this field
TECOS	Exchange transnational best practices and foster cooperation with other Project Partners and their stakeholders/companies in advance manufacturing systems to exchange knowledge and develop joint pilot actions. Organize promotional and awareness raising events Develop B2B and R2B cooperation. Test solutions
HGK VZ	• To learn from other partners having expertise in field of data analytics, modelling and simulation systems to gain internal knowledge and comprehend opportunities for business sector • To cooperate with other partner and contribute to creation of an international network and connect with other EU entities relevant for this field. • To spread intra –regionally the new values and by implementation of foreseen activities contribute to modernization of SME's sector.

KTP	• to support start-ups and SMEs from regional ecosystem in implementing AI in their businesses • to exchange transnational best practices and lessons learnt within study visit, B2B meetings, training platforms etc. • to organize tailored conferences, seminars, speed dating and industry weeks • to improve the strong cooperation with PPs who are experts in the field of AI to exchange knowledge and implement joint pilot action in this field.

Conclusion provided by Leader:

<1 page maximum>

S3 and DIH network

Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IMECH	• Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • ADMA assessment – European commis-sion (http://www.adma.ec/) (TECOS as project partner, TECOS as important regional stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) • Slovenian Government office for development and European cohesion policy (SVRK) • Technology Park Ljubljana	• 3Dhubs electronic knowledge base (e-portal)(https://www.3dhubs.com) and similar… • Lombardy Intelligent Factory Association – AFIL and similar… • Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/) • Other (various) academic and industrial relations are to be established during the course of the project, depending on their relevancy and practicality… • Etc.

ECIPA	• Region of Veneto (managing the regional RIS3) • Unismart • Uni PD (competence center) • CNA Digital Innovation Hub network at national level • Fablab network in Veneto • Veneto Innovazione	• Monitoris 3 (INTERREG Europe project) • Friuli Innovazione • NOITech Park Bolzano • Area Science Park
PBN	• 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics) • Ministry for National Economy • National Research, Development and Innovation Office • Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties	Looking for relevant actors and stakeholders in the field and establish new cooperations with them
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	Companies and other relevant stakeholders will be involved in the later phase accordingly.
BWCON	Ministerium für Wirtschaft, Arbeit und Wohnungsbau	
KTP	• Poland's Future Industry Platform • Ministry of Entrepreneurship and Technology • Marshall Office of Malopolska Region, Department of Corporate Governance and Economy • Malopolska Regional Development Agency	Looking for relevant actors and stakeholders in the field of AI and establish new cooperation's with them: • identification of relevant SMEs to increase their knowledge • identification of best practices of AI in Malopolska & Poland • identification of experts and specialists within TPA

Conclusion provided by Leader:

<1 page maximum>

Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder)	Other regional DIH connections to be established…
ECIPA	CNA DIH network	• Monitoris 3 (INTERREG Europe project) • Friuli Innovazione • NOITech Park Bolzano • Area Science Park
PBN	• Good cooperation with the 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well
BWCON	• de:hub Stuttgart (Future Industries) • Digital Hub Südbaden (DIGIHUB Südbaden)	
KTP	KTP is a one of the 5 national DIHs acting as a one-stop-shop, serving companies within their local region and beyond to digitize their business. KTP DIH is based on a clear understanding of actual needs of the stakeholders. Main task of KTP DIH is	To initiate and develop cooperation with other 4 national DIHs

	to inspire industrial enterprises to implement innovative digital solutions related to Industry 4.0 and actively support and co-create them in implementation at various stages: from diagnosis, needs analysis and conceptualization to post-deployment testing. KTP DIH partners: • Universities: AGH University of Science and Technology, Cracow University of Technology, Jagiellonian University, University of Economy • SMEs: Autenti, Kangur Electronics, Astor, Protech, ES-System, Game Desire, Velis • LE: T-Mobile, Comarch, Fideltronik, EC Group, Woodward Poland, Transition Technologies, Merit Poland, Wisniowski • Małopolska Regional Development Agency • Municipality of Krakow, Marshall Office of Malopolska Region	

Conclusion provided by Leader:

<1 page maximum>

Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
IMECH	• Application of modelization techniques and data analytics methodology in order to	• SALF S.p.A. • LOVATO S.p.A. • BALANCE SYSTEMS S.p.A.

	improve quality of an assembly line • Development of a machine vision system for picking phase • Development of a machine vision system for checking quality of the tubes • Development of a machine vision system for detection of anomaly in industrial LCD • Development of a machine vision system for checking the quality of electric engines • Development of a fault detection system for low voltage circuit breaker	
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • Slovenian Government office for development and European cohesion policy (SVRK) • Technology Park (TP) Ljubljana	• Members of the TECOS Tool-and-die technology cluster (high-tech industrial companies, ranging from SMEs to LEs) (https://www.tecos.si/index.php/en/membership/list-of-members) • ADMA assessment - European commission (http://www.adma.ec/) (TECOS as pro-ject partner, TECOS as important regional stake-holder) • LUI (Ljubljana University Incubator) • ABC Hub Ljubljana (http://accelerationbusinesscity.com/) • Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) • Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) • various other incubators, digital hubs and regional development agencies.
ECIPA	• Labs4sme project (INTERREG IT-AT) • Talentjourney project (Erasmus KA2)	

PBN	• Future Internet LivingLab Association (SME) • 3D Printing Zrt LTD (R&D Center) • iQor Global Services Hungary Kft. (Large enterprise) • BPW-Hungária Kft.(Large enterprise) • Széchenyi University (Győr;) • BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS • PBN's currently running EU projects can be considered as synergic ones: - 4STEPS: - Interreg Central Europe https://www.interreg-central.eu/Content.Node/4STEPS.html - DIH2: Horizon 2020 http://www.dih-squared.eu/ - CHAIN REACTIONS: (CE) https://www.interreg-central.eu/Content.Node/CHAIN-REACTIONS.html - Innopeer AVM: (CE): https://www.interreg-central.eu/Content.Node/InnoPeerAVM.html	Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.
HGK VZ	• Faculty of organization and informatics: https://www.foi.unizg.hr/en • Faculty of Geotehnical Engineering: http://www.gfv.unizg.hr/en/index.html	Companies and other relevant stakeholders will be involved in the later phase accordingly.
BWCON	Special Interest Groups (SIG)	Stuttgart Research Centre for Simulation Technology (SRC SimTech)

KTP	All relevant stakeholders were listed above in 6.3.2. Additionally we can list some partners from synergic projects: Interreg CE Projects: ECOS4inCE: Cross-border ecosystem for Industry 4.0 Project partners: Ústecký kraj, Czech Republic , Università Cà Foscari Venezia, Italy, Pannon Novum Nyugat-dunántúli Regionális Innovációs Nonprofit Kft, Hungary, Business Upper Austria – OÖ Wirtschaftsa gentur GmbH, Austria, Koprivnički poduzetnik d.o.o., Croatia, Fondazion E Giacomo Brodolini, Italy, Malopolska Regional Development Agency, Poland https://www.interreg-central.eu/Content.Node/ECOS4IN.html InNOW InnoEnergy Central Europe, Project partners: ABC Accelerator; Optimization, University of Debrecen, EH Invest, Neulogy https://www.interreg-central.eu/Content.Node/InNow.html H2020 project: Boosting Widening Digital Innovation Hubs H2020-DT-2018-2020; (Digitising and transforming European industry and services: digital innovation hubs and platforms); Topic: DT-ICT-01-2019; Type of action: IA (KTP is partner in the project) BOWI: Boosting Widening Digital Innovation Hubs, Project Partners: UAB Civita LT, Fundingbox Accelerator Sp z o.o. PL, Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoektno NL, Teknologian	Specialized RTD facilities that focus on AI Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.

	tutkimuskeskus VTT FI, Firheinisch-Westfaelische Technische Hochschule Aachen DE, Asociatia Transilvania IT, Rolatvijas Informacijas Tehnologiju Klasteris LV, Zapadoceska Univerzita v Plzni CZ, Krakowski Park Technologiczny sp. z o.o. PL, Norges Teknisk-Naturvitenskapelige Universitet Ntnu, NO, Foundation Cluster Information and Communication Technologies, BG	

Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
IMECH	• Application of modelization techniques and data analytics methodology in order to improve quality of an assembly line • Development of a machine vision system for picking phase • Development of a machine vision system for checking quality of the tubes • Development of a machine vision system for detection of anomaly in industrial LCD • Development of a machine vision system for checking the quality of electric engines • Development of a fault detection system for low voltage circuit breaker	• use the projects developed to show real implementations • use of the skills developed within the projects to develop new applications
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project	• Multiplier concerning DIH setup • Multiplier concerning Start-up community or spin-offs

	partner, TECOS as key stake-holder) • Technology Park (TP) Ljubljana	
ECIPA	Region of Veneto	ECIPA will be involved within the stakeholders group for the RIS3 monitoring and definition at regional level
PBN	IFKA Public Benefit Non Profit Ltd. for the Development of the Industry	• organize meetings (online, personal) • inform them regularly about project implementations • discuss the future plans
HGK VZ	• The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	• We will keep the ASP contact person duly informed and involved in project activities where necessary We will consult the ASP as institution responsible for S3 in Croatia
BWCON	Wirtschaftsregion Stuttgart	To use it as partner and multiplier for companies, specially SMS, in shaping technological change and digitisation in the region
KTP	Urząd Marszałkowski Województwa Małopolskiego (engl. Marshal Office of Malopolska Region, Department of Corporate Governance and Economy)	• introductory meeting (July 2019) • regular meetings/telcos with project management team (each month) • consultation of all relevant documents f.eg. Navigation Crew reports etc.(September/October 2019) • participation at Intro conference Krakow (November 2019) • participation in PPs meetings and Kick-off Conference Villach (November 2019) supporting regional authorities in the preparation of the RIS3 update by providing relevant content f.eg. Navigation Crew reports etc.

NAVIGATION CREW

MACHINE VISION

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – Machine Vision

3.1.1. SPECIFIC TOPICS

Artificial Intelligence: Machine Vision

DEFINITION

Computer vision refers in broad terms to the capture of images and automation of their analysis with an emphasis on the extraction of pieces of information from images to make sense of them. So, for example through the use of Image Processing techniques (techniques primarily used to improve the quality of an image, convert it into another format, or otherwise change it for further processing) an image is converted to grayscale and then analysed through Computer Vision to detect objects within that image.

In some ways, it is possible to think about Machine Vision as a child of Computer Vision, because it uses techniques and algorithms for Computer Vision and Image Processing, but the focus is more on specific applications.

In fact, Machine vision traditionally refers to the use of computer vision in an industrial or practical application or process where it is necessary to execute a certain function or outcome based on the image analysis done by the vision system.

The target is to extract information from an image on an automated basis. The information extracted can be a simple good-part/bad-part signal, or more a complex set of data such as the identity, position and orientation of each object in an image. It differs from image processing, where the output is another image. The information can be used for such applications as automatic inspection and robot and process guidance in industry, for security monitoring and vehicle guidance.

The components of a basic computer vision and machine vision system are the generally the same:

- An imaging device, usually a camera that contains an image sensor and a lens.
- An image capture board or frame grabber may be used (in some digital cameras that use a modern interface, a frame grabber is not required).
- Lighting appropriate for the specific application.
- A computer, but in some cases, as with “smart cameras” where the processing happens in the camera, a computer may not be required.
- Image processing software.

EXAMPLE

Packaging Inspection

It is critical for pharmaceutical companies to count tablets or capsules before placing them into containers. To solve this problem, a company has developed a solution that can be deployed to existing production lines or even ran as a standalone unit.

A key feature of the solution involves using computer vision to check for broken or partially formed tablets. As tablets make their way through the production line, pictures are taken and transferred to a dedicated PC that then processes the images using software which then runs further analysis to check if the tablets are the right color, length, width, and whole.

The PC based Vision Inspection system is also implemented to a PC that performs the counting function and if a tablet is deemed as defective, this information is logged which then sends a signal to the counting functioning, and by the time the bottle of containers reaches the end of production line, containers that have defective tablets are then rejected, thereby removing the possibility of shipping defective medical tablets.

Defect Reduction

Machine vision can play a massive role in the motoring sector.

A machine vision inspection system can be used in a production line to undertake tasks that humans can sometimes struggle with. In this use case, the system uses high-resolution images to build up a full 3d model of components and their connector pins.

As components pass through the manufacturing plant, the machine vision system takes multiple scans of images from different angles to produce a 3d model, these images, when combined, allow the system to identify if connector pins on circuitry are faulty which could have disastrous effects later down the production line.

3d vision inspection has many applications but one of the most common use cases for the technology is in the production of automobiles.

With electrical faults accounting for a lot of automobile faults these days, being able to perform 3d scans of connector pins can help car manufacturers drive cost savings, reduce the chance of shipping faulty electrical components and help improve driver safety.

4. Introduction

4.1. Motivation

<Motivate why the above described topic area/s is relevant at regional / national level? Motivation should be provided by each crew member and ideally supported by quantitative / qualitative evidence> Relevance can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
IMECH	Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of Machine Vision to capture value and generate insight from their own video/image data assets will become a question of competitiveness and ultimately survival within the next 10 years. In terms of business change, the key outcomes will be: • Greater levels of automation resulting in improved quality, speed and reliability • Improved decision support with data analytics that drive processes in real time • Enhanced customer experience using gesture and behavior recognition to deliver personalized and intuitive interfaces • Reduced costs and improved quality through automatization of visual inspection	Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in manufacturing fields concerning innovation, economic growth and development.

TECOS	While TECOS can provide broad expertise in the field of data analytics, complex simulation and modelling (topic 1), we regard topic 2 as a field where we would like to gain knowledge and expertise from other crew members as a learner, and, wherever possible, through our own initiative of finding sources of knowledge (case studies, related projects, partners from the Slovenian industry etc.). This is how we intend to play an 'active role' as a learner within NC 1 and inform and share knowledge with other members about concrete findings in the context of tasks planned ahead.

4.2. Problem statement

<Are there any specific challenges that can already be identified by crew members. Please note and remember that a specific need assessment activity will be done under Activity 1.2. therefore, this first overview should ideally provide the main directions that will guide the need assessment activity. Again, each crew member should provide its point of view.

Challenges can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.500 characters / member

Crew Member	Main Challenges
IMECH	• Application and implementation of Machine Vision technologies to the business processes of our member associated to solve real-work problems. In this way they can improve their competitivity on the market according to Intellimech mission: "An environment where our partners can catch the opportunities offered by new technologies". • To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of artificial intelligence in italian SMEs. • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.
TECOS	• Similarly to the statement of IMECH, TECOS is intended to spread an innovation culture in the SMEs, not only among our cluster members, but broader within the tooling and related industries in Slovenia. It remains clear, that lack of competences represents the principal gap in the implementation of simulation and modelling into industrial use. Therefore we regard this as the main challenge.

	• To raise awareness locally, nationally, and above, of what can be achieved through effective practical use of data analytics, simulation and modelling. • The challenge to offer concrete practical and tangible solutions to SMEs. As we know the later - due to lack of information and other assimilarities - fail to recognize, what the market is able to ofter already in terms of available technology and know-how. This challenge therefore also deals with the concern of effective planning SMEs need to undertake in order to co-create future trends in their niches as opposed to only following them. • Last but not least - another challenge we recognize is directed towards establishing as many Open Innovation Communities as lead best-practice examples as possible - regionally and nationally. This will provide transparency and availability of market and tech information and hence accelerate fair market competition, which shall ideally include all economic subjects.

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
Artificial Intelligence: a European perspective	**JRC**	**Consorzio Intellimech**
Digital Transformation Scoreboard 2018: EU businesses go digital: Opportunities, outcomes and uptake	**European Commission**	**Consorzio Intellimech**
Artificial Intelligenge: on your marks	**Osservatorio A.I.**	**Consorzio Intellimech**

Top 10 Strategic Technology Trends for 2019: A Gartner Trend Insight Report	Gartner	Consorzio Intellimech
A Comprehensive AI-Enabled Predictive Maintenance Plan Starts With Business Understanding	Gartner	Consorzio Intellimech
Statistical Report "Rapporto Statistico Regione del Veneto", 2019	Regione del Veneto	Regione del Veneto
DGR n. 216, 28/02/2017, all. A - Percorso di "Fine-Tuning", RIS3 Veneto	Regione del Veneto	Regione del Veneto
RIS3 VENETO LA ROADMAP DI MONITORAGGIO, PRINCIPALI RISULTATI E NUOVE OPPORTUNITÀ (PowerPoint Presentation, Padova, 19/06/2019)	Regione del Veneto	Regione del Veneto
ec.europa.eu/growth/tools-databases/regional-innovation-	European Commission	ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto

monitor/base-profile/veneto		
Comunicato Stampa 21/11/2018	Osservatorio Big Data Analytics & Business Intelligence	www.osservatori.net/it_it/osservatori/comunicati-stampa/big-data-analytics-italia-mercato-2018
100 Radical Innovation Breakthroughs for the future	European Commission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	Available online in national language and in English, but it was downloaded by PBN.
Digitalisierungsstrategie der Landesregierung Baden-Wurttemberg (2017)	Ministerium für Inneres, Digitalisierung und Migration	https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/Digitalisierungsstrategie-BW.pdf
Policy for the Development of AI in Poland in the years 2019-2027		https://www.gov.pl/attachment/0aa51cd5-b934-4bcb-8660-bfecb20ea2a9
Map of the polish AI 2019		https://www.digitalpoland.org/assets/publications/mapa-polskiego-ai/map-of-the-polish-ai-2019-edition-i-report.pdf

Map of Polish Science in the field of AI 2019		https://www.digitalpoland.org/assets/publications/map-of-polish-science-in-the-field-of-ai/2019-map-of-polish-science-in-the-field-of-ai-v2.pdf

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)
2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)
3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

<Description of methods or tools which are applied in order to achieve the thematic topics are specified here.>

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
IMECH	Test Industria 4.0 - DIH (https://www.testindustria4-0.com/)	Regional Strategic community – AFIL (Work in progress)	ADMA assessment – European commission (http://www.adma.ec/)
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)	Various national and regional strategic communities...	ADMA assessment – European commission (http://www.adma.ec/) (TECOS as an active partner within ADMA)

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
IMECH	Contributor	X
TECOS	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
IMECH	• Considerable skills developed in the field of vision thanks to the development of research projects for its members and thanks to its participation in funded projects • Structured network of experts, consisting of universities, consultants and suppliers	• Demo cases related to the work done for associate companies • Network of companies to carry out the development of use cases and their testing
TECOS	• Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. the tooling industry • Excellent expertise in engineering services and applied industrial research • Excellent expertise in product and material development • Very good institutional and political connections (nationally and EU-wide) • Excellent industrial references within the EU: https://www.tecos.si/index.php/en/about-us/references • Experience from dozens of success-fully executed technological projects	• Very good EU-wide connections to European technology partners and customers (product development) • Excellent connections to our tool-and-die cluster members • Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/about-us/equipment 22 highly skilled professionals employed full time, while also cooperating with many contractual external experts

	Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	

Conclusion provided by Crew Leader:

<1 page maximum>

6.2.2. Partner’s weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
IMECH	• Lack of knowledge related to the needs of EU foreign companies about machine vision • Lack of links at European level to structure a transnational competence network about machine vision
TECOS	• While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain competences in this context. • Lacking knowledge in practical/technical establishment of Digital innovation plattforms. We would like to gain competences in this context

Conclusion provided by Leader:

<1 page maximum>

6.2.3. Partner’s common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
IMECH	• Create a transnational network of companies and experts in the field of machine vision • Identify the needs of companies at European level in order to start new collaborations in machine vision field
TECOS	• Create a transnational network of companies and experts in the field of machine vision • Identify the needs of companies at European level in order to start new collaborations in machine vision field

Conclusion provided by Leader:

<1 page maximum>

6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
IMECH	• Some pilot actions will be carried on to spread an innovation culture and raise awareness and skills about the main issues of advanced production • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics. • Exchange transnational best practices and foster cooperation with other Project Partners in advance manufactory systems to exchange knowledge and develop joint pilot actions. • Disseminate the project to policy stakeholder in order to create a European awareness concerning digitalization
TECOS	• Implementation of actions focusing on innovation culture and awareness raising in the field of new technologies related to advanced production • Events regarding the needed skills in advanced manufacturing organized together with the leading research institutions in Slovenia, with partners as guests. • B2B opportunities creation between partner regions • Exchange of best practices and creation of new pilot initiatives • Dissemination of the project results to stakeholders to prepare instruments boosting digitization.

Conclusion provided by Leader:

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6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IMECH	• Lombardy Intelligent Factory Association – AFIL	-

	• Italian national intelligent factory cluster - CFI	
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • ADMA assessment – European commis-sion (http://www.adma.ec/) (TECOS as project partner, TECOS as important regional stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) • Slovenian Government office for development and European cohesion policy (SVRK) • Technology Park Ljubljana	• 3Dhubs electronic knowledge base (e-portal)(https://www.3dhubs.com) and similar… • Lombardy Intelligent Factory Association – AFIL and similar… • Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/) • Other (various) academic and industrial relations are to be established during the course of the project, depending on their relevancy and practicality… • Etc.

Conclusion provided by Leader:

<1 page maximum>

6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder)	Other regional DIH connections to be established...

6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
IMECH	• Application of modelization techniques and data analytics methodology in order to improve quality of an assembly line • Development of a machine vision system for picking phase • Development of a machine vision system for checking quality of the tubes	• SALF S.p.A. • LOVATO S.p.A. • BALANCE SYSTEMS S.p.A.

	• Development of a machine vision system for detection of anomaly in industrial LCD • Development of a machine vision system for checking the quality of electric engines • Development of a fault detection system for low voltage circuit breaker	
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • Slovenian Government office for development and European cohesion policy (SVRK) • Technology Park (TP) Ljubljana	• Members of the TECOS Tool-and-die technology cluster (high-tech industrial companies, ranging from SMEs to LEs) (https://www.tecos.si/index.php/en/membership/list-of-members) • ADMA assessment – European commission (http://www.adma.ec/) (TECOS as pro-ject partner, TECOS as important regional stake-holder) • LUI (Ljubljana University Incubator) • ABC Hub Ljubljana (http://accelerationbusinesscity.com/) • Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) • Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) • various other incubators, digital hubs and regional development agencies.

Conclusion provided by Leader:

<1 page maximum>

6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
IMECH	• Application of modelization techniques and data analytics methodology in order to improve quality of an assembly line • Development of a machine vision system for picking phase • Development of a machine vision system for checking quality of the tubes • Development of a machine vision system for detection of anomaly in industrial LCD • Development of a machine vision system for checking the quality of electric engines • Development of a fault detection system for low voltage circuit breaker	• use the projects developed to show real implementations • use of the skills developed within the projects to develop new applications
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • Technology Park (TP) Ljubljana	• Multiplier concerning DIH setup • Multiplier concerning Start-up community or spin-offs

NAVIGATION CREW

PREDICTIVE MAINTENANCE

INTELLIMECH®

CONSORZIO PER LA MECCATRONICA

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – PREDICTIVE MAINTENANCE

3.1.1. SPECIFIC TOPICS

Artificial Intelligence: Predictive Maintenance

DEFINITION

Maintenance approach has changed in the last years, moving from Repair Maintenance to Preventive Maintenance: the first one is a run-to-failure maintenance which takes place only when a breakdown occurs, while the second one expects to carry out maintenance intervention before the fault occurs, in order to avoid long unscheduled downtime.

Preventive maintenance can be declined according to different approaches:

- Planned maintenance, which expects periodic maintenance interventions based on average life of the system. This is a time-based preventive maintenance, which sets a periodic interval to perform maintenance intervention regardless the health status of a physical asset.
- Condition based maintenance, which expects to carry out maintenance interventions according to need indicated by condition monitoring, which aims at promptly detecting, diagnosing, signaling and highlighting any deviation from the nominal operations of machines. Condition based maintenance refers to diagnostic as the process of detection, isolation and identification of faults when they occur by monitoring the weak signals of a physical asset.
- Predictive Maintenance, which aims at predicting the future trend of the equipment health conditions, according to prognostics approach. Predictive maintenance refers to prognostic as the process that attempts to predict faults or failures before they occur and projects the Remaining Useful-Life of a physical system through the use of automated methods.

EXAMPLE

Predictive maintenance applied to plane

Planes have about 6,000 sensors, producing 2.5Tb of data per day. These sensors measure health and performance and provide insights by tracking everything, from fuel flow, pressure and temperature to the aircraft's altitude, speed, weather and air temperature.

By combining this real-time information with historical data and robust analytics, airlines can determine the condition of in-service equipment to make proactive decisions on maintenance schedules and ways to maximise aircraft availability. This result in greater efficiency in the maintenance, repair and overhaul process and enhanced fleet management. Predictive maintenance not only enables airlines to keep earning revenue by preventing groundings and disruptions but also helps improve safety by preventing equipment failure.

Aircraft and engine components, such as a fuel pump, often have a "soft life"—the point at which it is recommended to remove it for maintenance based on its time in operation. By analyzing detailed data from each specific pump and comparing it to data models and other pumps in the fleet, it is possible to provide an alert that indicates that a specific pump might not be performing well and should be replaced sooner than its soft life.

Predictive maintenance applied to machine tools

The machines tool are equipped with a lot of sensors that bring data from the real world into the digital world, where it can be used to visualize, analyze and predict machine conditions.

These sensors collect huge amounts of data about the machine's condition. The sensors—which measure vibrations, forces, temperatures and pressures—are integrated into components such as bearings and linear guidance systems.

Data generated is saved and processed locally in the machine, as well as in the cloud, where evaluations that require more computing power are made using specially developed algorithms. These evaluations help users gauge the probability of various process and production faults. When necessary, measures can be taken to prevent such faults, reducing unplanned machine downtime.

Other possible benefits of the enhanced data collection and analysis made possible by Machine Tool 4.0 include:

- Greater machining precision.
- Process optimization, where sensor feedback from the cutting edge can trigger process changes that, for example, extend tool life or lower energy consumption.

4. Introduction

4.1. Motivation

<Motivate why the above described topic area/s is relevant at regional / national level? Motivation should be provided by each crew member and ideally supported by quantitative / qualitative evidence> Relevance can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.000 characters / member.

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
IMECH	Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of Predictive Maintenance plays a key role for reaching the KPI needed for equipment reliability and availability. For Gartner through 2022, decision automation in the form of predictive maintenance will generate the highest business value for organizations with heavy assets. In terms of business change, the key outcomes will be: • Greater levels of automation resulting in improved quality, speed and reliability • Improved decision support with data analytics that drive processes in real time • Reduced costs and improved quality through optimization of maintenance management	Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in manufacturing fields concerning innovation, economic growth and development.

<table>
<tr><td>CUAS</td><td colspan="2">Both CUAS and the University Klagenfurt have experience in research and education on AI-topics. One focus are industrial applications. The needs of Carinthia’s manufacturing enterprises is still fragmented. However, there is the need to prepare particularly SMEs with respect to data acquisition and data quality in order to be prepared for the application of AI in their manufacturing processes.</td></tr>
<tr><td>FB</td><td>In order to develop and work efficiently in this research area, regional knowledge is important about this topic.</td><td>In order to develop and work efficiently, national knowledge is important in this area.</td></tr>
<tr><td>ECIPA</td><td>“Smart manufacturing” is one of the RIS3 four areas of regional specialization; these areas have been identified by the Region of Veneto as the result of the expression of its productive system, of its scientific and technological excellences and of the innovative potential towards local and global markets. Among these four areas of regional specialization, “smart manufacturing” is the one with strongest incidence (39%) in terms of projects submitted at ERDF 2014-2020 calls.

In 2018, the manufacturing sector represented the 11,8% of enterprises in Veneto (Rapporto Statistico Regione del Veneto, 2019). The socio-economic fabric of the Region is characterized by small and medium enterprises; there is still a broad gap between large and small businesses in the level of digitalization (Digital intensity indicator): high levels are present in 44.0% of companies with at least 250 employees and only in 12.2% of companies with 10 to 49 employees (Rapporto Statistico Regione del Veneto, 2019). This entails critical issues in</td><td>Veneto is one of the most competitive regions in Italy; it accounts for 9.25% of the national GDP. However, it shows a relatively low level of investment in RTDI and a de-specialisation in high technology sectors. The R&D intensity of Veneto is lower than the Italian average (1.34%) and the European one (2.04%). In 2017, about 2,6% of Veneto employed population worked in high-tech sectors, below the Italian average (3.4%) and the European one (4%).

Also due to its specialisation in traditional manufacturing, Veneto experiences difficulties in carrying out more intensive investments in innovation and in entering high value-added product markets.

However, the percentage of its enterprises with innovative activities in 2014 was 53% (the highest rate in Italy), above the Italian average (45%). The Region also performs well in patenting activity.

Veneto is classified as an "Advanced Manufacturing and Clustering Region with no specialization in knowledge activities". It has a high degree of specialization in high craftsmanship, a good presence of KIBS, a high rate of informal relationships that allow</td></tr>
</table>

	terms of competitiveness for smaller companies. Machine Learning Solutions for Predictive Maintenance, Soft Sensing and Advanced Diagnostics and Self-Diagnosis are specifically mentioned among the measures to pursue within the Development and Technological Trajectory towards the RIS3 “Smart Manufacturing” Macro Trajectory for Cognitive Systems and Automation.	to make use of external expertise to generate a high rate of innovation activities. Therefore, advanced manufacturing is strategic for this territory which strongly contributes to the country economy and which needs to be sustained in gaining efficiency and stronger competitiveness at the global level, especially if considering the prevalence of small and medium sized manufacturing firms, often organized according to the most traditional systems. As an example: most SMEs still use expensive maintenance systems based on remedial actions, and this one of the factors for scarce competitiveness compared to companies that have already converted to the 4.0 model.
PBN	The goal is to support the re-industrialization process in Western Hungary. Currently, the region is located at a relatively low end of the manufacturing value chain, and the goal is to realize its upgrade. Since mechatronics is decisive in the region, material science related to that, new material and composited development, additionally power train improvements are important. Autonomous vehicle drive testing and its applications are also in the focal point of the developments. As a result, companies (SMEs+ large employers) will have to deal with AI and predictive maintenance from the next few years to follow the market demand. Furthermore, they have to take into account not only the AI	Artificial Intelligence technologies have been penetrating all aspects of our lives, businesses and technologies, so it can be considered as national issue. Many experts expect a boom in connection with AI in medical sciences, genetics, pharmaceutical research, environmental research, and also in socio-economic fields, from finance to politics. That is why, Hungarian companies, almost irrespective of their field, will have to use AI applications in a certain method.

	solutions currently on the market, but also the expected trends of technological development and the potential of AI-based products and services in 2-10 years time as well.	
HGK VZ	The Varaždin industrial basin, as a part of NUTS 2 - Continental Croatia, has a strong tradition of manufacturing industry. In order to achieve the optimal market position, companies need to become less expensive and more effective. To achieve these results, they may require a change how maintain plant's equipment and leave traditional maintenance practice to a predict and prevent approach.	Croatia has an open, market-based economy, however to achieve sustainable income and strengthen international competitiveness, Croatia needs to become more innovative. Facing critical international and domestic challenges, Croatia needs to produce and export innovation based products, as well as move towards higher value added activities. Maintenance is for a lot of businesses a huge cost. However, currently, most companies in Croatia spend their maintenance budget in a suboptimal way. Cost optimization in SME's is highly need for better international competitiveness of the Croatian manufacturing sector.

4.2. Problem statement

<Are there any specific challenges that can already be identified by crew members. Please note and remember that a specific need assessment activity will be done under Activity 1.2. therefore, this first overview should ideally provide the main directions that will guide the need assessment activity. Again, each crew member should provide its point of view.

Challenges can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.500 characters / member

Crew Member	Main Challenges
IMECH	• Application and implementation of Predictive Maintenance methodologies to the processes of our member associated to solve real-work problems. In this way they can improve their competitivity on the market according to Intellimech mission: "An environment

	where our partners can catch the opportunities offered by new technologies”. • To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of artificial intelligence in italian SMEs. • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.
CUAS	• What are appropriate AI-applications for discrete manufacturing – production organized in manufacturing cells and very diverse levels of automation? • What are strategies to raise the quality of data and the level of data acquisition in discrete production with small volume size or lot-size 1?
FB	This topic is very essential for the production sector. We would like to improve our knowledge on this topic to be able to help SMEs in the future.
ECIPA	• To spread the awareness of the added value of predictive maintenance to the business processes to face real-work problems/challenges (addressing mainly to CNA associated companies and SMEs of the region) • To stress the need of “competence updating” in the specific field spreading an innovation culture in SMEs located in Veneto. • To make the AI application an user friendly opportunity for SMEs in order to stress their innovation potential (eg.: through shared practices already implemented)
PBN	• The main barrier can be the permanently changing technological background, namely that digitalization processes are so fast that it is very hard to find out what are the real needs of SMEs. Doing a research about the exact needs of SMEs has to be very fast and actions have to be made as fast as possible. • According to the current statistics and analysis of the (Western) Hungarian companies are not developed and competent enough to utilise Artificial Intelligence and within that Predictive Maintenance, so there is a principal gap between the current status and the desired status of the implementation of AI technologies.
HGK VZ	• Lack of adequate linkages between different types of stakeholders (business sector, academia, R&D institutions …) and very low awareness regarding the benefits and costs of AI and predictive maintenance

	• Lack of available financial resources for the business sector and as a consequence business sector, especially SMEs, is not ready to adopt the recent changes in technology • Lack of adequate linkages between different types of stakeholders (business sector, academia, R&D institutions …) and international networking

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
Artificial Intelligence: a European perspective	**JRC**	**Consorzio Intellimech**
Digital Transformation Scoreboard 2018: EU businesses go digital: Opportunities, outcomes and uptake	**European Commission**	**Consorzio Intellimech**
Artificial Intelligenge: on your marks	**Osservatorio A.I.**	**Consorzio Intellimech**
Top 10 Strategic Technology Trends for 2019: A Gartner Trend Insight Report	**Gartner**	**Consorzio Intellimech**
A Comprehensive AI-Enabled Predictive Maintenance Plan Starts With Business Understanding	**Gartner**	**Consorzio Intellimech**

Statistical Report "Rapporto Statistico Regione del Veneto", 2019	Regione del Veneto	Regione del Veneto
DGR n. 216, 28/02/2017, all. A - Percorso di "Fine-Tuning", RIS3 Veneto	Regione del Veneto	Regione del Veneto
RIS3 VENETO LA ROADMAP DI MONITORAGGIO, PRINCIPALI RISULTATI E NUOVE OPPORTUNITÀ (PowerPoint Presentation, Padova, 19/06/2019)	Regione del Veneto	Regione del Veneto
ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto	European Commission	ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto
Comunicato Stampa 21/11/2018	Osservatorio Big Data Analytics & Business Intelligence	www.osservatori.net/it_it/osservatori/comunicati-stampa/big-data-analytics-italia-mercato-2018
100 Radical Innovation Breakthroughs for the future	European Commission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf

		Dowloaded by PBN
National Smart Specialisation Strategy **November 2014**	**National Research, Development and Innovation Office**	**Available online in national language and in English, but it was downloaded by PBN.**
Digitalisierungsstrategie der Landesregierung Baden-Wurttemberg (2017)	Ministerium für Inneres, Digitalisierung und Migration	https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/Digitalisierungsstrategie-BW.pdf
Policy for the Development of AI in Poland in the years 2019-2027		https://www.gov.pl/attachment/0aa51cd5-b934-4bcb-8660-bfecb20ea2a9
Map of the polish AI 2019		https://www.digitalpoland.org/assets/publications/mapa-polskiego-ai/map-of-the-polish-ai-2019-edition-i-report.pdf
Map of Polish Science in the field of AI 2019		https://www.digitalpoland.org/assets/publications/map-of-polish-science-in-the-field-of-ai/2019-map-of-polish-science-in-the-field-of-ai-v2.pdf

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)
2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)
3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

<Description of methods or tools which are applied in order to achieve the thematic topics are specified here.>

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
IMECH	Test Industria 4.0 - DIH (https://www.testindustria4-0.com/)	Regional Strategic community – AFIL (Work in progress)	ADMA assessment – European commission (http://www.adma.ec/)
CUAS	Review of status of SMEs based on digital maturity assessment (of CUAS) and development of individual transformation roadmaps. Involvements of AI-experts from the network of CUAS (CUAS, Alpe Adria University, KNOW CENTER) for transformation projects		
FB	Literature review and qualitative interviews with relevant stakeholders	Interviews with important political stakeholders	Literature review / qualitative interviews
ECIPA	Digital innovation assessment CNA	Regional innovative Networks (Cluster and Industrial Networks):	ADMA assessment – European

		- IMPROVENET http://www.improvenet.it - M3 net https://www.venetoclusters.it/area-reti-innovative-regionali/m3-net - Veneto Innovazione	commission (http://www.adma.ec/)
PBN	In the framework of another EU project of PBN called 4STEPS (further details can be seen here: https://www.interreg-central.eu/Content.Node/4STEPS.html) a transnational tool has been developed which measures RIS3 relevant SMEs in the point of view of needs and the level of adaptation to I4.0 themes. The transnational tool (online questionnaire can be filled here: https://4stepscrm.com/index.php?kitoltesboard&sys=startQuestionnaire The replies from SMEs have been being collected from August-October 2019 in the partnership, including Hungarian SMEs too		ADMA assessment – European commission (http://www.adma.ec/)

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
IMECH	Contributor	X
CUAS	Contributor	
FB	Learner	
ECIPA	Learner	
PBN	Contributor	
HGK VZ	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
IMECH	• Considerable skills developed in the field of predictive maintenance thanks to the development of research projects for its members and thanks to its participation in funded projects • Structured network of experts, consisting of universities, consultants and suppliers	• Demo cases related to the work done for associate companies • Network of companies to carry out the development of use cases and their testing
CUAS	• Experience with data acquisition and data quality assurance in highly automated and diverse automated discrete manufacturing. • Experience with the application of machine learning algorithms in the production area.	
FB	• As we do not have any knowledge on this topic yet, we would like to improve our competencies in this area.	• As we do not have any knowledge on this topic yet, we would like to improve our competencies in this area.
ECIPA	• Network of experts, namely universities, consultants and suppliers • Networking skills in the specific field • Basic skills developed in the field thanks to pilot actions in funded projects	• Explore Innospaces platform (tool to match demand and supply of services 4.0 between SMEs and FabLab)

PBN	• PBN is leading the Artificial Intelligence Working Group in the Priority Area 8 of the Danube Region Strategy • Network of international experts • PBN(AM-LAB) employees attend to trainings, seminars where they can improve their knowledge in AI and Predictive Maintencance	• Within the AI Working Group, 64 relevant institutions were contacted throughout the Danube Region • 15 institutions confirmed their participation; Kick-off meeting of the AI WG will be held on 18th October in Budapest, in the framework of a transnational conference on AI and Automotive (PBN is the main organisator of this conference)
HGK VZ	• Network with regional business and academic community • The potential of ICT sector is high and can be a booster of the economic development	• Platforms and networks available from other implemented EU projects https://greenomed.interreg-med.eu/

Conclusion provided by Crew Leader:

<1 page maximum>

6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
IMECH	• Lack of knowledge related to the needs of EU foreign companies about machine vision • Lack of links at European level to structure a transnational competence network about predictive maintenance
CUAS	• Currently not the strategic focus of the faculty but awareness about increasing need.
FB	• We would like to build up general knowledge in this area and how to connect it to our competences.
ECIPA	• Lack of applied / demo cases with SMEs

	• Lack of links at European level to structure a transnational competence network about predictive maintenance
PBN	• AI and predictive maintenance knowledge should be improved, now this topic can be considered a perspective for the near future
HGK VZ	• General lack of knowledge on benefits and costs of predictive maintenance • Most SMEs in Croatia spend their maintenance budget in a time consuming and non-cost effective way and we would like to improve our competencies in relation to this topic

Conclusion provided by Leader:

<1 page maximum>

6.2.3. Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
IMECH	• Create a transnational network of companies and experts in the field of machine vision • Identify the needs of companies at European level in order to start new collaborations in machine vision field
CUAS	• Raising awareness about the advantage von AI and the preparatory measures in SMEs management
FB	• We would like to develop knowledge and skills in this area.
ECIPA	• Identify common strategies and approaches in order to better support companies - despite their dimension/size - in the field of predicitive maintenance • Spread culture/knowledge on the topic (eg. Intellimech could share demo case(s) of AI applied to predictive maintenance during a workshop carried out with Unismart or during a workshop carried out with CNA • Enhance the platform Exploreinnospaces increasing demo cases • Identify/train local experts through international network of experts
PBN	• Improve the knowledge of the internal staff regarding AI and predictive maintenance→ e.g.:Take part in relevant (international) conferences and meetings

	• Contact experts in regional, national, or international level to establish new co-operations in the field of AI and improve our knowledge as well as experience good practices
HGK VZ	• To comprehend the opportunities offered by digital transformation and the changing needs of companies regarding AI and predictive maintenance • To contribute to creation of an international network which gathers relevant companies and tech experts able to support digital transformation regarding AI and predictive maintenance • To adopt specific knowledge and necessary skills regarding data analytics and modelling in order to offer the new values through a one-stop shop in the region • To raise awareness of companies to overcome the digitalization gap and improve intra/inter-regional and international collaboration

Conclusion provided by Leader:

<1 page maximum>

6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
IMECH	• Some pilot actions will be carried on to spread an innovation culture and raise awareness and skills about the main issues of advanced production • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics. • Exchange transnational best practices and foster cooperation with other Project Partners in advance manufactory systems to exchange knowledge and develop joint pilot actions. • Disseminate the project to policy stakeholder in order to create a European awareness concerning digitalization
CUAS	Digital maturity assessments with SMEs, development of transformation roadmaps for SMEs.
FB	We would like to develop knowledge on this topic. Depending on the input and our gained knowledge, we will carry out several activities in the further course of the project.

ECIPA	We would like to use the pilot action phase to a) showcase concrete examples to our members (would be ideal to identify a “champion” among small enterprises); b) try to develop a use case to understand the process of introducing predictive maintenance in small enterprise and demonstrate the benefits; c) connect to European entities (for instance Digital Innovation Hubs) that are already supporting small enterprises in this domain
PBN	Strong cooperation with PPs who are experts in the field of AI: Predictive maintenance to improve our knowledge and might implement pilot action in this field
HGK VZ	• To learn from other partners having expertise in AI and predictive maintenance field and gain internal knowledge in order to comprehend opportunities for business sector • To cooperate with other partners and contribute to creation of an international network and connect with other EU entities relevant in this field • To spread intra –regionally the new values and by implementation of foreseen activities contribute to modernization of SME’s sector.

Conclusion provided by Leader:

<1 page maximum>

6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IMECH	• Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
CUAS	• Part of 1 DIH to be established in Carinthia	• With University Klagenfurt and KNOW Center in Graz
FB	• Provincial government • Industrial Association • Economic Chamber • DIH-Ost • Haus der Digitalisierung •	• Digital Forum 2019 • Digital Austria platform, FFG • Industry 4.0 platform
ECIPA	• Region of Veneto (managing the regional RIS3) • Unismart • Uni PD (competence center) • CNA Digital Innovation Hub network at national level • Fablab network in Veneto • Veneto Innovazione	• Monitoris 3 (INTERREG Europe project) • Friuli Innovazione • NOITech Park Bolzano • Area Science Park
PBN	• 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics) • Ministry for National Economy • National Research, Development and Innovation Office • Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties	Looking for relevant actors and stakeholders in the field and establish new cooperations with them

HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	Companies and other relevant stakeholders will be involved in the later phase accordingly.

6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
CUAS	N/A	Amongst the PPs
FB	DIH-OSt: https://dih-ost.at/ Haus der Digitaisierung: https://www.virtuell-haus.at/	Digital Makers Hub in St. Pölten and Digital Innovation Hub – West in Innsbruck
ECIPA	CNA DIH network	• Monitoris 3 (INTERREG Europe project) • Friuli Innovazione • NOITech Park Bolzano • Area Science Park
PBN	• Good cooperation with the 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well

Conclusion provided by Leader:

<1 page maximum>

6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
IMECH	• Application of modelization techniques and data analytics methodology in order to improve quality of an assembly line • Development of a machine vision system for picking phase • Development of a machine vision system for checking quality of the tubes • Development of a machine vision system for detection of anomaly in industrial LCD • Development of a machine vision system for checking the quality of electric engines • Development of a fault detection system for low voltage circuit breaker	• SALF S.p.A. • LOVATO S.p.A. • BALANCE SYSTEMS S.p.A.
CUAS	• BABEG • University Klagenfurt • KNOW Center Graz	
FB	• FH Burgenland • Akademie Burgenland • Wirtschaft Burgenland • Initiative “Start Up Burgenland” • Energie Burgenland • Project “Smart Up”, Interreg	• Haus der Digitalisierung • Project “Green energy lab - Open Data Platform”, FFG. • Educational and training centers • Special Interest Groups • Relevant SMEs and LEs
ECIPA	• Labs4sme project (INTERREG IT-AT) • Talentjourney project (Erasmus KA2)	

PBN	• Future Internet LivingLab Association (SME) • 3D Printing Zrt LTD (R&D Center) • iQor Global Services Hungary Kft. (Large enterprise) • BPW-Hungária Kft.(Large enterprise) • Széchenyi University (Győr;) • BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS • PBN's currently running EU projects can be considered as synergic ones: - 4STEPS: - Interreg Central Europe https://www.interreg-central.eu/Content.Node/4STEPS.html - DIH2: Horizon 2020 http://www.dih-squared.eu/ - CHAIN REACTIONS: (CE) https://www.interreg-central.eu/Content.Node/CHAIN-REACTIONS.html - Innopeer AVM: (CE): https://www.interreg-central.eu/Content.Node/InnoPeerAVM.html	Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.
HGK VZ	• Faculty of organization and informatics: https://www.foi.unizg.hr/en • Faculty of Geotechnical Engineering: http://www.gfv.unizg.hr/en/index.html	Companies and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

<1 page maximum>

6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
IMECH	• Application of modelization techniques and data analytics methodology in order to improve quality of an assembly line • Development of a machine vision system for picking phase • Development of a machine vision system for checking quality of the tubes • Development of a machine vision system for detection of anomaly in industrial LCD • Development of a machine vision system for checking the quality of electric engines • Development of a fault detection system for low voltage circuit breaker	• use the projects developed to show real implementations • use of the skills developed within the projects to develop new applications
CUAS	Project funding via KWF for transformation projects	
FB	Regional Management Burgenland	We would like to involve the partner through an exchange of know-how and personal meetings. This should last for a longer period of time to be efficient. RMB will also be involved as a peer Reviewer.
ECIPA	Region of Veneto	ECIPA will be involved within the stakeholders group for the RIS3 monitoring and definition at regional level
PBN	IFKA Public Benefit Non Profit Ltd. for the Development of the Industry	• organize meetings (online, personal) • inform them regularly about project implementations • discuss the future plans

HGK VZ	• The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	• We will keep the ASP contact person duly informed and involved in project activities where necessary We will consult the ASP as institution responsible for S3 in Croatia

Conclusion provided by Leader:

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NAVIGATION CREW

FACTORY & PROCESS AUTOMATION

Slovenian Tool and Die Development Centre

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – FACTORY & PROCESS AUTOMATION

3.1.1. SPECIFIC TOPICS

DEFINITION

Factory automation (FA) is defined as the use of control systems for operation of machinery and processes. Factory automation applications have evolved greatly in the recent past, growing in size and complexity. Today, industrial devices such as robots, programmable logic controllers (PLCs), and industrial PCs (IPCs) embed powerful logic capabilities that allow modification of their behaviour, depending on an evaluation of the surrounding environment and on interactions with other devices. FA is widely employed in the manufacturing of chemicals, plastics, fertilizers, paper products, automobile assembly, aircraft production, and food processing as some examples. The benefits of automation include increased productivity, improved quality and consistency, and reduced human labour costs. The use of power electronic controllers with microprocessors allows for numerical control of industrial machinery. Numerical controls are defined as the automation of machine tools with precise computer programmed commands. Computer numerical control systems are commonly used today for performing a series of precise movements and operations such as laser cutting, welding, bending, gluing, sewing, placement, and routing [1].

A **Process automation** or Process automation system (PAS) is used to automatically control a process. Process automation involves using computer technology and software engineering to help power plants and factories in industries as diverse as paper, mining and cement operate more efficiently and safely. The PAS often uses a network to interconnect sensors, controllers, operator terminals and actuators. A PAS is often based on open standards in contrast to a DCS (distributed control system), which is traditionally proprietary. In the absence of process automation, plant operators have to physically monitor performance values and the quality of outputs to determine the best settings on which to run the production equipment. Maintenance is carried out at set intervals. This generally results in operational inefficiency and unsafe operating conditions. Process automation simplifies this with the help of sensors at thousands of spots around the plant that collect data on temperatures, pressures, flows and so on. The information is stored and analyzed on a computer and the entire plant and each piece of production equipment can be monitored on a large screen in a control room. Plant operating settings are then automatically adjusted to achieve the optimum production. Plant operators can manually override the process automation systems when necessary.

Some of the most applicable industries related to factory and process automation are in the picture below.

Automation Applications

Factory Automation and Robotics Applications

- Automotive
- Avionics
- Communications
- Equipment
- Consumer Goods
- Energy
- Food and Beverage
- Packaging
- Pharmaceutical and Medical (blood pressure and heart rate monitors, hearing aids)
- Robotics
- Semiconductors and Electronics
- Web Inspection (for inspecting product sheets, such as foil, paper, or fabric)

Micro Electronics Applications

- Sensors and controllers
- Microwave modules
- Munitions/Armament (guidance, RF, GPS, laser, Gyro, Accelerometer)
- Satellite components
- RFID
- Scientific instrumentation
- Wireless telecommunication components
- Optoelectronics

4. Introduction

4.1. Motivation

Companies undertake projects in manufacturing automation and computer-integrated manufacturing for a variety of good reasons. Some of the reasons used to justify automation are as follows: a) to increase labor productivity (greater output per hour of labor input), b) to reduce labor cost, c) to mitigate the effects of labor shortages, d) to reduce or eliminate routine manual and clerical tasks, e) to improve worker safety, f) to improve product quality (greater uniformity and conformity to quality specifications; consequently reduction of fraction defect rate is one of the chief benefits of automation), g) reduced manufacturing lead time (automation helps to reduce the elapsed time between customer order and product delivery, providing a competitive advantage to the manufacturer for future orders; by reducing manufacturing lead time, the manufacturer also reduces work-in-process inventory), h) accomplishment of processes that cannot be done manually (requirements for precision, miniaturization, or complexity of geometry, that cannot be achieved manually), i) avoiding the high cost of not automating, and so forth…

The benefits of automation often show up in unexpected and intangible ways, such as in improved quality, higher sales, better labor relations, and better company image. Companies that do not automate are likely to find themselves at a competitive disadvantage with their customers, their employees, and the general public [3].

On the other hand we must, at least theoretically, also consider disadvantages/threats of factory automation: a) unpredictable costs, b) large initial investments, c) potentially more pollution to be generated (some machine types use chemicals or gases to be able to operate – this means more pollution to be generated and more problems to the environment), d) generally lesser versatility (having your factory automated means lesser capability of performing a specific task and limiting the variety and flexibility of various tasks that an employee can do), and so forth… [4].

All mentioned above is highly relevant at all levels, since automated industrial companies are present on all levels – locally, regionally, nationally, and so forth. The idea is to fully understand the underlying topic of factory and process automation, not only technically, but above that the social and economic impact automation has and will have in the future. The motivation for the navigation crew establishment is therefore in careful consideration of theoretical and practical options on how to use digital technologies to reduce information assymetry in economic systems and grant real-time information to all economic subjects. This includes active measures to accelerate local and inter-regional cooperation between PPs, industrial companies, relevant R&D institutions and other project stakeholders, ongoing technology transfer and knowhow circulation, etc.

Motivation

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
TECOS	The topic is highly relevant at regional and national levels since the use of purposive inflows and outflows of knowledge to accelerate internal	

	innovation, and, expand the markets for external use of innovation, must clearly be an economic and societal priority. Within this context companies and individuals must get real-time access to information and technology… Knowledge provision and knowledge transfer must be accelerated on all levels…
KPT	One of Malopolska 7 smart specializations listed in the Regional Smart Specializations is Electrical engineering and machinery, that encompasses factory&process automation. Within this specialisation Malopolska companies operate predominantly in the areas of repair, maintenance and installation of machinery and equipment. 45% of the entities are located in Krakow. In the last 15 years the sector is becoming a strong point of the regional economy. The region witnesses an increase in industrial production sold and an increase in the employment in the industry. Many of the companies are operating in the field of machinery and transport sector (Valeo Autosystemy, Delphi, Woodward, EC Engineering, CADM Automotive, WAMECH, FlyTech Solutions, MAN Trucks, NEWAG, NIDEC Motors, Zasław TSS), electrical engineering sector (ABB, ES-Systems, EC Systems, Fideltronik, TELE-Fonika Kable), metal sector (Wisniowski, Can-Pack) etc. The research and development institutions include the Institute of Advanced Manufacturing Technology, the Research and Development Center operating within Zakłady Mechaniczne Tarnów S.A., the higher education institutions are AGH University of Science and Technology and University of Technology in Krakow. Manufacturing accounts for 27% of Poland's GDP, and Poland is the sixth largest manufacturing country in the European Union. In 2017, manufacturing grew by 6.2%, outpacing the country's overall 4.6% GDP growth rate. Poland's Central Statistical Office (GUS) further confirms the positive outlook for Poland's manufacturing sector, reporting that 66.3% of industrial companies were planning substantial investments in 2017. Polish manufacturing is beginning to make the move to Industry 4.0. The amount of automation in Polish factories is low. Six percent of manufacturers report making moves towards Industry 4.0. Only 15% of Polish manufacturers are fully automated, while 76% have yet to complete the automation process, and 14% of Poland's manufacturing remains wholly manual. To move up, Poland needs to encourage digital integration of industry. A recent PwC report indicated that manufacturers experience an income increase of 2.9% while experiencing a decrease in costs of 3.6% in the five years following their investments in digital technologies. Such investments allow the use of simulations that shorten the time needed to begin or change production; increase energy efficiency; optimize material usage; and facilitate communication with suppliers and customers. IoT sensors would enhance production with monitoring and maintenance services.

	The study "Smart Industry Polska 2017", commissioned by the Ministry of Development and Siemens, and conducted on a sample of 251 small and medium-sized enterprises (SME), indicates that in 2016 as many as 77 per cent of these companies implemented at least one of the solutions supporting innovation (the most popular was automation with the use of individual machines – 48.6 per cent of the companies; the use of cooperating machines was the 3rd most frequent option, indicated by 27 per cent). Additionally 10.4 per cent of the companies intend to introduce automation based on individual machines within the next year, while 8.8 per cent want to introduce automation based on cooperating machines. The surveyed entities also have plans to implement mobile technologies (7.2 per cent) and cloud computing (6.8 per cent).
CUAS	Increasing need for automation also in regional manufacturing SMEs. Therefore, there is also the need to be permanently up to date on this topic in the university's curricula.
BWCON	The state is the frontrunner in the state ranking of the nationwide Industry 4.0 Atlas and thus offers numerous opportunities for knowledge transfer. Industrialization and automation are successful in BW, and in order to continue in the age of digitization companies need to break new ground. Germany is aware of its excellent starting conditions. It is the No. 1 mechanical engineering country in Europe, with over 150 years of production and innovation experience, a high-quality education system and an excellent scientific and research landscape. Germany is also aware that the technologies of today cannot conquer the markets of tomorrow. That's why it is important for SMEs to reorient themselves, to review their own business models and, if necessary, to renew them. However, this is linked to an entrepreneurial and innovative mindset. At no other time do founders have such great opportunities as in times of technological revolution.
IMECH	Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of factory automation is fundamental. In fact, this is the basis of the smart factory and of industry 4.0, which involves the self-regulation of the factory in order to improve working conditions, create new business models and increase the productivity and production quality of the plants. In terms of business change, the key outcomes will be: • cost containment, thanks to the reduction of employees and their re-use for other tasks • reduction of the time required to carry out the activities • Improvement of ergonomics and safety Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in

	manufacturing fields concerning innovation, economic growth and development.
FB	In times of digitization, the region and thus the small and medium enterprises (SMEs) have to adapt to current circumstances. Automated processes are important to remain competitive in the future. Therefore, the topic is highly relevant at regional level. In order to keep up with the international competition, companies in Austria must gradually improve their business processes. Therefore, this navigation crew is of great national relevance.
HGK VZ	The Varaždin region is already recognized as a rather agile new industry centre in the Continental Croatia (NUTS 2), with an emerging regional economy, a promising technological and scientific infrastructure and a new university in its region. A rather distinctive feature of Varaždin-centered region is the share of industry in its economy, reaching nearly 40 %, nearly 15 % points higher than the runner-up region. On the other hand, there is a significant lack in innovation in SMEs. The innovation value chain is not functional due to incoherent eco-system and difficulty to adopt and apply current technologies. SMEs and mid-caps in North-Western part of Croatia need upgrading of competencies and performance in the digital economy, especially regarding automation in manufacturing processes. Therefore, this topic is recognized as highly important. Industrial production accounts for about 21% of the Croatian GDP. The fastest growing sectors within the processing industry are also the largest: food and beverage (24% of the processing industry), pharmaceutical and chemical products manufacturing (11%), electrical machinery and equipment manufacturers (9%), and rubber, plastic, leather and paper products (9%). The processing industry generates 15.5% of the Gross Added Value, a little below the EU average. Over 21,000 enterprises in Croatia are registered in the manufacturing industry; they employ almost 300,000 people and generate about $20 billion of turnover a year.

4.2. Problem statement

Specific challenges for the navigation crew have to be defined while looking at the challenges and trends in industrial automation itself: a) lack of skilled and knowledgeable staff, b) inconsistent demand on micro and macro level, c) addressing changing trends, d) system security in the 'big data' environment and e) increasingly demanding maintenance, f) fear of job loss. The challenges are therefore to develop digital solutions which will help develop and support the ongoing provision of fresh knowledge (a), provide better marketing planning (b), boost security (d) incorporate predictive maintenance, e)address potential social challenges and fears. The project deliverables, tangible or intangible, must follow the points listed above and must provide relevant solutions.

Crew Member	Main Challenges
TECOS	1. To define (and develop) digital solutions (as deliverables), which will help develop and support the ongoing provision of fresh knowledge, enable better marketing planning, boost data security *per se* and incorporate options for predictive maintenance on technical level. 2. To include not only the PPs (crew members) into the 'definition process' but to collect ideas from a broader perspective (inclusion of associate partners and other stakeholders, if technically competent). 3. To define specific development roles and tasks for each PP, once specific deliverables are defined and agreed upon. 4. Effective marketing of deliverables (later project stages). 5. Accelerating successful industrialization of project deliverables with a short development-to-market time, while considering all relevant aspects and principles of a functioning circular economy.
KPT	1. main barrier in introducing factory and process automation is the size of companies: in Malopolska 90,2% companies are micro enterprises, 6,3% small business, 3,2% medium sized, and 0,3% large companies (LE). The adaption, organisation and investment costs are relatively higher in micro and SME than in LE. 2. constraints due to lack of resources (competences in-house, training, not adequate education system) 3. relatively limited skilled workers and dedicated staff to introduce and monitor factory and process automation 4. insufficient awareness of modern tools that foster Industry 4.0 standards implementation 5. insufficient common structure at regional and national level to support SMEs in implementing factory and process automation (common platform with best practises, statistics data, reports) 6. lack of awareness of consequences which may result from not introducing changes towards the Industry 4.0 standards. Entrepreneurs that fail to digitize their companies have to face the fact that their activities will be limited only to simple production of components and parts 7. • spreading the information of the technology areas to SMEs and practical study visits is not developing according to SMEs needs
CUAS	1. How to combine the need for automation and the need for more agile manufacturing? 2. How to enrol automation in discrete manufacturing of niches (small volume or lot size 1) in combination with manual labour – human machine interaction?

	3. How to setup horizontal machine-to-machine integration as a plug-n-play scenario for manufacturing enterprises? How to solve this challenge across the borders of machine suppliers based on standards?
BWCON	1. SMEs in particular require external support due to their limited human and financial resources. To this end, the main goal is to support innovative approaches and formats and use knowledge transfer to make existing knowledge and technologies more applicable in scientific and entrepreneurial fields, especially targeted to SMEs. 2. Production technology faces high demands and challenges due to increasing specialization and a concentration on system solutions.
IMECH	1. Application and implementation of automation technologies to the business processes of our member associated to solve real-work problems. In this way they can improve their competitivity on the market according to Intellimech mission: "An environment where our partners can catch the opportunities offered by new technologies". 2. To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of automation in italian SMEs. 3. Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.
HGK VZ	1. Difficulties to follow technological changes and rapidly introduce recent digital economy tools 2. Large outflow of highly educated professionals and consequent lack of technological knowledge 3. Lack of available financial resources for the business sector and therefore, business sector, especially SMEs, is not ready to adopt the recent changes in technology 4. Lack of adequate linkages between different types of stakeholders (business sector, academia, R&D institutions ...) and inadequate entrepreneurial climate for innovation

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
[1]		**https://www.sciencedirect.com/topics/engineering/factory-automation**
[2]		**https://en.wikipedia.org/wiki/Process_automation_system**

[3]		https://electrical-engineering-portal.com/9-reasons-for-automation-of-manufacturing-processes
[4]		https://beaconlamps.com/blog/factory-automation-is-it-necessary-3793
Digital Transformation Scoreboard 2018: EU businesses go digital: Opportunities, outcomes and uptake	European Commission	Consorzio Intellimech
Research and Innovation Roadmap	Italian national intelligent factory cluster - CFI	Consorzio Intellimech
Predicts 2018: Industrie 4.0 and Advanced Manufacturing	Gartner	Consorzio Intellimech
Digitalisierungsstrategie der Landesregierung Baden-Wurttemberg (2017)	Ministerium für Inneres, Digitalisierung und Migration	Digitalisierungsstrategie der Landesregierung Baden-Wurttemberg (2017)
Map of the Polish AI	2019	https://www.digitalpoland.org/assets/reports/map-of-the-polish-ai---2019-edition-i.pdf

Digital Transformation Monitor Poland: "Initiative for Polish Industry 4.0 - The Future Industry Platform"	2018	https://ec.europa.eu/growth/tools-databases/dem/monitor/content/poland-%E2%80%9Cinitiative-polish-industry-40-%E2%80%93-future-industry-platform%E2%80%9D
Summary of the most important results of the in-depth diagnosis of economic innovativeness in Małopolska Region (full version in Polish)	2018	https://www.malopolska.pl/_userfiles/uploads/RG-X/badania%20i%20analizy/Aktualizacja%20pog%C5%82%C4%99bionej%20diagnozy%20innowacyjno%C5%9Bci%20Ma%C5%82op%20(2018).pdf
Report. Astor Whitepaper. Engineer 4.0® (Not) ready for changes?	2017	https://www.astor.com.pl/downloads/pliki/ASTOR_Whitepaper_Engineer40_Not_ready_for_changes_2019.pdf
Report. Integration of robotics, industry automation and ICT market. Opportunities & challenges of Industry 4.0. in Poland.		https://www.arp.pl/__data/assets/pdf_file/0008/89918/_Raport_ARP_druk_po_stronie_calosc.pdf

(only in Polish)		
Report. FGI with enterprises operating within smart specialization in Malopolska region. (only in Polish)	2017, 2016	https://www.malopolska.pl/file/publications/Jakociowe_badanie_maopolskich_przedsibiorstw_dziaajcych_w_obrbie_inteligentnych_specjalizacji_regionu.pdf
Report. Industry 4.0. Revolution is here. What do you know about it? (only in Polish)	2016	https://www.astor.com.pl/images/Industry_4-0_Przemysl_4-0/ASTOR_przemysl4_whitepaper.pdf
Impact of smart regional specialization on the economic development of Malopolska (only in Polish)	2016	https://www.malopolska.pl/file/publications/Oddziaywanie_inteligentnych_specjalizacji_regionalnych_na_rozwj_gospodarczy_Maopolski.pdf
Characteristics of 3 of 7 smart specializations of the Malopolska region and identification of enterprises needs in this area.	2014	https://www.malopolska.pl/file/publications/Charakterystyka_3_spord_7_dziedzin_wytyczonych_przez_inteligentn_specjalizacj_regionu.pdf

(only in Polish)		
Verification analysis of areas of smart specialization in Malopolska (only in Polish)	2014	https://www.malopolska.pl/file/publications/Analiza_weryfikacyjna_obszarw_inteligentnej_specjalizacji_regionalnej_wojewdztwa_maopolskiego__II_edycja.pdf

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

The work of the Navigation Crew shall follow a road map as described in the sequel.

1. Common and individual objectives of each crew member shall be clarified first.
2. As a subsequent step existing experiences of each crew member are determined (strengths and weaknesses) are described in a competency map. At the same time the target groups and their needs are described as well as regional and global trends are determined (opportunities and chances).
3. The results of Step 2. are leading to a SWOT analysis resulting in measures to be commonly performed.
4. Appropriate and available case studies are selected amongst the crew members in order to evaluate the usability of taken measures.

Crew Member	Level 1	Level 2	Level 3
TECOS	**Digital Innovation Hub** (DIH) Slo-venia (https://dihslovenia.si/en/home-english/) **Jožef Stefan Institute Ljubljana** (IJS) (TECOS as an important pro-ject partner in the Smart facto-ries Strategic Innovation Partner-ship 'SRIP-ToP')	Various national and regional strategic communities…	ADMA assessment – European commission (http://www.adma.ec/)
KPT	Individual meeting Workshop Questionnaires On-site visits	Digital assessment tool https://dojrzalosc40.delabapps.eu The main mission of the Platform will be to act as an integrator of all stakeholders interested in Industry 4.0 as well as an accelerator of the digital transformation of Polish industry.	ADMA
CUAS	1. Building awareness through the network of policymakers and multipliers.		

	2. Application of the online DMA (digital maturity assessment) by enterprises – www.smartindustry-carinthia.at 3. Application of the digital maturity assessment model (developed by CUAS) at each enterprise. 4. Definition of digital transformation roadmaps individually for each enterprise. Sharing of experiences about DMA with other project partners. Supporting the adaptation of DMA for regional needs of partners.		
BWCON	-Reifegrad Modell -Special Interest Groups (SIGs)	-Hightech Summit -SIGs -Allianz 4.0: https://www.i40-bw.de/de/readiness-4-0/ -DIGIHUB Südbaden: https://www.digihub-suedbaden.de/digitalisierungs-check	-Smart Space (Alpine Space)
IMECH	Test Industria 4.0 - DIH (https://www.testindustria4-0.com/)	Regional Strategic community – AFIL (Work in progress)	ADMA assessment - European commission (http://www.adma.ec/)
FB	We will use qualitative methods in the first step to discuss the needs of small and medium enterprises. Qualitative methods such as interviews and on-site inspections are particularly suitable for dealing individually with the companies.	We are going to do a comprehensive literature research to find the digitalization needs/gaps at policy levels. If necessary we are going to talk to relevant stakeholders.	Monitoring is carried out through comprehensive research.
HGK VZ	Dissemination of information and interviews with stakeholders; planning and implementing the actions according to identification of the stakeholders' needs and level of knowledge	Communication and discussion with relevant stakeholders (University) and Ministry of Economy, Entrepreneurship and Craft	Exploring and adjusting with recent trends

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
TECOS	Contributor	X
KPT	Contributor	
CUAS	Contributor	
BWCON	Contributor	
IMECH	Contributor	
FB	Learner	
HGK VZ	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
TECOS	- Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. the tooling industry - Excellent expertise in engineering services and applied industrial rese-arch - Excellent expertise in product and material development - Very good institutional and political connections (nationally and EU-wide) - Excellent industrial references wit-hin the EU: https://www.tecos.si/index.php/en/about-us/references - Experience from dozzens of success-fully executed technological projects - Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	- Very good EU-wide connections to European technology partners and customers (product development) - Excellent connections to our tool-and-die cluster members - Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/about-us/equipment - 22 highly skilled professionals employed full time, while also cooperating with many contractual external experts
KPT	- Data Center - Cloud Computing Laboratory: 3 IT specialists (cloud computing, software development, security, IT projects management) - Business development: 7 specialists for business support & development (startups, business models, financing, solutions) - ScaleUp Accelerator: 4 specialists (business models, financing,	- Data Center - Cloud Computing Laboratory (1000+ cores, 7+ TB of RAM, 5+ PB of dataspace with various access speeds, 7+ PB of space for data protection, high capacity redundant LAN and SAN network devices) - MultiLab (Motion Capture markerless system, rendering farm, open space studio with 24 high-power

	solutions, cooperation between startups and large enterprises, presentations, negotiations, international expansion) - Krakow Living Lab: 2 specialists (living lab approach, products and services testing) - 20 external experts and mentors supporting KTP team	workstations, audio-video editing studios, cinema hall, 3D scanner) - Showroom (modern location for presenting technology solutions; videowalls, projectors, multitouch table, MS Kinects solutions) - 7 conference halls (1 for 200 people, 3 for 35 people, 3 for 15 people) - equipment rental (laptops and computers, smartphones, game consoles, drones, 3D printers, smartwatches, Red Dragon 6K camera) - Krakow Living Lab - one of Poland's two living lab centers certified by ENoLL (European Network of Living Labs) where products and services can be tested and co-created with end-users involvement (team, methodology, experience, partners) - Main tool: Singu – tool and platform for communication between KTP and tenant companies, including helpdesk, invoices, data, conference halls and equipment renting etc. - Moodle platform for on-line trainings within rapid prototyping, smart engineering & technology transfer areas -
CUAS	• Experiences with respect to vertical and horizontal machine integration. • Knowledge about existing communication standards. • Experiences about the needs for agile manufacturing. • Digital maturity assessment tool and related method for roadmap development.	• Access to demo automated production line • Fab labs for creation of automation prototypes

	• Experience with the application of digital maturity assessment in more than 20 enterprises (SMEs, LEs).	
BWCON	• Experience in technology transfer from research to industry and open innovation trainings. • Established network of industry experts and researchers.	• Strong network of companies (including SMS and small companies)
IMECH	• Considerable know-how developed in the field of automation thanks to the development of research projects for its members and thanks to its participation in funded projects • Structured network of experts, consisting of universities, consultants and suppliers	• Network of companies to carry out the development of use cases and their testing • Demo cases related to the work done for associate companies
HGK VZ	• Established connections with regional companies and academic community	Platforms and networks available from other implemented EU projects

6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
TECOS	• While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain compe-tences in this context. • Lacking knowledge in practical/technical establishment of Digital inno-vation plattforms. We would like to gain competences in this context.
KPT	• lack of factory&process automation competences inhouse (network of external experts, companies, research organizations etc.) • lack of established international connections in the field of factory&process automation

	• insufficient common structure (still in progress) at regional and national level to support SMEs in implementing factory and process automation (common platform with best practises, statistics data, reports)
CUAS	• Organization of faculties • Lack of cooperation with external organizations
BWCON	• While competent in consultancy and advisory, we would like to gain more technical capacities • We look forward to extend our international cooperation in this topic
IMECH	• Lack of knowledge related to the needs of EU foreign companies about automation • Lack of links at European level to structure a transnational competence network about automation
FB	We want to learn about automation possibilities in companies. How these can be implemented efficiently and how they can survive in the long term, for instance. We are also interested in manufacturing processes in general.
HGK VZ	• Lack of knowledge on digital transformation, internally and in business sector • Lack of linkages with supporting infrastructure, knowledge and international networking

6.2.3. Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
TECOS	• Development options on how to effectively use digital technologies to enhance inter-regional cooperation within the EU (technology, society, environment) to reach a significantly higher state of development of circular economies and therefore environmentally friendly and accessible technologies for everyday lives. • Investigate on how automation can become more accessible (financially, technically) and acceptable (image in society). To be considered, especial-ly within the dissemination phase of the project (later stages).

KPT	•	to get deeper understanding and knowledge on factory&process automation
	•	to establish international network for exchange of know-how and best practices
	•	to create a system which promotes collaborative exchange, where individuals share their experiences in the field of factory&process automation for example by study visit etc.
CUAS	•	Answers to the questions in Chapter 4.2
BWCON	•	Co-create a robust support network based on knowledge exchange to address current challenges and barriers in the fully implementation and further deployment of advance manufactory technologies.
IMECH	•	Create a transnational network of companies and experts in the field of automation
	•	Identify the needs of companies at European level in order to start new collaborations in automation field
FB	•	We would like to investigate the possibilities of automation in small and medium enterprises together in the research consortium. In addition, we want to exploit identified potential.
HGK VZ	•	To comprehend the opportunities offered by automation in manufacturing
	•	To contribute to creation of an international network which gathers relevant companies and tech experts able to support transformation regarding automation of processes
	•	To adopt knowledge and necessary skills in order to offer the new values through a one-stop shop in the region
	•	To improve intra/inter-regional and international collaboration

Conclusion provided by Leader:

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6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services	
TECOS	•	To support SMEs in the factory automation improvements

	• To exchange best practices, connect R&D and SMEs in adoption and marketing of solutions • To organized tailored events targeting identified challenges • To improve cooperation between PPs, regions and stakeholders.
KPT	• to support start-ups and SMEs from regional ecosystem in implementing process and factory automation in their businesses • to exchange transnational best practices and lessons learnt within study visit, B2B meetings, training platforms etc. • to organize tailored conferences, seminars, speed dating and industry weeks • to improve the strong cooperation with PPs who are experts in the field of factory&process automation to exchange knowledge and implement joint pilot action in this field.
CUAS	• Organization of multi-thematic events where results of those activities are proposed to SMEs. • Promoting the definition of interfaces between machines and manufacturing IT. • Direct support of SMEs. • Transition of the digital maturity assessment to other regions of the project.
BWCON	• Specifically, bwcon looks forward to: • Organize and promote tailored transfer events, as well as participate in relevant stakeholder events. • Provide support to our regional ecosystem network of small and medium companies in integrating relevant topics of advance manufactory systems to their industries and businesses. • Exchange transnational best practices and foster cooperation with other Project Partners in advance manufactory systems to exchange knowledge and develop joint pilot actions.
HGK VZ	• Learn from other partners having expertise in factory & process automation field, gain internal knowledge in order to comprehend opportunities for business sector • Increase the level of awareness/show benefits/tools for regional companies needs and readiness to adapt • Cooperate and exchange best practice with other partners and contribute to creation of an international network and connect with other entities relevant in this field

	• Spread new values intra-regionally and by implementation of foreseen activities contribute to modernization of SME's sector

6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • ADMA assessment – European commis-sion (http://www.adma.ec/) (TECOS as project partner, TECOS as impor-tant regional stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project par-tner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) • Slovenian Government office for deve-lopment and European cohesion policy (SVRK) • Technology Park Ljubljana	• Lombardy Intelligent Factory Association – AFIL • Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/)

KPT	• Poland's Future Industry Platform • Ministry of Entrepreneurship and Technology • Marshall Office of Malopolska Region, Department of Corporate Governance and Economy • Malopolska Regional Development Agency	• Looking for relevant actors and stakeholders in the field of Facotry&process Automation and establish new cooperations with them: • identification of relevant SMEs to increase their knowledge • identification of best practices of factory&process automation in Malopolska & Poland • identification of experts and specialists within TPA
CUAS	• N/A	• Joanneum Research - Klagenfurt
BWCON	• Ministerium für Wirtschaft, Arbeit und Wohnungsbau	• Ministerium für Wirtschaft, Arbeit und Wohnungsbau
IMECH	• Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	•
FB	• Provincial government • Industrial Association • Economic Chamber • DIH-Ost • Haus der Digitalisierung	• Digital Forum 2019 • Digital Austria platform, FFG • Industry 4.0 platform
HGK VZ	• The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	• Companies and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

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6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder)	Other regional DIH connections to be established…
KPT	KTP is a regional DIH acting as a one-stop-shop, serving companies within their local region and beyond to digitize their business. KTP DIH is based on a clear understanding of actual needs of the stakeholders. Main task of KTP DIH is to inspire industrial enterprises to implement innovative digital solutions related to Industry 4.0 and actively support and co-create them in implementation at various stages: from diagnosis, needs analysis and conceptualization to post-deployment testing. KTP DIH partners: • Universities: AGH University of Science and Technology, Cracow University of Technology, Jagiellonian University, University of Economy • SMEs: Autenti, Kangur Electronics, Astor, Protech, ES-System, Game Desire, Velis • LE: Comarch, Fideltronik, EC Group, Woodward Poland, Transition Technologies, Merit Poland, Wisniowski • Małopolska Regional Development Agency Municipality of Krakow, Marshall Office of Malopolska Region	• to initiate and develop cooperation with Automation and Robotics Hub (ARH), Warsaw • to initiate and develop cooperation with Silesia Competence Centre Industry 4.0, Katowice
CUAS	N/A	The PPs DIHs
BWCON	• de:hub Stuttgart (Future Industries)	

	• Digital Hub Südbaden (DIGIHUB Südbaden)	
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	
FB	DIH-OSt: https://dih-ost.at/ Haus der Digitaisierung: https://www.virtuell-haus.at/	Digital Makers Hub in St. Pölten and Digital Innovation Hub – West in Innsbruck
HGK VZ	N/A	The PPs DIHs

6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Memb er	Current stakeholders	Stakeholders that need to be involved
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner and key stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project par-tner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • Slovenian Government office for deve-lopment and European cohesion policy (SVRK) • Technology Park (TP) Ljubljana	• Members of the TECOS Tool-and-die tech-nology cluster (high-tech industrial com-panies, ranging from SMEs to LEs) • (https://www.tecos.si/index.php/en/ • membership/list-of-members) • ADMA assessment – European commission (http://www.adma.ec/) (TECOS as pro-ject partner and important regional stake-holder)

		• LUI (Ljubljana University Incubator) • ABC Hub Ljubljana • (http://accelerationbusinesscity.com/) • Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) • Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) • (various other incubators, digital hubs and regional development agencies)
KPT	• All relevant stakeholders were listed above in 6.3.2. • Additionally we can list some partners from synergic projects: • Interreg CE Projects: • ECOS4inCE: Cross-border ecosystem for Industry 4.0 Project partners: Ústecký kraj, Czech Republic , Università Cà Foscari Venezia, Italy, Pannon Novum Nyugat-dunántúli Regionális Innovációs Nonprofit Kft, Hungary, Business Upper Austria – OÖ Wirtschaftsa gentur GmbH, Austria, Koprivnički poduzetnik d.o.o., Croatia, Fondazion E Giacomo Brodolini, Italy, Malopolska Regional Development Agency, Poland https://www.interreg-central.eu/Content.Node/ECOS4IN.html • InNOW InnoEnergy Central Europe, Project partners: ABC Accelerator; Optimization,	• Specialized RTD facilities that focus on factory and process automation • Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.

	University of Debrecen, EH Invest, Neulogy https://www.interreg-central.eu/Content.Node/InNow.html • H2020 projects: • BOWI: Boosting Widening Digital Innovation Hubs, Project Partners: UAB Civita LT, Fundingbox Accelerator Sp z o.o. PL, Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoektno NL, Teknologian tutkimuskeskus VTT FI, Firheinisch-Westfaelische Technische Hochschule Aachen DE, Asociatia Transilvania IT, Rolatvijas Informacijas Tehnologiju Klasteris LV, Zapadoceska Univerzita v Plzni CZ, Krakowski Park Technologiczny sp. z o.o. PL, Norges Teknisk-Naturvitenskapelige Universitet Ntnu, NO, Foundation Cluster Information and Communication Technologies, BG	
CUAS	• N/A	•
BWCON	• Special Interest Groups (SIG)	• Fraunhofer Institute for Manufacturing Engineering and Automation IPA • Rhein Main Neckar Automation Region c/o IHK Darmstadt
IMECH	• Development of a slag detection system for continuous casting plant • Development of a remote communication system for AGV	• TENARIS S.p.A. • SCAGLIA INDEVA S.p.A. • COSBERG S.p.A.

	• Development of a monitoring system for an automated assembly line • Development of collaborative robotics applications for self-learning welding	
FB	• FH Burgenland • Akademie Burgenland • Wirtschaft Burgenland • Initiative “Start Up Burgenland” • Energie Burgenland • Project “Smart Up”, Interreg	• Haus der Digitalisierung • Project “Green energy lab - Open Data Platform”, FFG. • Educational and training centers • Special Interest Groups • Relevant SMEs and LEs
HGK VZ	• Faculty of organization and informatics • https://www.foi.unizg.hr/en • Faculty of Geotehnical Engineering • http://www.gfv.unizg.hr/en/index.html	• Companies and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

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6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner and key stake-holder) • Technology Park (TP) Ljubljana	• Multiplier concerning setup of a digital innovation platform • Multiplier concerning Start-up community or spin-offs

KPT	• Urząd Marszałkowski Województwa Małopolskiego (engl. Marshal Office of Malopolska Region, Department of Corporate Governance and Economy)	• introductory meeting (July 2019) • regular meetings/telcos with project management team (each month) • consultation of all relevant documents f.eg. Navigation Crew reports etc.(September/October 2019) • participation at Intro conference Krakow (November 2019) • participation in PPs meetings and Kick-off Conference Villach (November 2019) • supporting regional authorities in the preparation of the RIS3 update by providing relevant content f.eg. Navigation Crew reports etc.
CUAS	• BABEG – hosting of Online DMA platform.	• BABEG – setup of a DIH with a focus on additive manufacturing. However, a general section shall already cover access to the online DMA and related information about support for SMEs.
BWCON	• Wirtschaftsregion Stuttgart	• To use it as partner and multiplier for companies, specially SMS, in shaping technological change and digitisation in the region
IMECH	• Development of a slag detection system for continuous casting plant • Development of a remote communication system for AGV • Development of a monitoring system for an automated assembly line	• use the projects developed to show real implementations • use of the skills developed within the projects to develop new applications

	• Development of collaborative robotics applications for self-learning welding	
FB	• Regional Management Burgenland	• We would like to involve the partner through an exchange of know-how and personal meetings. This should last for a longer period of time to be efficient. • RMB will also be involved as a peer Reviewer.
HGK VZ	• The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	• We will keep the ASP contact person duly informed and involved in project activities where necessary • We will consult the ASP as institution responsible for S3 in Croatia

Conclusion provided by Leader:

<1 page maximum>

NAVIGATION CREW

DI&I Machinery

Slovenian Tool and Die Development Centre

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	
1.0.3	Final version	Knežević Vernon, Hančič	11.12.2019

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – DIGITAL INNOVATION and INDUSTRIES

3.1.1. SPECIFIC TOPICS

Machinery and digital innovation

DEFINITION

Industrial machinery and equipment is by definition machinery and equipment used by a manufacturer in a manufacturing establishment. Machinery is any mechanical, electrical or electronic device designed and used to perform some function and to produce a certain effect or result. The word includes not only the basic unit of the machinery but also any adjunct or attachment necessary for the basic unit to accomplish its intended function. The word also includes all devices used or required to *control*, *regulate* or *operate* a piece of machinery, provided such devices are directly connected with or are an integral part of the machinery and are used primarily for control, regulation or operation of machinery. Jigs, dies, tools, and other devices necessary to the operation of or used in conjunction with the operation of what would be ordinarily thought of as machinery are also considered to be machinery.

Industrial machinery and equipment also represents tangible personal property or other property that has a depreciable life of at least 3 years or more and that is used as an integral part in the manufacturing, processing, compounding, or production of tangible personal, i.e. commercial property for sale. A building and its structural components are generally considered as not being industrial machinery and equipment [1].

DATA INTEGRATION

For machine learning to be effective and analysis to be comprehensive, enterprises must utilize data from the greatest possible variety of sources. A machine learning algorithm is only as good as the data used to train it. Although there is an abundance of enterprise data, much of it is still not easy to find or use. This type of data is called dark data. Enterprises are struggling to throw light on this dark data and make use of it.

Data integration systems have risen to this challenge, resulting in an emergence of several data catalogues and data lake management products. These products aspire to be the "Google for enterprise data" and offer a simple search-based interface to find and explore all the data in an enterprise while honoring existing access control mechanisms.

Data integration systems are increasingly looking to use machine learning-based approaches for finding and highlighting the islands of useful data in the vast ocean of dark data (and thus improve analytics). Metadata is gaining a stronger emphasis and is being captured explicitly or inferred with help of machine learning. Some examples are the use of machine learning in the inference of schema, data distribution, and common value patterns.

Machine learning algorithms are employed on metadata, social context, and operational characteristics to identify accurate, clean, and relevant data for various analytics exercises. For example, in the context of data catalogues, clustering algorithms can be used to group similar data sets, and then collaborative filtering algorithms can be used to recommend the more useful ones among them in each context.

Similarly, in the context of data protection, classification algorithms can be used to automatically detect sensitive data and protect them using an appropriate scheme in a policy driven manner. These are only a couple of examples of how data integration systems are applying machine learning to improve analytics. Every dimension of data management is evolving to make space for applying machine learning to improve the whole process.

Machine learning and data integration making each other more effective is a true example of a symbiotic system. This is just the beginning of what promises to be an exciting journey.

EXAMPLE

- **Data cataloguing,**
- **Data alignment,**
- **Transformation recommendations for data normalization**

4. Introduction

4.1. Motivation

To succeed in today's competitive global market, manufacturers of industrial machinery must find ways to compress design cycles and accelerate product time-to-market, while simultaneously controlling costs, increasing product complexity, and delivering consistently high levels of quality. Meeting these challenges requires to modernize product development systems and implement an integrated 3D design platform, so you can realize the benefits of automation and eliminate the unnecessary tasks, costs, and delays associated with traditional, non-integrated approaches to machine design [3].

In general, complex industrial equipment can have more than 1 million parts, calling for system simulation and complex design to produce them. And, like other design engineers, the people making industrial machinery are being tasked with making those machines smarter, connecting them to the industrial internet of things (IIoT) and the digital thread. In fact, industrial machinery is seen as an excellent IIoT use case because a machine with 1 million parts is bound to need maintenance, and it remains difficult to keep a million parts on hand. If the machine can predictively call for maintenance, expensive downtimes are avoided and parts can be ready as needed. If the machine can record and share manufacturing information that can be mined to help determine which parts in an assembly might be redesigned to improve productivity or which machine components are breaking down most often, it can pay huge dividends. But there's more to the IIoT than sensors and data communication. Vendors are working hard to develop automated workflows to get data from the factory floor everywhere it can be useful to the enterprise. If the challenge of sharing data back and forth along the digital thread can be met, it paves the way for fulfilling much of the promises around Industry 4.0 — from digital twins to enhanced automation. The pressure is on for industrial machinery designers to not only design and simulate incredibly complex machines that blend mechanical, electronic and software engineering disciplines, but that can also serve as the front line of the IIoT [2].

4.1.1. Motivation – Data integration in machinery development

It doesn't matter if you are using 2D tools or non-integrated 3D modeling applications for machinery design, the lack of data integration across functions that are critically important adds time to development processes and lengthens time-to-market. The lack of data compatibility among the used CAD application, finite element analysis (FEA) tools, product data management (PDM) system, quality control software, CAM application, and assembly instruction and documentation preparation tools result in duplicative efforts and unnecessary tasks. Data incompatibility forces developers/producers to operate sequentially because of the need to import/export and convert/translate files to support other functions. Working in a non-integrated development environments also inhibits ones capacity for making design changes quickly and easily, and complicates the producers' ability to communicate efficiently and effectively with customers, resulting in additional delays [3].

4.1.2. Motivation – Efficient cost control in development processes

Accelerating machine design cycles doesn't mean that development costs will rise dramatically - that is if you use an integrated 3D development platform. With integrated parametric 3D design technology, you can make design changes at any stage of the process — your change will ripple across all related data, including manufacturing tools paths, product documentation, and assembly instructions without incurring additional costs.

Potential cost savings related to working in an integrated 3D design environment include:

a) reduced prototyping requirements, through the greater use of FEA simulations for virtual prototyping iterations and design validation,

b) increased design reuse by leveraging the PDM system to advance efforts toward modular design,

c) more extensive use of 3D CAD data to perform other functions, such as design visualization,

d) electrical schematics creation,

e) electronic (PCB board) design,

f) inspection reports,

g) cost estimating/quoting,

h) generation of BOMs, PMI, and GD&T information,

i) CAM tool path generation, and

j) product assembly instructions and documentation preparation.

4.1.3. Motivation - Improved quality of machinery design

An integrated 3D design environment will complement quality improvement efforts in many ways. In addition to supporting the use of integrated FEA simulation tools, to identify and resolve potential performance issues, and an integrated inspection application, to generate inspection requirements and catch errors in manufactured components, an integrated 3D system provides the structure and controls that you need to consistently maintain high levels of quality. Integrated PDM not only provides the workflow constraints needed to drive development processes forward, it also improves handling of engineering change orders (ECOs), it encourages reuse of proven design solutions. Increased mechanical/electrical collaboration can eliminate space issues surrounding electrical panels and housings. With an integrated parametric 3D development ecosystem, design changes become so fast and simple that one is able to take steps to improve quality at any time, instead of waiting to make improvements to a future model [3].

4.1.4. Motivation – Towards greater efficiency

With an integrated 3D machine design platform, producers of industrial machinery can take advantage of workflow automation to completely eliminate duplicative tasks and redundant efforts — as well as trim time wasted on file transfers and data exchanges — and therefore achieve additional efficiencies by completing certain steps in the process concurrently instead of consecutively. It is possible to a) use design configuration tools to automatically create an entire family of products from a single, base design, b) automatically generate BOM, PMI, and GD&T information for the entire line, and c) begin creating product documentation in the time that it would take to model a single design in the past. Customer communications in a 3D integrated system become virtually instantaneous, and because 3D design technology is parametric, design changes at any stage of the process ripple across all related data, including manufacturing tools paths, product documentation, and assembly instructions [3].

Motivation

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
TECOS	Developing and producing more innovative, higher quality industrial machinery in less time and at lower cost is the definition of success in today’s competitive machine design market. Achieving this success requires a level of automation that is only possible through the use of integrated 3D design technologies, concurrent workflows, total data compatibility and management, and the ability to completely leverage 3D design data across all vital functions. By utilizing an integrated, 3D development ecosystem for machine design, validation, manufacturing,	

	quality control, assembly, and documentation, you can boost efficiency, control costs, and improve quality — all at the same time. The topic is highly relevant at regional and national levels since the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and, expand the markets for external use of innovation, must clearly be an economic and societal priority. Within this context companies and individuals must get real-time access to information and democratized production. TECOS can provide broad expertise in this technology field ('Machinery' in general, automation, simulation, material and product design, data integration etc.). Therefore it remains highly relevant for us as we would like to actively contribute, not only as a national player, but also above that – inter-regionally - as this navigation crew is set up.
PBN	The goal is to support the re-industrialization process in Western Hungary. Currently, the region is located at a relatively low end of the manufacturing value chain, and the goal is to realize its upgrade. Since mechatronics is decisive in the region, material science related to that, new material and composited development, additionally power train improvements are important. Autonomous vehicle drive testing and its applications are also in the focal point of the developments. SMEs and large enterprises located in the region must keep abreast of the technological development of the market, therefore the exploitation of digital innovation technologies will be crucial fields of the near future in the region. The main motivation is to: • increase the knowledge of digital innovation methodologies of companies in the region One of the horizontal priorities of the Hungarian National RIS 3 Strategy is ICT and Services. Besides, advanced technologies in the vehicle and other machine industries are listed as sectoral priorities in the national strategic document. These priorities (horizontal + sectoral as well) include lot of subtopics, but digital innovation is a crucial area in the strategic document.
IMECH	Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of factory digitalization is fundamental. In fact, this is the basis of the smart factory and of industry 4.0, which involves the self-regulation of the factory in order to improve working conditions, create new business models and increase the productivity and production quality of the plants. In terms of business change, the key outcomes will be:

	• greater visibility and control of the business through the integration of business processes and supply chain • optimization of decision-making processes through the introduction of data-based support information systems Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in manufacturing fields concerning innovation, economic growth and development.
KPT	One of Malopolska 7 smart specializations listed in the Regional Smart Specializations is Electrical engineering and machinery. Machine industry is a branch of the electromechanical industry. It manufactures various types of mining, metallurgic, construction, agricultural machines, engines and machine tools. In 2016, the value of sold production of activity related to the production of machinery and equipment in Malopolska reached PLN 1.865 billion. This is the equivalent of EUR 427.5 million. In 2017, the number of entities producing in Malopolska machinery and equipment not classified elsewhere exceeded 600. For comparison, in June 2014 such entities were 548 Half of the machinery market entities in Malopolska produce general purpose machines. Moreover, approximately 1/3 are the entities produce other special-purpose machines In the last 10–15 years, the electrical and machine industry in Malopolska created production sectors that have become a strong point of the regional economy. These sectors are characterised by their continuously growing significance on the global market, appearance of new investors and close ties with scientific and university circles. The share of foreign capital in electrical engineering companies in Poland and in Malopolska is approximately 50%. Within an electrotechnics and machinery industry sector a total number of 3.277 companies were identified. The majority of them represent repair, maintenance and installation of machinery and equipment (66.8%). The biggest concentration of these companies are in Kraków (45.3%), 2.7% are located in Tarnów and 2.4% in Nowy Sącz. No other area contains more than 2.0% of the total number of companies. According to available data (GUS), 90.2% of these companies were microenterprises, 6.3% small businesses, 3.2% medium-sized businesses and remaining 0.3% were large companies. Małopolska Region is home for several research institutions linked to electrotechnics and machinery industry sector. They include six technical universities from Kraków, as well as R&D Center for mechanical equipment in Tarnow.

	Manufacturing of machinery and equipment (not specified) and electrical equipment experienced a significant increase in Poland in recent years. The Purchasing Managers Index (PMI), an indicator of the performance of the manufacturing sector, reflects this growth, showing an annual average of 53.6 points. The high dynamics of the Poland economy is boosting the production of the machinery and equipment, it achieved nearly 49 billion PLN value in 2018. In Poland, investments have been unblocked, which led to larger orders from the domestic processing sector for the machinery industry. Poland with a 1.7% share in the production of the European machine industry belongs to the smaller (12th place) manufacturers of machinery and equipment, but in some segments of this market it plays an important role. The Central Statistical Office data shows that in the machinery industry (PKD 28) there are nearly 5,900 entrepreneurs in Poland (2017), the vast majority of which are small companies employing no more than 9 people. There are approx. 400 medium-sized companies (employing up to 250 people), and large entities (over 250 people) - only 80.
HGK VZ	The Varaždin region is already recognized as a rather agile new industry centre in the Continental Croatia (NUTS 2), with an emerging regional economy, a promising technological and scientific infrastructure and a new university in its region. A rather distinctive feature of Varaždin-cantered region is the share of industry in its economy, reaching nearly 40%, nearly 15% points higher than the runner-up regions. In the Varaždin County, companies in production of electrical equipment and machinery make a share of 20% in Croatia. On the other hand, there is a significant lack in innovation in SMEs. The innovation value chain is not functional due to incoherent eco-system and difficulty to adopt and apply current technologies. Manufacture of Machinery and Equipment is one of the most important industries in Croatia. Businesses dealing in this industry are focused on exports, the introduction of new technologies, training professional personnel, quality system certification, eco-friendly production and connecting domestic and foreign producers. In Croatia Manufacture of Machinery and Equipment is mostly developed in the Continental Croatia. The businesses in the sector grow continuously due to increase in their production capacity, new products, and increased exports.

	Number of registered companies is 708. Number of employees in the Manufacture of Machinery and Equipment is 20 980 and the share of Manufacture of Machinery and Equipment in total exports is 7.2% (2018).

4.2. Problem statement

Crew Member	Main Challenges
TECOS	Definition of deliverables, tangible and intangible (products and/or technologies), towards integrated 3D design, concurrent workflows, total data compatibility and management, and leveraging 3D design data across all vital functions of industrial machinery design. By utilizing an integrated, 3D development ecosystem for machine design, validation, manufacturing, quality control, assembly, and documentation etc. … efficiency, cost control, and product quality itself will improve dramatically — all at the same time. Establishing an open innovation community of design and engineering experts, manufacturing service providers etc. to support a broad project stakeholder map. Accelerating successful industrialization of ideas with shortened development-to-market times while considering all relevant aspects of a functioning circular economy.
PBN	• The main barrier can be the permanently changing technological background, namely that digitalization processes are so fast that it is very hard to find out what are the real needs of SMEs. Doing a research about the exact needs of SMEs has to be very fast and actions have to be made as fast as possible. • According to the current statistics and analysis of the (Western) Hungarian companies are not developed and competent enough to utilise Digital innovation elements, including Machinery, so there is a principal gap between the current status and the desired status of the implementation of these technologies. • Spreading the information of the innovation technologies within digital innovation to SMEs is challenging
IMECH	• Application and implementation of digitalization technologies to the business processes of our member associated to solve real-work problems. In this way they can improve their competitivity on the market according to Intellimech mission: “An environment where our partners can catch the opportunities offered by new technologies”.

	• To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of digitalization in italian SMEs. • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.
KPT	Barriers and challenges identified by entrepreneurs in the area of electrotechnics and machinery industry • Low awareness level among SMEs, long legislative process and the complexity of establishing a mechanism supporting SMEs financially in implementing new technologies. • a rapid development in a sector of electrotechnics and machinery is impossible due to growing price competition from foreign companies, • the long term development is strongly influenced by technological progress of a whole sector, as well as individual businesses and requires systematic financial investing • relatively limited dedicated staff to conduct analysis, hardly ever forming a separate section within the company • need in support in hiring of personnel and staff training • research and development is often contracted out to others, especially when companies do not have expensive machinery required for analysis • not clear identification of companies that they are operating within a framework of smart specialization of the region – support to promote this idea in mass media, Internet and institutions which have regular contacts with them (e.g. revenue agency). • expected greater flexibility from local administration (understanding of needs, creating the education system profiled on specialized qualifications and skills within smart specializations, creating better conditions for doing business • regarding international cooperation Polish companies are involved as subcontractors or partners of foreign companies. Entering foreign markets they find as a challenge. They declare interest in cooperation with neighbouring and EU countries.
HGK VZ	Manufacturing industry in Croatia faces many obstacles that have a large impact on its competitiveness. • too many employees but insufficiently educated and unskilled personnel because new digital technologies requires completely new knowledge. For small companies investment is too expensive, in large

	companies the complexity of organisation is barrier to adopt new technology. • weak financial situation and lack of public financial support for investment in new technology • low productivity is burden by obsolete technology and new technology is too expensive to cover cost of investment. • predominant lack of unique selling proposition and products which are demanded by developed markets, quality product and services differentiation is necessary • Cooperation between economy and science is rather weak • Administration is not aligned with the market driven need of companies, especially regarding technology needs and the policy goals which require a radical change of existing mind settings • Regulations are not supportive for investing in new technologies and tools

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
[1]		**https://www.lawinsider.com/dictionary/industrial-machinery-and-equipment**
[2]		**https://www.digitalengineering247.com/download/designing-for-industrial-machinery-and-heavy-equipment/plm**
[3]		**https://www.solidworks.com/sw/docs/Streamlining-the-Design-of-Industrial-Machinery-and-Heavy-Equipment.pdf**
Digital machinery - how companies can win the changing manufacturing game		**https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-machinery-how-companies-can-win-the-changing-manufacturing-game**
Data integration using machine		

learningAutomation of data mapping using machine learning techniquesMARCUS BIRGERSSON and GUSTAV HANSSON		
Digital Transformation Scoreboard 2018: EU businesses go digital: Opportunities, outcomes and uptake	European Commission	Consorzio Intellimech
Research and Innovation Roadmap	Italian national intelligent factory cluster - CFI	Consorzio Intellimech
Predicts 2018: Industrie 4.0 and Advanced Manufacturing	Gartner	Consorzio Intellimech
100 Radical	European	Available online:

Innovation Breakthroughs for the future	Comission	https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	
Małopolska Electrical engineering industry, machine industry and metal industry		https://businessinmalopolska.pl/images/publikacje/opracowania/wydawnictwa_branzowe/02_sektor-maszynowy-w-Maopolsce_ENG.pdf
Characteristics of 3 of 7 smart specializations of the Malopolska region and identification of enterprises needs in this area. (only in Polish)	2014	https://www.malopolska.pl/file/publications/Charakterystyka_3_spord_7_dziedzin_wytyczonych_przez_inteligentn_specjalizacj_regionu.pdf
Impact of smart regional specialization on the	2016	https://www.malopolska.pl/file/publications/Oddziaywanie_inteligentnych_specjalizacji_regionalnych_na_rozwj_gospodarczy_Maopolski.pdf

economic development of Malopolska (only in Polish)		
Verification analysis of areas of smart specialization in Malopolska (only in Polish)	2014	https://www.malopolska.pl/file/publications/Analiza_weryfikacyjna_obszarw_inteligentnej_specjalizacji_regionalnej_wojewdztwa_maopolskiego__II_edycja.pdf
Digital Transformation Monitor Poland: “Initiative for Polish Industry 4.0 - The Future Industry Platform”	2018	https://ec.europa.eu/growth/tools-databases/dem/monitor/content/poland-%E2%80%9Cinitiative-polish-industry-40-%E2%80%93-future-industry-platform%E2%80%9D
CROATIAN SMART SPECIALISATION STRATEGY 2016.-2020.	March, 2016	https://s3platform.jrc.ec.europa.eu/documents/20182/222782/strategy_EN.pdf/e0e7a3d7-a3b9-4240-a651-a3f6bfaaf10e

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)
2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)
3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)	Various national and inter-regional strategic communities… Strategic research and Innovation partnership - SRIP Factories of the future	ADMA assessment – European commission (http://www.adma.ec/)
PBN	In the framework of another EU project of PBN called 4STEPS (further details can be seen here: https://www.interreg-central.eu/Content.Node/4STEPS.html) a transnational tool has been developed which measures RIS3 relevant SMEs in the point of view of needs and the level of adaptation to I4.0 themes. The transnational tool (online questionnaire can be		ADMA assessment – European commission (http://www.adma.ec/)

	filled here: https://4stepscrm.com/index.php?kitoltesboard&sys=startQuestionnaire The replies from SMEs have been being collected from August-October 2019 in the partnership, including Hungarian SMEs too		
IMECH	Test Industria 4.0 - DIH (https://www.testindustria4-0.com/)	Regional Strategic community - AFIL (Work in progress)	ADMA assessment - European commission (http://www.adma.ec/)
KPT	Individual meeting Workshop Questionnaires On-site visits	Digital assessment tool https://dojrzalosc40.delabapps.eu The main mission of the Poland's Future Industry Platform will be to act as an integrator of all stakeholders interested in Industry 4.0 as well as an accelerator of the digital transformation of Polish industry.	ADMA
HGK VZ	na	na	na

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
TECOS	Contributor	X
PBN	Contributor	
IMECH	Learner	
KPT	Learner	
HGK VZ	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
TECOS	- Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. the tooling industry - Excellent expertise in engineering services and applied industrial re-search - Excellent expertise in product and material development - Very good institutional and political connections (nationally and EU-wide) - Excellent industrial refferences wit-hin the EU: https://www.tecos.si/index.php/en/about-us/references - Experience from dozzens of success-fully executed technological projects - Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	- Very good EU-wide connections to European technology partners and customers (product development) - Excellent connections to our tool-and-die cluster members - Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/about-us/equipment - 22 highly skilled professionals emplo-yed full time, while also cooperating with many contractual external experts
PBN	• With the cooperation of PBN an additive manufacturing center, called AM-LAB was established in 2017, and since then this laboratory has gained the DIH status. • The am-LAB is a service centre specialized on the application and presentation of most recent manufacturing technologies to develop	• In AM-LAB non-conventional and creative product design is realized by our market leader model softwares, in a cost efficient way. Products are featured in a realistic virtual environment during any phase of the development. • Cost- efficient data access and process are enabled by

	smart end-user product in strong co-operation with our key customers. • In AM-LAB skilled and motivated multidisciplinary team of economists, engineers, medical staff, sales manager and international project coordinators work together who prefer lifelong learning • Applied physics, sensor technology, modelling, ICT are representing the core technical competencies, while data analysis and visualization, project engineering, ROI calculations of the business perspectives. Sensor technology applications, polymer printing integration, strong interactions of smart production technologies ensure the smart character of the products and services offered by the aM-LAB team	integration of digital manufacturing solutions Maximised production capacity, real-time simulation of manufacturing, integration the new machine into production line.
IMECH	• Considerable know-how developed in the field of digitalization thanks to the development of research projects for its members and thanks to its participation in funded projects Structured network of experts, consisting of universities, consultants and suppliers	• Network of companies to carry out the development of use cases and their testing • Demo cases related to the work done for associate companies
KPT	•Data Center - Cloud Computing Laboratory: 3 IT specialists (cloud computing, software development, security, IT projects management), •Business development: 7 specialists for business support & development (startups, business models, financing, solutions), •ScaleUp Accelerator: 4 specialists (business models, financing, solutions, cooperation between startups and large enterprises, presentations, negotiations, international expansion), •Krakow Living Lab: 2 specialists (living lab approach, products and services testing) •20 external experts and mentors supporting KTP team	•Data Center - Cloud Computing Laboratory (1000+ cores, 7+ TB of RAM, 5+ PB of dataspace with various access speeds, 7+ PB of space for data protection, high capacity redundant LAN and SAN network devices), •MultiLab (Motion Capture markerless system, rendering farm, open space studio with 24 high-power workstations, audio-video editing studios, cinema hall, 3D scanner), •Showroom (modern location for presenting technology solutions; videowalls, projectors, multitouch table, MS Kinects solutions), •7 conference halls (1 for 200 people, 3 for 35 people, 3 for 15 people),

		•equipment rental (laptops and computers, smartphones, game consoles, drones, 3D printers, smartwatches, Red Dragon 6K camera), •Krakow Living Lab - one of Poland's two living lab centres certified by ENoLL (European Network of Living Labs) where products and services can be tested and co-created with end-users involvement (team, methodology, experience, partners). •Main tool: Singu – tool and platform for communication between KTP and tenant, companies, including helpdesk, invoices, data, conference halls and equipment renting etc. •Moodle platform for online trainings for rapid prototyping, smart engineering and Transfer Technology Area
HGK VZ	• Established connections with regional companies and academic community	Platforms and networks available from other implemented EU projects https://greenomed.interreg-med.eu/

Conclusion provided by Crew Leader:

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6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
TECOS	- While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain competences in this context (relevant to later, dissemination stages of the project). - Lacking knowledge in practical/technical establishment of Digital innovation plattforms. We would like to gain competences in this context.
PBN	• Not easy to carry out digitalization development in most of the companies because they are not competent enough
IMECH	• Lack of knowledge related to the needs of EU foreign companies about digitalization

	• Lack of links at European level to structure a transnational competence network about automation
KPT	• lack of machinery competences inhouse (network of external experts, companies, research organizations etc.) • Lack of established international connections in the field of machinery
HGK VZ	• Lack of knowledge in digital technology field • Incapability to introduce changes that will lead to targeted improvement • Lack of supporting infrastructure, knowledge and international networking

Conclusion provided by Leader:

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6.2.3. Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
TECOS	Definition of deliverables, tangible and intangible (products and/or technologies), towards integrated 3D design, concurrent workflows, total data compatibility and management, and leveraging 3D design data across all vital functions of industrial machinery design. By utilizing an integrated, 3D development ecosystem for machine design, validation, manufacturing, quality control, assembly, and documentation etc. … efficiency, cost control, and product quality itself will improve dramatically — all at the same time. Establishing an open innovation community of design and engineering experts, manufacturing service providers etc. to support a broad project stakeholder map. Development options on how to effectively use digital technologies to enhance inter-regional cooperation within the EU (technology, society, environment) to reach a significantly higher state of development of circular economies and therefore environmentally friendly and accessible technologies for everyday lives.
PBN	• Improve the knowledge of the internal staff regarding digital innovation and industries¤ e.g.:Take part in relevant (international) conferences and meetings

	Contact experts in regional, national, or international level to establish new co-operations in the field of digital innovation and industries and improve our knowledge as well as experience good practices
IMECH	• Create a transnational network of companies and experts in the field of digitalization • Identify the needs of companies at European level in order to start new collaborations in digitalization field
KPT	• to establish international network for exchange of know-how and best practices • to create a system which promotes collaborative exchange, where individuals share their experiences in the field of machinery for example by study visit etc.
HGK VZ	• To comprehend the opportunities offered by digital transformation and the changing needs of companies regarding data analytics and modelling • To contribute to creation of an international network which gathers relevant companies and tech experts • To raise level of specific knowledge and necessary skills in regional eco-system, especially business sector regarding digital technologies in industries • To raise awareness of companies to overcome the digitalization gap and improve intra/inter-regional and international collaboration

Conclusion provided by Leader:

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6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
TECOS	- Strong linkages of best practices, - Exchange of best practices, B2B, - Develop support mechanisms for transition to data integration in machining sector.
PBN	Strong cooperation with PPs who are experts in the field of data analytics, simulation and modelling to improve our knowledge and might implement pilot action in this field
IMECH	

KPT	• to support start-ups and SMEs from regional ecosystem in the field of machinery in their businesses • to exchange of transnational best practices and lessons learnt within study visit, B2B meetings, training platforms etc. • to organize tailored conferences, seminars, speed dating and industry weeks • to improve the strong cooperation with PPs who are experts in the field of machinery to exchange knowledge and implement joint pilot action in this field.
HGK VZ	• To learn from other partners having expertise in field of digital technologies to gain internal knowledge and comprehend opportunities for business sector • To cooperate with other partners and contribute to creation of an international network and connect with other EU entities relevant for this field. • To spread intra –regionally the new values and by implementation of foreseen activities contribute to modernization of SME’s sector.

Conclusion provided by Leader:

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6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) ADMA assessment – European commission (http://www.adma.ec/) (TECOS as project partner, TECOS as important regional stake-holder) Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) Slovenian Government office for development and European cohesion policy (SVRK) Technology Park (TP) Ljubljana	3Dhubs electronic knowledge base (e-portal) (https://www.3dhubs.com) Lombardy Intelligent Factory Association – AFIL Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/) etc…
PBN	• 2 further DIHs in Hungary (Digi-HUB and Budapest University Of Technology And Economics) • Ministry for National Economy • National Research, Development and Innovation Office • Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties	Looking for relevant actors and stakeholders in the field and establish new cooperations with them

IMECH	Lombardy Intelligent Factory Association - AFIL	Lombardy Intelligent Factory Association - AFIL
KPT	• Poland's Future Industry Platform • Ministry of Entrepreneurship and Technology • Marshall Office of Malopolska Region, Department of Corporate Governance and Economy Malopolska Regional Development Agency	Looking for relevant actors and stakeholders in the field of machinery and establish new cooperations with them. • identification of relevant SMEs to increase their knowledge • identification of best practices of machinery in Malopolska & Poland identification of experts and specialists within TPA
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	Companies, experts and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

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6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner and key stake-holder)	Other regional DIH connections to be es-tablished...
PBN	• Good cooperation with the 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association - AFIL	

	Italian national intelligent factory cluster - CFI	
KPT	KTP is a regional DIH acting as a one-stop-shop, serving companies within their local region and beyond to digitise their business. KTP DIH is based on a clear understanding of actual needs of the stakeholders. Main task of KTP DIH is to inspire industrial enterprises to implement innovative digital solutions related to Industry 4.0 and actively support and co-create them in implementation at various stages: from diagnosis, needs analysis and conceptualization to post-deployment testing. KTP DIH partners: • Universities: AGH University of Science and Technology, Cracow University of Technology, Jagiellonian University, University of Economy • SMEs: Autenti, Kangur Electronics, Astor, Protech, ES-System, Game Desire, Velis • LE: Comarch, Fideltronik, EC Group, Woodward Poland, Transition Technologies, Merit Poland, Wisniowski • Małopolska Regional Development Agency Municipality of Krakow, Marshall Office of Małopolska Region	• to initiate and develop cooperation with Automation and Robotics Hub (ARH), Warsaw to initiate and develop cooperation with Silesia Competence Centre Industry 4.0, Katowice
HGK VZ	na	na

Conclusion provided by Leader:

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6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') Slovenian Government office for development and European cohesion policy (SVRK) Technology Park (TP) Ljubljana	Members of the TECOS Tool-and-die technology cluster (high-tech industrial companies, ranging from SMEs to LEs) (https://www.tecos.si/index.php/en/ membership/list-of-members) ADMA assessment - European commission (http://www.adma.ec/) (TECOS as pro-ject partner, TECOS as important regional stake-holder) LUI (Ljubljana University Incubator) ABC Hub Ljubljana (http://accelerationbusinesscity.com/) Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) (various other incubators, digital hubs and regional development agencies)
PBN	• Future Internet LivingLab Association (SME) • 3D Printing Zrt LTD (R&D Center) • iQor Global Services Hungary Kft. (Large enterprise) • BPW-Hungária Kft.(Large enterprise) • Széchenyi University (Győr;) • BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS • PBN's currently running EU projects can be considered as synergic ones: • 4STEPS: Interreg Central Europe • https://www.interreg-central.eu/Content.Node/4STEPS.html • DIH2: Horizon 2020 • http://www.dih-squared.eu/	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well

	• CHAIN REACTIONS: (CE) • https://www.interreg-central.eu/Content.Node/CHAIN-REACTIONS.html • • Innopeer AVM: (CE): • https://www.interreg-central.eu/Content.Node/InnoPeerAVM.html Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.	
IMECH	• Development of a monitoring system for an automated assembly line • Development of a remote maintenance system for an industrial manipulator Development of SCADA for textile looms	• COSBERG S.p.A. • INDEVA S.p.A. ITEMA S.p.A.
KPT	All relevant stakeholders were listed above in 6.3.2. Additionally we can list some partners from synergic projects: Interreg CE Projects: • ECOS4inCE Cross-border ecosystem for Industry 4.0 Ústecký kraj, Czech Republic , Università Cà Foscari Venezia, Italy, Pannon Novum Nyugat-dunántúli Regionális Innovációs Nonprofit Kft, Hungary, Business Upper Austria - OÖ Wirtschaftsa gentur GmbH, Austria, ddsssssKoprivnički poduzetnik d.o.o., Croatia, Fondazion E Giacomo Brodolini, Italy, Malopolska Regional Development Agency, Poland https://www.interreg-central.eu/Content.Node/ECOS4IN.html • InNOW InnoEnergy Central Europe, ABC Accelerator; Optimization, University of Debrecen, EH Invest, Neulogy https://www.interreg-central.eu/Content.Node/InNow.html H2020 projects:	Specialized RTD facilities that focus on machinery Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.

	BOWI: Boosting Widening Digital Innovation Hubs, Project Partners: UAB Civita LT, Fundingbox Accelerator Sp z o.o. PL, Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoektno NL, Teknologian tutkimuskeskus VTT FI, Firheinisch-Westfaelische Technische Hochschule Aachen DE, Asociatia Transilvania IT, Rolatvijas Informacijas Tehnologiju Klasteris LV, Zapadoceska Univerzita v Plzni CZ, Krakowski Park Technologiczny sp. z o.o. PL, Norges Teknisk-Naturvitenskapelige Universitet Ntnu, NO, Foundation Cluster Information and Communication Technologies, BG	
HGK VZ	• Faculty of organization and informatics https://www.foi.unizg.hr/en • Faculty of Geotehnical Engineering http://www.gfv.unizg.hr/en/index.html Current EU project: • Greenomed (Interreg MED) https://greenomed.interreg-med.eu/ Mediterranean Trans-Regional Cooperation for green manufacturing innovation	Companies, experts and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

<1 page maximum>

6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner and key stake-holder) Technology Park (TP) Ljubljana	Multiplier concerning DIH setup Multiplier concerning Start-up community or spin-offs
PBN	IFKA Public Benefit Non Profit Ltd. for the Development of the Industry	• organize meetings (online, personal) • inform them regularly about project implementations discuss the future plans
IMECH	• Development of a monitoring system for an automated assembly line	• use the projects developed to show real implementations

	• Development of a remote maintenance system for an industrial manipulator Development of SCADA for textile looms	use of the skills developed within the projects to develop new applications
KPT	Urząd Marszałkowski Województwa Małopolskiego (engl. Marshall Office of Malopolska Region, Department of Corporate Governance and Economy)	• Introductory meeting (July 2019) • Regular meetings/telcos with project management team (each month) • Consultation of all relevant documents f.eg. Navigation Crew reports etc.(September/October 2019) • Participation at Intro conference Krakow (November 2019) • Participation in PPs meetings and Kick-off Conference Villach (November 2019) Supporting regional authorities in the preparation of the RIS3 update by providing relevant content f.eg. Navigation Crew reports etc.
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	We will keep the ASP contact person duly informed and involved in project activities where necessary and consult the ASP as institution responsible for S3 in Croatia

Conclusion provided by Leader:

<1 page maximum>

NAVIGATION CREW

Advanced & Smart Materials

Fraunhofer

IWU

Interreg CENTRAL EUROPE European Union European Regional Development Fund
S3HubsinCE

Content

Introduction

Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	

Table 1: Release history of this document.

Crew: definitions and examples

NAVIGATION CREW – ADVANCED & SMART MATERIALS

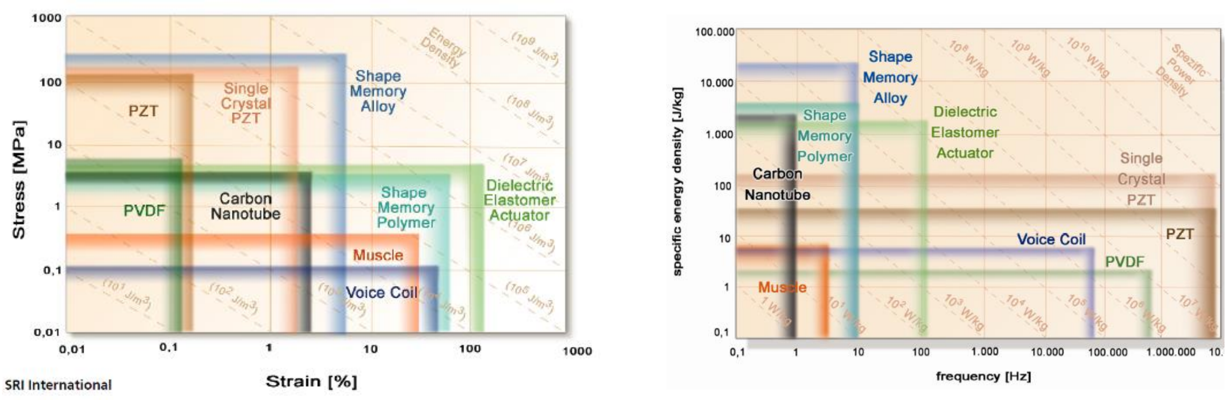
SPECIFIC TOPICS

Advanced & Smart Materials

DEFINITION

In Germany 70 % of all technological innovations are based on new materials and materials technology (Source: Zukunftsletter of the ITZ Heidelberg).

Materials technology is a key technology for the future and calls for a paradigm shift in the product: The fusion of functions and structures. Our particular focus is on smart materials that combine these elements. "Appropriate smart materials include piezo ceramics, shape memory alloys or electromagnetically activated fluids and polymers. Figure 1 (left) shows the stress-strain behaviour of certain smart materials, followed by Figure 2 (right) which demonstrates their properties considering energy density and frequency.



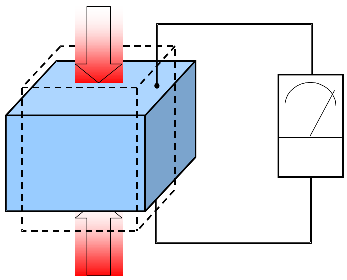
stress-strain energy density–frequency

Figure 1: properties of smart materials [3]

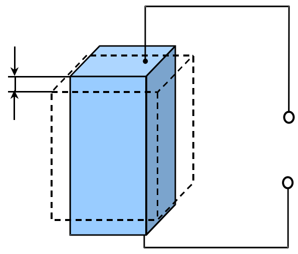
EXAMPLES (text by Dr. Kenny Pagel, Fraunhofer IWU)

A. Piezoceramics

The piezoelectric effect was discovered by Pierre and Jacques Curie in 1880. The direct piezoelectric effect consists of the ability of certain crystalline materials (ceramics) to generate an electrical charge in proportion to an externally applied force. The direct effect is used in force transducers. According to the inverse piezoelectric effect, an electric field parallel to the direction of polarization induces an expansion of the ceramic [4].



direct piezoelectric effect



indirect piezoelectric effect

Figure 1: piezoelectric effect

Applications

Fuel Injector

Modern diesel engines operate on the principle of direct fuel injection. Such system consists – in simplified form – of a pump that brings the fuel up to a high pressure level of up to 2000 bar and a nozzle that injects finely dosed quantities of fuel into the engine cylinder with the aid of a valve. The higher the pressure and the more accurate the dosing and time of injection the more efficient and less polluting the combustion. Figure 2 (middle and right) shows a picture of a car engine with 4 fuel injectors in place and a simplified cross-section through one fuel injector. The greyish cylinder on top is the stack of piezoelectric materials also shown in Figure 2 (left). It reacts very quickly to an applied voltage by elongating (more than 5 times faster than old "solenoid" technology), thus allowing fuel to be pressed in the cylinder. Just as important, it exerts a very large force, which is needed because injection takes place at huge pressures (up to 2000 bar).

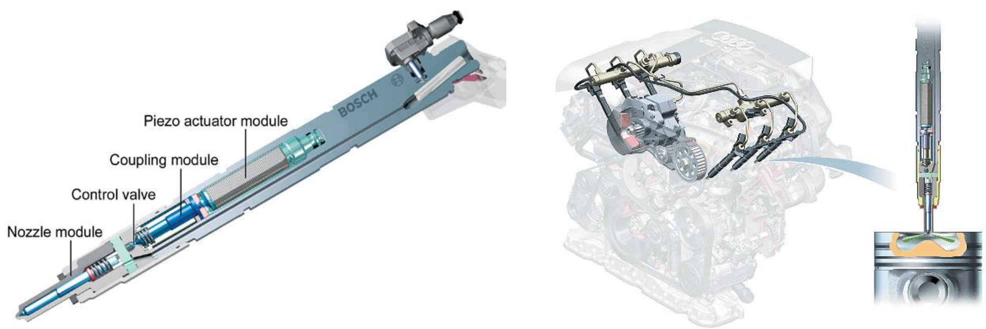


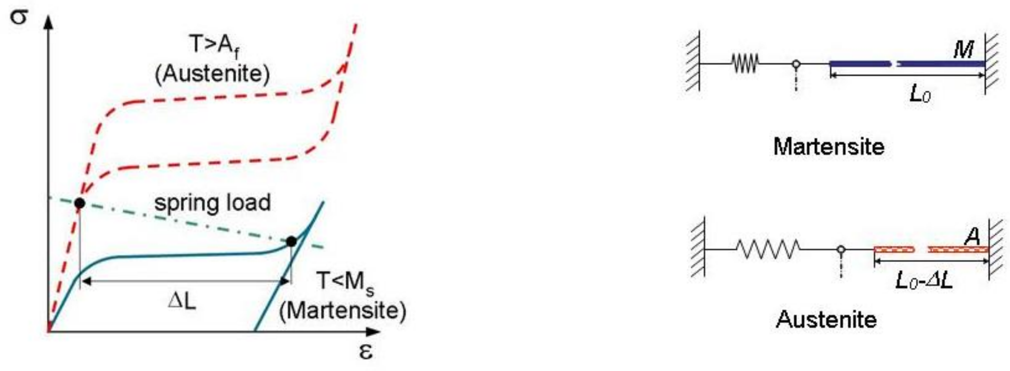
Figure 2: Piezo based fuel injector [5]

A modern actuator for diesel injection consists of around 350 active piezo layers. At a length of 30 millimetres, it can produce a stroke of 40 micrometres. Forces of up to 2500 N are then released.

In principle, the piezoelectric fuel injector is a result of Siemens research. Production began around 2000, in 2005 more than 5 Mio injectors had been delivered. The technology boosts performance while reducing fuel consumption up to 20% and cutting carbon dioxide emissions.

B. Shape Memory Alloys

Thermal shape memory alloys are materials which offer the special ability to “remember“ and re-assume their original shape following permanent plastic distortion below a specific critical temperature by means of heating up above this temperature. A reversible austenite-martensite phase transformation is required for the development of the shape memory effect. Analogous to steel the high temperature phase β of the material is also described as austenite and low temperature phase α as martensite. In an ideal situation the austenite β phase is converted into the martensite α phase as a result of shear. Due to diffusion-free rearrangement processes in relation to the atoms this generates a change in the stacking sequence of the crystal lattice levels and therefore a change in the structure of the crystal lattice. Consequently, two different stress-strain-curves exist as shown in Figure 3 (left). In the low-temperature phase a small Hook region is followed by a so-called plateau-stress. There the actuator (e.g. wire) can be easily deflected almost without increasing the applied external stress. After setting the stress to zero, a plastic deflection remains to the actuator. Heating the material causes the described phase transformation and results in a completely different stress-strain-behavior. The Hook region is significantly wider; the Young’s-modulus is two to three times higher. Applying a high amount of stress causes a so called super-elastic-behavior. During the phase transformation from martensite to austenite (heating) the wire is able to perform mechanical work see Figure 3 (left). The amount of work depends on the mechanical boundary conditions of the actuator. In case of a free actuator the amount of work would be zero, but the deflection would be maximum. In contrast, blocking the actuator causes a very high force but no deflection. The work output is also zero. Using a spring with a defined stiffness as boundary element instead, causes a deflection as well as a reaction force and therefore a usable workload. The amount of that workload depends on the stress-strain-curves of the material and the design of the spring (see Figure 3 (left)) [6].



Stress-strain-behaviour mechanical arrangement

Figure 3: SMA actuating principle wire against spring

One of the advantages to using shape-memory alloys is the high level of recoverable plastic strain that can be induced. The maximum recoverable strain these materials can hold without permanent damage is up to 8% for some alloys (compared with a maximum strain 0.5% for conventional steels). The yield strength of shape-memory alloys is lower than that of conventional steel, but some compositions have a higher yield strength than plastic or aluminum. The yield stress for NiTi can reach up to 500 MPa.

Applications

Variable Geometry Jet Noozle

In aerospace engineering morphing technologies are able to increase a system's performance by manipulating characteristics to better match the system state to the operating conditions. Current morphing has certain disadvantages: Even small structural changes are very difficult. They require heavy motors, hydraulics and structural reinforcements. Hence current systems are very complex and expensive. “Smart materials” lead to new morphing concepts since they offer a number of advantages: They enable to design fully integrated, distributed and simple actuation systems without adding any weight. Especially SMAs are a very light, robust, simple and easy to integrate technology for realizing morphing structures.

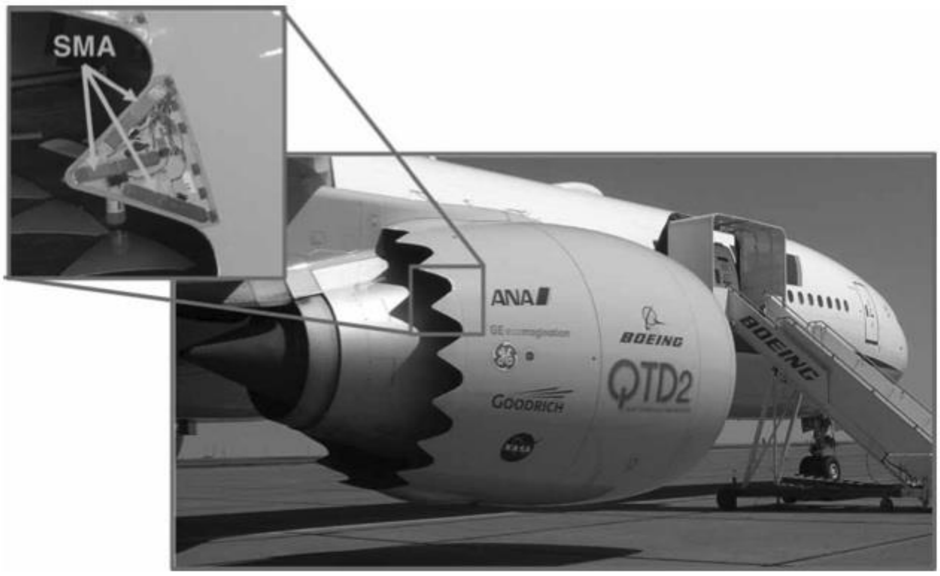


Figure 4: SMA [7]

In the beginning of 2000 Boeing presented a system of a reconfigurable engine nozzle fan chevron based on shape memory alloys (see **Figure 4**). The approach was to implement bending SMA strips in the outlet chevrons of a jet engine in order to set the optimum shape for take of (low noise) and cruise position (fuel efficiency). The system is able to use the engines temperature for actuation and can consequently perform fully autonomous operation depending on the flight condition. The system was further used in flight tests for the development of the 787 static fan chevrons by using external activation.

C. Rheological Fluids

Rheological fluids are generally a dispersion composed of a base fluid (usually a type of oil) and particles. These particles can be either polymer- in electrorheological fluids (ERF) or iron based in magnetorheological fluids (MRF). If a field is applied so-called particle chains are built and the fluid changes its viscosity to the point of becoming a viscoelastic solid (see Figure 5).

no field applied   field applied

Figure 5: Magento -/Electrorheological Effect

That causes a blockage in the flow cross-section, and thus increases the fluid flow resistance. Hence the fluid is able to transmit forces. The yield stress and so the transmittable forces can be controlled very accurately by varying the field intensity. Rheological fluids are thus considered valuable for manipulating viscosity over a wide range without consuming or degenerating the substance.

However there are some disadvantages of MRF. The high density difference of the basis fluid and the iron particles can particularly in rotating systems cause a segregation of fluid and particles. Thus MRF based systems require designs where the fluid is permanently mixed. Due to high magnetic activation fields and hence the required inductance of the activation coils the realizable working frequency of MRF is comparatively small.

Applications

Magnetic Ride Suspension

Magnetic Ride is an automotive suspension system that utilizes magnetically controlled dampers, or shock absorbers, for a highly adaptive ride. As opposed to traditional suspension systems, Magnetic Ride has no mechanical valves or small moving parts that can wear out. This system consists of four monotube dampers, one on each corner of the vehicle, a sensor set, and an ECU (electronic control unit) to maintain the system.

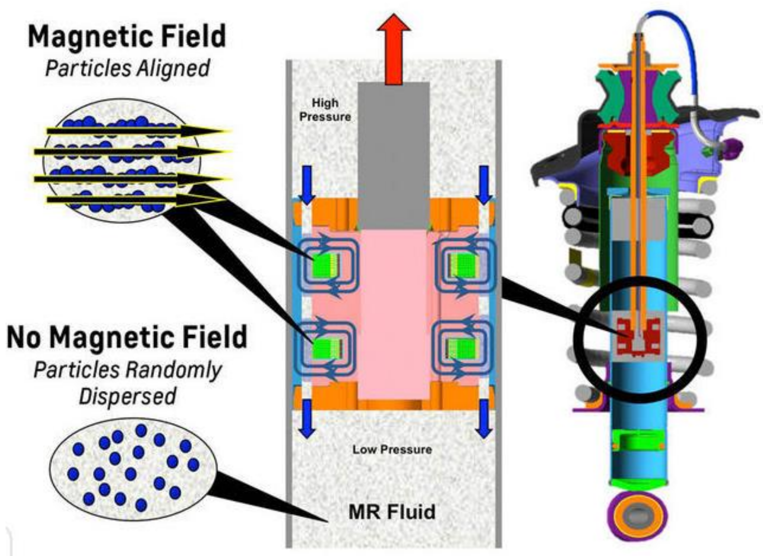


Figure 6: Magnetic Ride [9]

As shown in Figure 6 the dampers are filled with magnetorheological fluid. In each of the dampers is a piston containing two electromagnetic coils and two small fluid passages through the piston. The electromagnets are able to create a variable magnetic field across the fluid passages. When the magnets are off, the fluid travels through the passages freely. However, when the magnets are turned on, the iron particles in the fluid create a fibrous structure through the passages in the same direction of the magnetic field. The strength of the bonds between the magnetized iron particles causes the viscosity of the fluid to increase resulting in a stiffer suspension. Altering the strength of the current results in an instantaneous change in force of the piston. If the sensors sense any body-roll, they communicate the information to the ECU. The ECU will compensate for this by changing the strength of the current to the appropriate dampers.

References

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[11] Holz, B., Janocha, H., 2010, MSM Actuators – Magnetic Circuit Concepts and Operating Modes; 12th International Conference on New Actuators 2010, Bremen, Germany

Introduction

Motivation

<Motivate why the above described topic area/s is relevant at regional / national level? Motivation should be provided by each crew member and ideally supported by quantitative / qualitative evidence> Relevance can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.000 characters / member.

Motivation

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
IWU	The German state of Saxony specified the following Key Enabling Technologies (KETs) in its smart specialisation strategy RIS 3[1]: • Nano technologies • Micro and nano electronic • Photonic • New materials • Biotechnologies • Advanced production technologies Saxony considers the KET Advanced production technologies as cross-cutting with all of the others and enumerates these detailed areas of interest, amongst others: • Mobility • Leightweight structures • Smart materials • Integrated sensors/actuators • Information and communication technology (ICT) • Resource-efficient production The area of *Advanced & Smart Materials* is heavily cross-cutting and covers most of the aforementioned areas and KETs.	Germany is aware of its excellent starting conditions. It is the No. 1 mechanical engineering country in Europe, with over 150 years of production and innovation experience, a high-quality education system and an excellent scientific and research landscape. Germany is also aware that the technologies of today cannot conquer the markets of tomorrow. That's why it is important for SMEs to reorient themselves, to review their own business models and, if necessary, to renew them. However, this is linked to an entrepreneurial and innovative mindset. At no other time do founders have such great opportunities as in times of technological revolution. **Furthermore** In Germany 70 % of all technological innovations are based on new materials and materials technology (Source: Zukunftsletter of the ITZ Heidelberg).
CUAS	Some regional enterprises are already working with smart-made materials (e.g. integrated sensor systems) or are researching on this topic. However, the majority	

[1] https://s3platform.jrc.ec.europa.eu/documents/20182/229963/DE_Sachsen_RIS3_201307_Final.pdf/ca3f42e8-7720-4edf-9737-be2383e9bdf2 (visited 16th October 2019)

	of regional enterprises are not aware about the potential of smart-made materials, smart materials or meta-materials in the domain of their products. This gap shall be closes by research of CUAS in the context of its CISMAT (Carinthia Institute for Smart Materials and Manufacturing Technologies) https://www.fh-cismat.at/en/. In the context of this Navigation Crew there shall be established a bilateral exchange of experiences and knowledge in order to foster the roll-out of such technologies at regional SMEs.	
BWCON	BW has developed a unique cluster for its focus on nanotechnology research at the Karlsruhe Institute for Technology (KIT) and the NanMat national competence Network. It is shaped by the cooperation between research and Corporate development and companies from Karlsruhe and the surrounding area as well as from the neighbouring Rhein-Neckar region.	The development of new materials and surface properties is an interdisciplinary issue touching a wide range of industries. For them, the development of new smart materials and surface properties is a key subfield of their innovation management and serves to maintain or expand their competitive position. Because of this, the development and use of new materials is a key strategic technology field in the economy. On the other hand, nanotechnology is represented by highly specialised institutions and companies in a wide range of application industries.
PBN	The goal is to support the re-industrialization process in Western Hungary. Currently, the region is located at a relatively low end of the manufacturing value chain, and the goal is to realize its upgrade. Since mechatronics is decisive in the region, material science related to that, new material and composited development, additionally power train improvements are important. Autonomous vehicle drive testing and its applications are also in the focal point of the developments. SMEs and large enterprises located in the region must keep abreast of the technological development of the market, therefore the exploitation of Data Analytics, Simulation and modelling will be crucial fields of the near future in the region.	One of the horizontal priorities of the Hungarian National RIS 3 Strategy is ICT and Services. Besides, advanced technologies in the vehicle and other machine industries are listed as sectoral priorities in the national strategic document. These priorities (horizontal + sectoral as well) include lot of subtopics, among others they are dealing with advanced and smart materials. As a result these topics can be considered as national priorities.

Problem statement

<Are there any specific challenges that can already be identified by crew members. Please note and remember that a specific need assessment activity will be done under Activity 1.2. therefore, this first overview should ideally provide the main directions that will guide the need assessment activity. Again, each crew member should provide its point of view.

Challenges can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.500 characters / member

Crew Member	Main Challenges
IWU	• Regarding the implementation and application of smart and advanced materials in SMEs' premises many of them aren't even aware of the advantages oth theim. A tailored process is required for raising awareness and self-reflection in order to derive a specific process of activities in order to integrate smart and advanced materials in the production process.
CUAS	How to map the features of smart materials, smart-made materials or meta-materials to functional requirements or design patterns in order to make them easy accessible for engineering staff in SMEs.
BWCON	• SMEs in particular require external support due to their limited human and financial resources. To this end, the main goal is to support innovative approaches and formats and use knowledge transfer to make existing knowledge and technologies more applicable in scientific and entrepreneurial fields, especially targeted to SMEs.
PBN	• The main barrier can be the permanently changing technological background, namely that digitalization processes are so fast that it is very hard to find out what are the real needs of SMEs. Doing a research about the exact needs of SMEs has to be very fast and actions have to be made as fast as possible. • According to the current statistics and analysis of the (Western) Hungarian companies are not developed and competent enough to utilise Advanced and Smart Materials so there is a principal gap between the current status and the desired status of the implementation of these technologies. Spreading the information of the technology areas to SMEs is challenging

References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
100 Radical Innovation Breakthroughs for the future	European Commission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	Available online in national language and in English, but it was downloaded by PBN.
Regional Cluster Atlas Baden-Württemberg (2019)	Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg	https://www.clusterportal-bw.de/fileadmin/media/Download/Downloads_Publikationen/Cluster-Atlas_2019_englisch.pdf
Digitalisierungsstrategie der Landesregierung Baden-Wurttemberg (2017)	Ministerium für Inneres, Digitalisierung und Migration	https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/Digitalisierungsstrategie-BW.pdf
Innovationsstrategie **des Freistaates Sachsen**	**SMWA**	**Available online (German):** https://s3platform.jrc.ec.europa.eu/documents/20182/229963/DE_Sachsen_RIS3_201307_Final.pdf/ca3f42e8-7720-4edf-9737-be2383e9bdf2 visited 16th October 2019
Eye@RIS3: Innovation Priorities in Europe	**European Commission**	**Map available online:** **https://s3platform.jrc.ec.europa.eu/map?p_p_id=captargmap_WAR_CapTargMapportlet&_captargmap_WAR_CapTargMapportlet_non-eu-country=true&_captargmap_WAR_CapTargMapportlet_non-eu-region=true&_captargmap_WAR_CapTargMapportlet_regionids=767** visited 16th October 2019

Smart[3] - materials - solutions - growth	Fraunhofer IWU	www.smarthoch3.de

Table 2: Documents, which are referenced by this document.

Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)
2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)
3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

<Description of methods or tools which are applied in order to achieve the thematic topics are specified here.>

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
IWU	Level of Maturity Analysis	Smart Tools for Smart Design http://st4sd.de/	ADMA assessment - European commission (http://www.adma.ec/)
CUAS	Analysis of Functional Requirements with respect to smart products at regional SMEs. Mapping of Functional Requirements to Design Patterns	Networking with national experts on smart materials or printed electronics.	ADMA assessment - European commission (http://www.adma.ec/) Integration with Navigation Crew “Circular economy” and “Engineering for AM”
BWCON	-Reifegrad Modell	-Hightech Summit -Allianz 4.0:	-Smart Space (Alpine Space)

		https://www.i40-bw.de/de/readiness-4-0/ -DIGIHUB Südbaden: https://www.digihub-suedbaden.de/digitalisierungs-check	
PBN	In the framework of another EU project of PBN called 4STEPS (further details can be seen here: https://www.interreg-central.eu/Content.Node/4STEPS.html) a transnational tool has been developed which measures RIS3 relevant SMEs in the point of view of needs and the level of adaptation to I4.0 themes. The transnational tool (online questionnaire can be filled here: https://4stepscrm.com/index.php?kitoltesboard&sys=startQuestionnaire The replies from SMEs have been being collected from August-October 2019 in the partnership, including Hungarian SMEs too		ADMA assessment - European commission (http://www.adma.ec/

Table 5: List of available tools / methods.

Structure of the Navigation Crew

Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
IWU	Contributor	X
CUAS	Contributor	
BWCON	Contributor	
PBN	Contributor	

Table 6: Structure of the Navigation Crew.

Strength and weaknesses

Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
IWU	Experience in and working on many project on smart materials and their applications in the contexts of production technologies, health and medical technologies, lifestyle and architecture and mobility.	Leader of smart[3] network with over 150 member from various disciplines and backgrounds (companies, SMES, Universties, etc…) in the field of Smart and Advanced Materials in Germany
CUAS	Connected to Silicon Austria Labs (SAL).	CISMAT as institute, which researches on the disciplines of smart materials, integrated sensor systems, additive manufacturing in engineering of agile virtual production systems as well as interdisciplinary projects between this fields of expertise. First experiences with the mapping of AM-printed features to concrete problem cases could be adapted for smart materials. Expertise in meta materials and 3d-Printing as well as 3d-printing infrastructure
BWCON	• Experience in technology transfer from research to industry and open innovation trainings. • Established network of industry experts and researchers.	• Strong network of companies (including SMS and small companies)
PBN	• With the cooperation of PBN an additive manufacturing center, called AM-LAB was established in 2017, and since	• In AM-LAB non-conventional and creative product design is realized by our market leader model softwares, in a cost efficient way. Products are

	then this laboratory has gained the DIH status. • The am-LAB is a service centre specialized on the application and presentation of most recent manufacturing technologies to develop smart end-user product in strong co-operation with our key customers. • In AM-LAB skilled and motivated multidisciplinary team of economists, engineers, medical staff, sales manager and international project coordinators work together who prefer lifelong learning • Applied physics, sensor technology, modelling, ICT are representing the core technical competencies, while data analysis and visualization, project engineering, ROI calculations of the business perspectives. • Sensor technology applications, polymer printing integration, strong interactions of smart production technologies ensure the smart character of the products and services offered by the aM-LAB team	featured in a realistic virtual environment during any phase of the development. • Cost- efficient data access and process are enabled by integration of digital manufacturing solutions • Maximised production capacity, real-time simulation of manufacturing, integration the new machine into production line.

Conclusion provided by Crew Leader:

<1 page maximum>

Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
IWU	Lack of Knowledge of the needs of European Companies on Smart Materiasl
CUAS	Lack of Knowledge of the needs of regional enterprises. Lack of knowledge on how to adapt smart material features to real world problems. (see the statement: “we have a solution where is the problem?”)
BWCON	• While competent in consultancy and advisory, we would like to gain more technical capacities • We look forward to extend our international cooperation in this topic
PBN	• Not sufficient knowledge yet of application of advanced and smart materials • Knowledge of advanced and smart materials should be improved and updated,

Conclusion provided by Leader:

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Partner’s common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
IWU	Co-create a robust support network based on knowledge exchange to achieve new innovative applications of advanced & smart materials on a European Level.
BWCON	Co-create a robust support network based on knowledge exchange to achieve new innovative applications of advanced & smart materials as well as nanotechnologies.
PBN	• Improve the knowledge of the internal staff regarding Advanced and smart materials→ e.g.:Take part in relevant (international) conferences and meetings Contact experts in regional, national, or international level to establish new co-operations in the field of advanced and smart materials and improve our knowledge as well as experience good practices

Conclusion provided by Leader:

<1 page maximum>

Partner’s clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
IWU	• Organize a workshop at the IWU for transferring our understanding of Advanced and Smart Materials to partners of this Navigation Crew • Showcase some concrete examples from the smart^3 network Exchange experiences with partners from this Navigation Crew
CUAS	Development of smart material, smart-made material, meta material. Research on existing development of smart material, smart-made material, meta material. Classification of smart material, smart-made material, meta material → design patterns. Mapping of design patterns to functional requirements.
BWCON	Specifically, bwcon looks forward to: • Organize and promote tailored transfer events, as well as participate in relevant stakeholder events. • Provide support to our regional ecosystem network of small and medium companies in experimenting with advanced materials and nurture cross-industry applications. • Exchange transnational best practices and foster cooperation with other Project Partners in advanced materials and nanotechnology to exchange knowledge and develop joint pilot actions.
PBN	Field audit among Hungarian SMEs seeking smart material application might be carried out. „ Smart Material applications” can divided in two fields: 1. Production of Smart Material systems: Companies are main target who are dealing with automation. The objective is the manufacturing of smart materials products. 2. Improved manufacturing processes using smart material systems: This basically adresses the manufacturing companies which could improve their processes using smart material systems. The objective is the improved process - the smart materials system is just the tool.

Conclusion provided by Leader:

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S3 and DIH network

Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IWU	• Saxony is Vanguard region and Fraunhofer IWU is leading this region[1] Staatsministerium für Wirtschaft, Arbeit und Verkehr (= state ministry of economy, work and transport)	Looking for relevant actors and stakeholders in the field and establish new cooperations with them
CUAS	BABEG	BABEG, KWF – for hosting and funding of DIH on “engineering for AM”
BWCON	• Ministerium für Wirtschaft, Arbeit und Wohnungsbau	
PBN	• 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics) • Ministry for National Economy • National Research, Development and Innovation Office • Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties	Looking for relevant actors and stakeholders in the field and establish new cooperations with them

Conclusion provided by Leader:

<1 page maximum>

[1] https://www.s3vanguardinitiative.eu/cooperations/efficient-and-sustainable-manufacturing-esm (visited 17th October 2019)

Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IWU	• EU project TRINITY[2] • Regional Saxonian DIH Smart Systems Hub[3] • Regional Saxonian DIH InnoSax[4]	To other European DIH
CUAS	Silicon Austria Labs (SAL), Infineon Technologies, Material Center Leoben	Joanneum Research - https://www.joanneum.at/materials.html To be connected to DIH to be established in conjunction with "engineering for AM".
BWCON	• de:hub Stuttgart (Future Industries) • Digital Hub Südbaden (DIGIHUB Südbaden)	
PBN	• Good cooperation with the 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well

Conclusion provided by Leader:

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Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

[2] http://www.trinityrobotics.eu/ (visited 17th October 2019)

[3] http://smart-systems-hub.de/en/home/ (visited 16th October 2019)

[4] http://innosax-smartproductionsystems.de/ (visited 16th October 2019)

Crew Member	Current stakeholders	Stakeholders that need to be involved
IWU	Members of the smart[3] Network	Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.
CUAS	CISMAT, Talente Pipeline – both are research initiatives resp. projects of CUAS.	
BWCON	• NanoMat c/o Karlsruher Institut für Technologie: http://www.nanomat.de • Steinbeis-Transferzentrum Smart Products und Advanced Materials	• Institute for Textile Chemistry and Chemical Fibres ITCF) • Hohenstein-Institut für Textilinnovation gGmbH (HIT) • Nano-Zentrum Euregio Bodensee e. V. http://wp.neb-konstanz.de/
PBN	Future Internet LivingLab Association (SME) 3D Printing Zrt LTD (R&D Center) iQor Global Services Hungary Kft. (Large enterprise) BPW-Hungária Kft.(Large enterprise) Széchenyi University (Győr;) BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS Jankovits Engineering IGM ROBOTSYSTEM LTD Julius Globe LTD VESZ-Mont 2000 LTD PBN's currently running EU projects can be considered as synergic ones: 4STEPS: Interreg Central Europe https://www.interreg-central.eu/Content.Node/4STEPS.html DIH2: Horizon 2020 http://www.dih-squared.eu/	Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.

	CHAIN REACTIONS: (CE) https://www.interreg-central.eu/Content.Node/CHAIN-REACTIONS.html Innopeer AVM: (CE): https://www.interreg-central.eu/Content.Node/InnoPeerAVM.html	

Conclusion provided by Leader:

<1 page maximum>

Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
IWU	Staatsministerium für Wirtschaft, Arbeit und Verkehr (= state ministry of economy, work and transport)	• organize meetings (online, personal) • inform them regularly about project implementations discuss the future plans
CUAS	BABEG	BABEG, KWF
BWCON	Wirtschaftsregion Stuttgart	To use it as partner and multiplier for companies, specially SMS, in shaping technological change and digitisation in the region
PBN	IFKA Public Benefit Non Profit Ltd. for the Development of the Industry	• organize meetings (online, personal) • inform them regularly about project implementations discuss the future plans

Conclusion provided by Leader:

<1 page maximum>

NAVIGATION CREW

Industrial IOT

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	
1.0.3	Addition of IWU related information	Dr. Jan Reimann	17.10.2019
1.0.4	Compilation of final document	Dr. Jan Reimann	04.12.2019

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – INDUSTRIAL IoT

DEFINITION

The term *Internet of Things (IoT)* evolved a lot in the last decade. For the purpose of this Navigation Crew (NC) it simply denotes the interconnection of heterogeneous (computing) devices, such as mobile phones, machines or humans, over a network beyond physical limitations like companies, buildings or a Local Area Network (LAN).

The term *Industrial IoT (IIoT)* considers the IoT in an industrial context. This means that systems in manufacturing and production environments communicate with each other and use industrial communication channels and technology, e.g. OPC-UA[1] or PROFINET[2].

IIoT targets at connecting different manufacturing data sources, such as sensors, business logic for making decisions based on sensor data, machines to be controlled and other actuators (e.g. industrial robots) in order to increase efficiency of production and make manufacturing smarter. This approach implies the architecture in the following figure.

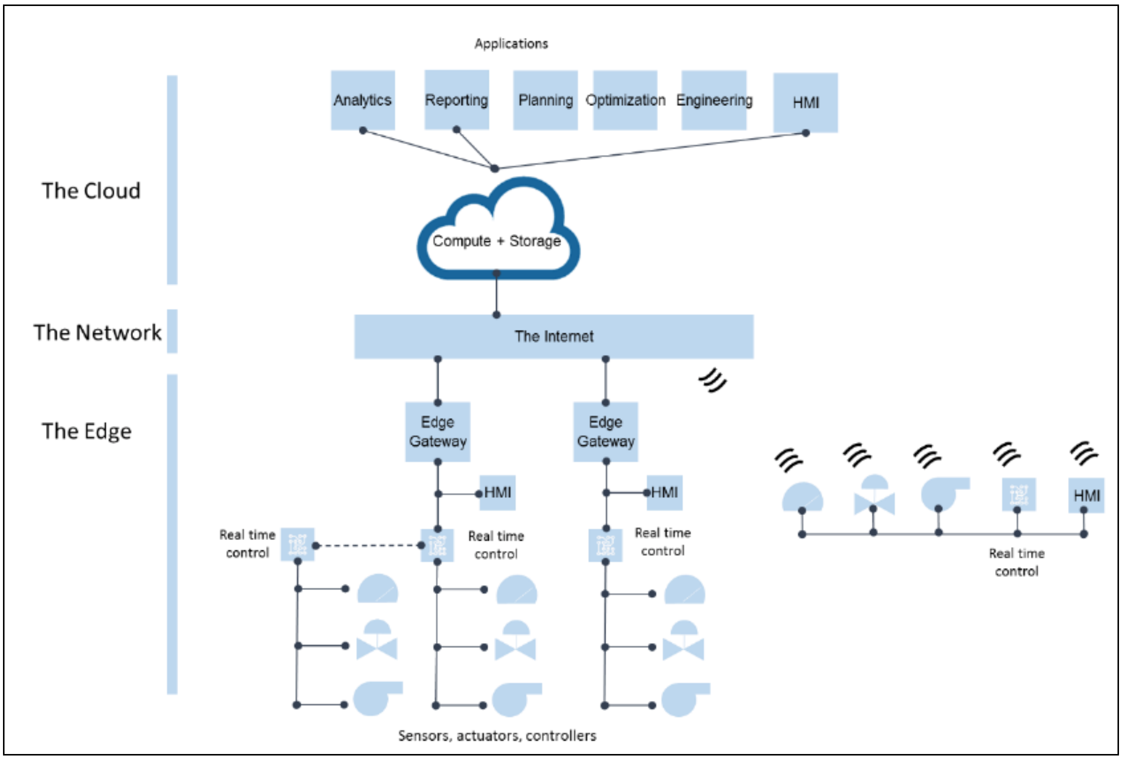

Figure 1 General IIoT Architecture (by Paul McLaughlin, Rohan McAdam - The Undiscovered Country: The Future of Industrial Automation)

This architecture shows the separation into multiple specific layers, whereas the *Cloud* layer needs not to be connected necessarily via the internet. All of the depicted layers may reside in the same company-

[1] https://industrie40.vdma.org/en/viewer/-/v2article/render/16617359 (visited 15th October 2019)

[2] https://www.profibus.com/technology/profinet/overview/ (visited 15th October 2019)

wide IT infrastructure like a private cloud. This kind of computing architecture is called *Fog Computing*[3] which significates to build up a hierarchical architecture where every layer has a specific purpose and data is processed further as near at the data source as possible in order to decrease throughput of data and to minimise latency. According to Figure 1 preprocessing data, e.g. filtering or aggregating, is realised at the *edge* of the whole architecture.

3.1.1.1. EXAMPLE: Forming 4.0 at Fraunhofer IWU

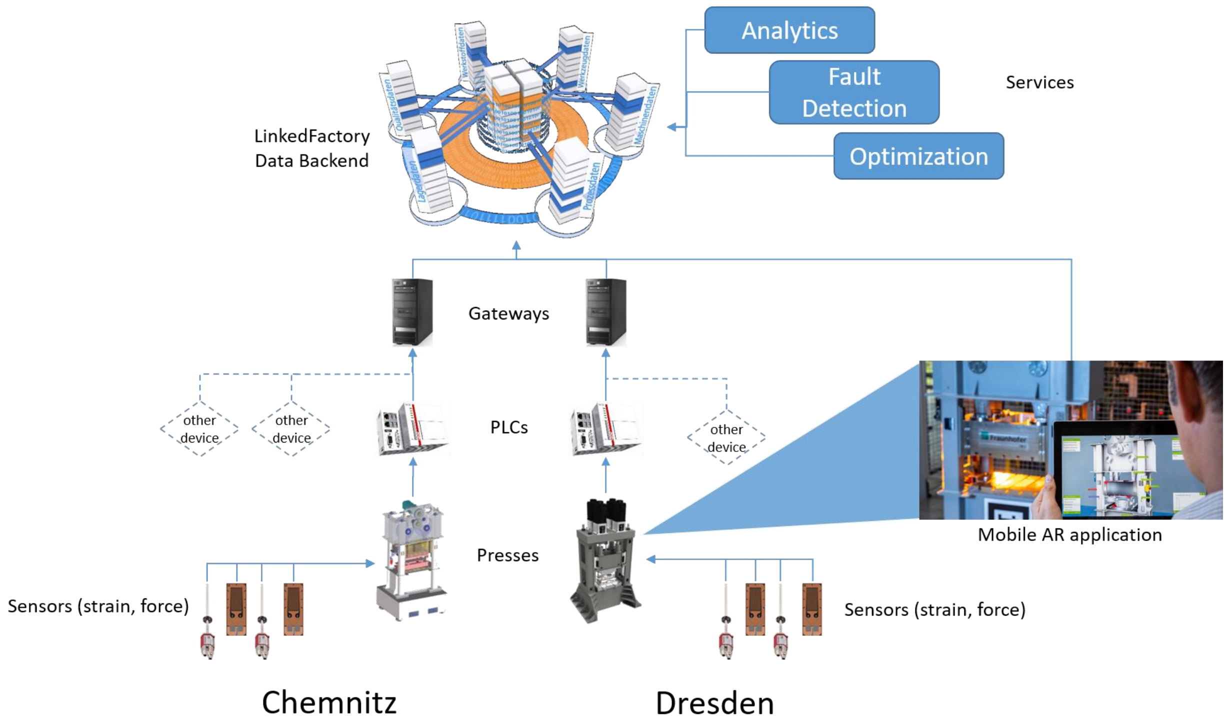

Figure 2 Architecture of two Servo Presses from the Fraunhofer IWU Forming 4.0

The Fraunhofer Institute for Machine Tools and Forming Technology IWU developed the concept and a solution called *Forming 4.0* which demonstrates the future of sheet metal forming[4]. It shows the interactive connection of two servo presses, one located in Chemnitz (headquarter of IWU) and the other located in Dresden, measuring the deformation and deflection of the press tables depending on the forces of the currently used tools in a process. In Figure 2 the general architecture of Forming 4.0 is illustrated. The goal of Forming 4.0 is to connected both presses in order to enable learning from each other and to optimise process and tool parameters and characteristics. Therefore, both presses consist of various sensors for measuring forces and strains in order to gather data. The data is processed further from the particular Programmable Logic Controller (PLC) and is sent to the Fraunhofer IWU's data backend *Linked Factory*[5]. It is based on semantic technologies for the enablement of integrating heterogeneous data sources because every machine vendor uses different standards (if any) or proprietary data communication channels. Provided services for analysing and optimising processes access the collected data in the Linked Factory and process it further. Derived new knowledge has

[3] Bonomi, F., Milito, R., Natarajan, P. and Zhu, J., "Fog Computing: A Platform for Internet of Things and Analytics", Bessis, N. & Dobre, C. (ed.), Big Data and Internet of Things: A Roadmap for Smart Environments, Springer, Cham, 2014, Vol. 546, pp. 169-186

[4] https://www.iwu.fraunhofer.de/content/dam/iwu/en/documents/Events/IWU-HZ-2018-Forming-40.pdf (visited 16th October 2019)

[5] https://www.presswerk-i40.de/en/Information.html (visited 16th October 2019)

implications to the locally executed press process and will be displayed on a Human Machine Interface (HMI) which can be seen in Figure 3, or a mobile Augmented Reality (AR) application (see Figure 4).

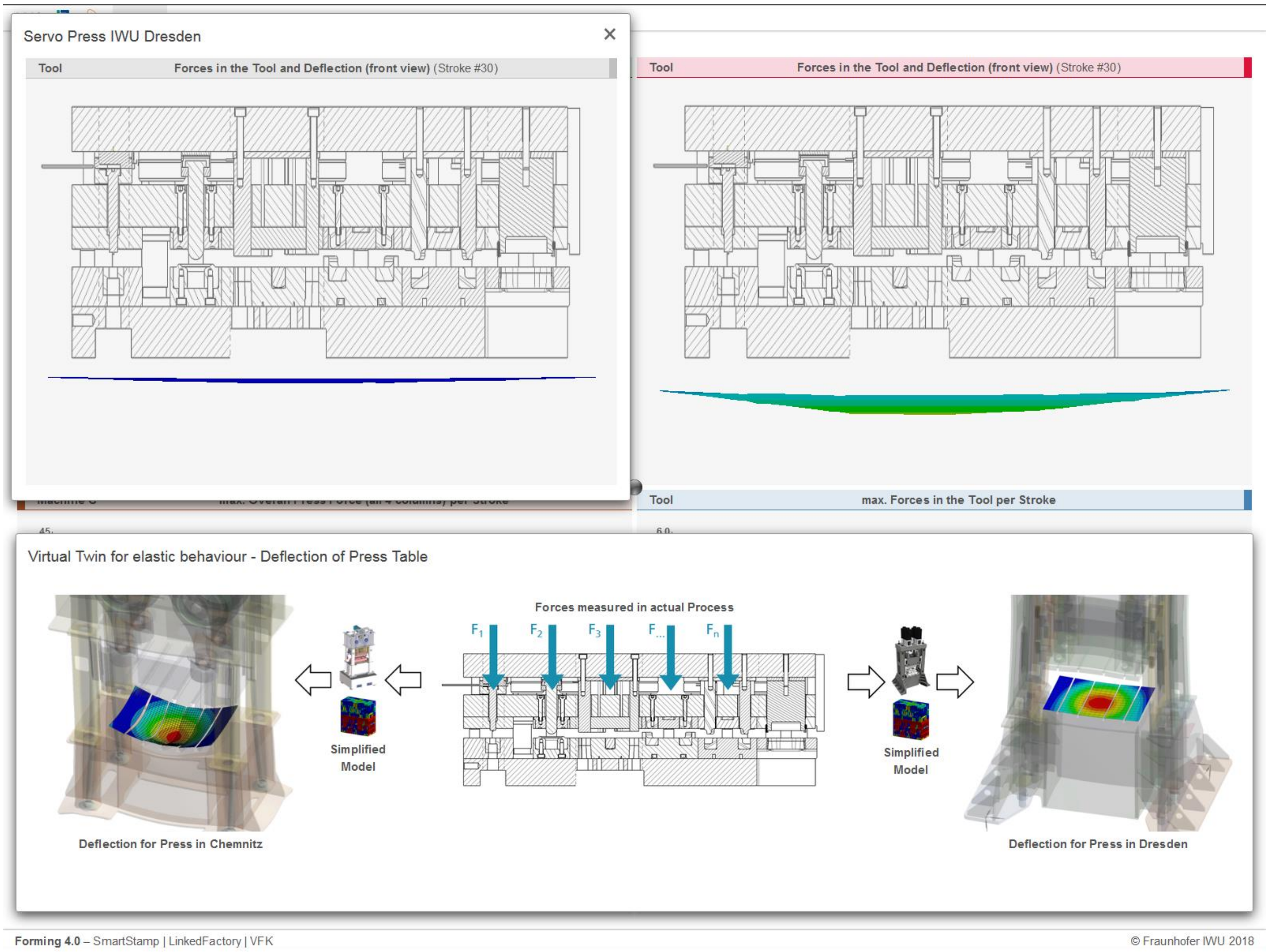

Figure 3 Visualization of Digital Twins of two presses of the Fraunhofer IWU in Forming 4.0

Figure 4 AR application visualizing current state of a Forming 4.0 presses

3.1.1.2. EXAMPLE: Revamping

Literally revamping means reconditioning, "putting back to new": it means subjecting existing machines within the company to interventions aimed at making them suitable for the Industry 4.0 model.

Through a work of Revamping it is, as far as possible, to revive a second "technical youth" to the machinery, extending its life, with an average cost estimated around half of that for the purchase of a new one.

The need for a company in the province of Treviso focused on reducing the time required to prepare shipments, as well as improving the management of the packaging material. Given the considerable increase in sales, the need to reduce handling costs also became a priority.

An automation intervention was therefore necessary, of the plant through the redesign of the functionalities of the electronic part and the introduction of a supervision software for all the operations to be carried out, integrated with the upper management system.

The plant of the company was equipped with sensors (to obtain the material in transit) and actuators (to provide instructions to the electronic / mechanical part), radically rethinking the whole PLC system (programmable logic controller) in order to send and receive information punctual on all the movements to be carried out and acknowledge the progress of the system. The system supervisor software was integrated with the ERP platform to receive customer order data and items to be produced; of return, it sends the data of the packages ready to be sent for the automatic generation of the transport documents.

4. Introduction

4.1. Motivation

<Motivate why the above described topic area/s is relevant at regional / national level? Motivation should be provided by each crew member and ideally supported by quantitative / qualitative evidence> Relevance can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.000 characters / member.

Motivation

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
IWU	The German state of Saxony specified the following Key Enabling Technologies (KETs) in its smart specialisation strategy RIS 3[6]: • Nano technologies • Micro and nano electronic • Photonic • New materials • Biotechnologies • Advanced production technologies Saxony considers the KET Advanced production technologies as cross-cutting with all of the others and enumerates these detailed areas of interest, amongst others: • Mobility • Leightweight structures • Smart materials • Integrated sensors/actuators • Information and communication technology (ICT)	(Copied from BWCON Navigation Crew 1, since it resides in Germany, too) Germany is aware of its excellent starting conditions. It is the No. 1 mechanical engineering country in Europe, with over 150 years of production and innovation experience, a high-quality education system and an excellent scientific and research landscape. Germany is also aware that the technologies of today cannot conquer the markets of tomorrow. That's why it is important for SMEs to reorient themselves, to review their own business models and, if necessary, to renew them. However, this is linked to an entrepreneurial and innovative mindset. At no other time do founders have such great opportunities as in times of technological revolution.

6 https://s3platform.jrc.ec.europa.eu/documents/20182/229963/DE_Sachsen_RIS3_201307_Final.pdf/ca3f42e8-7720-4edf-9737-be2383e9bdf2 (visited 16th October 2019)

	• Resource-efficient production The area of *Industrial IoT* is heavily cross-cutting as well and covers most of the aforementioned areas and KETs.	
IMECH	Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of IIoT (Industrial Internet of Things) will become a question of competitiveness. In terms of business change, the key outcomes will be: • Implementation of closed-loop control systems for on-site industrial assets. • Improvements of customer experience and product reliability, implementing remote software governance technologies	Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in manufacturing fields concerning innovation, economic growth and development.
ECIPA	In 2018, the manufacturing sector represented the 11,8% of enterprises in Veneto (Rapporto Statistico Regione del Veneto, 2019). The socio-economic fabric of the Region is characterized by small and medium enterprises; there is still a broad gap between large and small businesses in the level of digitalization (Digital intensity indicator): high levels are present in 44.0% of companies with at least 250 employees and only in 12.2% of companies with 10 to 49 employees (Rapporto Statistico Regione del Veneto, 2019). This entails critical issues in terms of competitiveness for smaller companies.	The Italian IoT market reached 5 billion in 2018 (+ 35% compared to the past). Almost half the market consists of Smart metering and SAM (1.4 billion) and Smart cars (just over 1 billion). Smart Home (+ 52%) and Smart Factory (+ 40%) the fastest growing segments. About the Smart Cities: 36% of the Municipalities have started projects in the last three years, with more robust and innovative initiatives. 58% of the factories started an Industrial IoT project, but the diffusion remains limited in SMEs. Veneto is one of the most competitive regions in Italy; it

	In terms of business change, the application of the Iot will become a support for a Smart execution (production, logistics, maintenance, quality and safety & compliance) as well as for a Smart integration (New Product Development, Suppliers Relationship Management e Product Lifecycle Management) for the SMEs in order to make the company more competitive and efficient.	accounts for 9.25% of the national GDP. However, it shows a relatively low level of investment in RTDI and a de-specialisation in high technology sectors. The R&D intensity of Veneto is lower than the Italian average (1.34%) and the European one (2.04%). Also due to its specialisation in traditional manufacturing, Veneto experiences difficulties in carrying out more intensive investments in innovation and in entering high added-value product markets. However, the percentage of its enterprises with innovative activities in 2014 was 53% (the highest rate in Italy), above the Italian average (45%). The Region also performs well in the patenting activity. Veneto is classified as an "Advanced Manufacturing and Clustering Region with no specialization in knowledge activities". It has a high degree of specialization in high craftsmanship, a good presence of KIBS, a high rate of informal relationships that allow to make use of external expertise to generate a high rate of innovation activities. Therefore, IoT application is strategic for this territory which strongly contributes to the country economy and which needs to be sustained in gaining efficiency and stronger competitiveness at the global level, especially if considering the prevalence of small and medium sized manufacturing firms, often organized according to the most traditional systems.
PBN	The goal is to support the re-industrialization process in	One of the horizontal priorities of the Hungarian National RIS 3 Strategy is

	Western Hungary. Currently, the region is located at a relatively low end of the manufacturing value chain, and the goal is to realize its upgrade. Since mechatronics is decisive in the region, material science related to that, new material and composited development, additionally power train improvements are important. Autonomous vehicle drive testing and its applications are also in the focal point of the developments. SMEs and large enterprises located in the region must keep abreast of the technological development of the market, therefore the exploitation of Industrial IOT will be crucial field of the near future in the region.	ICT and Services. Besides, advanced technologies in the vehicle and other machine industries are listed as sectoral priorities in the national strategic document. These priorities (horizontal + sectoral as well) include lot of subtopics, among others they are dealing with Industrial IOT. As a result, this topic can be considered as a national priority.
TECOS	Slovenian smart specialisation strategy defined the smart specialisation priorities on a national level as Slovenia is considered one region. With that in mind the S4 was designed be an operational plan facilitating the shift to high-productivity economy, through boosting innovation potential, fostering structural transformation and industrial diversification and supporting the growth of new and fast growing companies. The following priorities are considered: Industry 4.0, Digital and Circular. Within industry the following niche areas are defined: Materials as products, Mobility, Health-medicine and Factories of the future, whereas digital considers also Smart cities and communities and Smart buildings and homes. Horizontal technologies are intelligent processing and management technologies, robotics, nanotechnologies, photonics, plasma technologies, modern production technologies for materials.	
FB	IoT technologies promise great potential for different industries. It is important to acquire competencies in the field and then apply them correctly in the region. This will strengthen the region and make it more competitive.	Nationally, IOT is an important area where know-how must be acquired to be competitive.
HGK VZ	The Varaždin region is already recognized as a rather agile new	The chosen indicators showed that the Croatian manufacturing industry is

	industry center in the Continental Croatia (NUTS 2), with an emerging regional economy, a promising technological and scientific infrastructure and a new university in its region. A rather distinctive feature of Varaždin-centered region is the share of industry in its economy, reaching nearly 40 %, nearly 15 % points higher than the runner-up region. On the other hand, there is a significant lack in innovation in SMEs. The innovation value chain is not functional due to incoherent eco-system and difficulty to adopt and apply current technologies. SMEs and mid-caps in North-Western part of Croatia need upgrading of competencies and performance in the digital economy. Therefore this topic is recognized as highly important.	ranked 23rd on the criterion of productivity, and belongs to the last, fifth cluster of EU countries with an average annual productivity of 14,702 EUR per one person employed. According to the reports of Croatian Bureau of Statistics from 2017 Croatia has invested 0.73% of its GDP in R & D, in comparison EU average was 2.03% of GDP. Croatia was among the weakest countries of the European Union on the 27th place in terms of purchasing power and the fourth indicator refers to Croatia's position in the world with respect to the level of innovation and according to the global innovation index in 2017 Croatia was on the 41st place out of 128 countries.

4.2. Problem statement

<Are there any specific challenges that can already be identified by crew members. Please note and remember that a specific need assessment activity will be done under Activity 1.2. therefore, this first overview should ideally provide the main directions that will guide the need assessment activity. Again, each crew member should provide its point of view.

Challenges can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.500 characters / member

Crew Member	Main Challenges
IWU	• Regarding the implementation and application of IIoT solutions in SMEs' premises many of them aren't even aware of how far they are • A tailored process is required for raising awareness and self-reflection in order to derive a specific process of activities to reach a desired level of digitization to cover particular IIoT-related areas
IMECH	• Application and implementation of IIoT technologies to the business processes of our member associated to solve real-work problems. In

	this way they can improve their competitivity on the market according to Intellimech mission: “An environment where our partners can catch the opportunities offered by new technologies”. • To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of IIoT technologies in italian SMEs. • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.
ECIPA	• To spread the awareness of the added value of the application of IoT for a smart production and for a smart integration approach in order to gain an efficient and competitive management of the company (addressing mainly to CNA associated companies and SMEs of the region) • To stress the need of “competence updating” in the specific field spreading an innovation culture in SMEs located in Veneto.
PBN	• The main barrier can be the permanently changing technological background, namely that digitalization processes are so fast that it is very hard to find out what the real needs are of SMEs. Doing a research about the exact needs of SMEs has to be very fast and actions have to be made as fast as possible. • According to the current statistics and analysis of the (Western) Hungarian companies are not developed and competent enough to utilise Industrial IOT, so there is a principal gap between the current status and the desired status of the implementation of these technologies in this area. Spreading the information of the technology areas to SMEs is challenging.
TECOS	• It is important to stay on top and in touch with state-of-the-art of the technology and developments, understand companies’ needs and assess their potential and match the optimal solution customized for companies. • Spreading awareness on Value added in the application of IOT solutions • Spreading awareness on wider benefits of the IOT applications and their usability and matching / developing skills.
HGK VZ	The trends in last decade as market globalization, accelerated development of competitor countries, digitization of society and industry, aging of the population are the main challenges of the manufacturing industry.

	The new concept called Industry 4.0 prompted technologies as Cyber Physical Systems and Internet of Things and highlight features as digitalization, optimization and customization of production, human-machine interface and automated data exchange in industry. Companies need a blueprint which is going to lead them step by step through an intensive transformation like introduction of Industry 4.0.

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in

Statistical Report "Rapporto Statistico Regione del Veneto", 2019	Regione del Veneto	Regione del Veneto
DGR n. 216, 28/02/2017, all. A – Percorso di "Fine-Tuning", RIS3 Veneto	Regione del Veneto	Regione del Veneto
RIS3 VENETO LA ROADMAP DI MONITORAGGIO, PRINCIPALI RISULTATI E NUOVE OPPORTUNITÀ (PowerPoint Presentation, Padova, 19/06/2019)	Regione del Veneto	Regione del Veneto
ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto	European Commission	ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto
Report IoT 2019	Osservatorio Internet of Things (Politecnico di Milano)	Politecnico di MIlano
100 Radical Innovation Breakthroughs for the future	European Commission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	Available online in national language and in English, but it was downloaded by PBN.

CROATIAN SMART SPECIALISATION STRATEGY 2016.-2020.	March, 2016	https://s3platform.jrc.ec.europa.eu/documents/20182/222782/strategy_EN.pdf/e0e7a3d7-a3b9-4240-a651-a3f6bfaaf10e
e-Croatia 2020 Strategy	May, 2017	https://uprava.gov.hr/UserDocsImages/Istaknute%20teme/e-Hrvatska/e-Croatia%202020%20Strategy%20-final.pdf
Slovenian Smart specialisation strategy	November 2015	//www.eu-skladi.si/sl/dokumenti/kljucni-dokumenti/s4_strategija_v_dec17.pdf
Action plan of SRIP Factories of the future	2016/2017/2018	http://ctop.ijs.si/sl/domov/

Table 2.

Document title	Release	Location
Predicts 2019: IoT Will Drive Profound Changes to Your Core Business Applications and IT Infrastructure	Gartner	Consorzio Intellimech
2019 Strategic Roadmap for IoT Network Technology	Gartner	Consorzio Intellimech
Innovationsstrategie des Freistaates Sachsen	SMWA	Available online (German): https://s3platform.jrc.ec.europa.eu/documents/20182/229963/DE_Sachsen_RIS3_201307_Final.pdf/ca3f42e8-7720-4edf-9737-be2383e9bdf2 visited 16th October 2019
Eye@RIS3: Innovation Priorities in Europe	European Commission	Map available online: https://s3platform.jrc.ec.europa.eu/map?p_p_id=captargmap_WAR_CapTargMapportlet&_captargmap_WAR_CapTargMapportlet_non-eu-country=true&_captargmap_WAR_CapTargMapportlet_non-eu-region=true&_captargmap_WAR_CapTargMapportlet_regionids=767 visited 16th October 2019
FORMING 4.0: THE FUTURE OF SHEET METAL PROCESSING	Fraunhofer IWU	Available online: https://www.iwu.fraunhofer.de/content/dam/iwu/en/documents/Events/IWU-HZ-2018-Forming-40.pdf

		visited 16th October 2019
Statistical Report "Rapporto Statistico Regione del Veneto", 2019	Regione del Veneto	Regione del Veneto
DGR n. 216, 28/02/2017, all. A - Percorso di "Fine-Tuning", RIS3 Veneto	Regione del Veneto	Regione del Veneto
RIS3 VENETO LA ROADMAP DI MONITORAGGIO, PRINCIPALI RISULTATI E NUOVE OPPORTUNITÀ (PowerPoint Presentation, Padova, 19/06/2019)	Regione del Veneto	Regione del Veneto
ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto	European Commission	ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/veneto
Report IoT 2019	Osservatorio Internet of Things (Politecnico di Milano)	Politecnico di MIlano
100 Radical Innovation Breakthroughs for the future	European Commission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	Available online in national language and in English, but it was downloaded by PBN.
CROATIAN SMART SPECIALISATION STRATEGY 2016.-2020.	**March, 2016**	https://s3platform.jrc.ec.europa.eu/documents/20182/222782/strategy_EN.pdf/e0e7a3d7-a3b9-4240-a651-a3f6bfaaf10e
e-Croatia 2020 Strategy	**May, 2017**	https://uprava.gov.hr/UserDocsImages/Istaknute%20teme/e-Hrvatska/e-Croatia%202020%20Strategy%20-final.pdf
Slovenian Smart specialisation strategy	**November 2015**	//www.eu-skladi.si/sl/dokumenti/kljucni-dokumenti/s4_strategija_v_dec17.pdf

Action plan of SRIP Factories of the future	**2016/2017/2018**	http://ctop.ijs.si/sl/domov/

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)
2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)
3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

<Description of methods or tools which are applied in order to achieve the thematic topics are specified here.>

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
IWU	• Fraunhofer IWU Potentialanalyse Digitalisierung • Industrie 4.0 Reifegrad Modell[7]	• Regional networks: ○ Smart Systems Hub[8] ○ InnoSax[9]	ADMA assessment - European commission (http://www.adma.ec/)
ECIPA	Digital innovation assessment CNA	Regional innovative Networks (Cluster and Industrial Networks): - IMPROVENET	ADMA assessment - European commission

[7] JODLBAUER, Herbert y SCHAGERL, Michael. "Reifegradmodell industrie 4.0-ein vorgehensmodell zur identifikation von industrie 4.0 potentialen". Informatik 2016.

[8] http://smart-systems-hub.de/en/home/ (visited 16th October 2019)

[9] http://innosax-smartproductionsystems.de/ (visited 16th October 2019)

		http://www.improvenet.it - M3 net https://www.venetoclusters.it/area-reti-innovative-regionali/m3-net • Veneto Innovazione	(http://www.adma.ec/)
PBN	In the framework of another EU project of PBN called 4STEPS (further details can be seen here: https://www.interreg-central.eu/Content.Node/4STEPS.html) a transnational tool has been developed which measures RIS3 relevant SMEs in the point of view of needs and the level of adaptation to I4.0 themes. The transnational tool (online questionnaire can be filled here: https://4stepscrm.com/index.php?kitoltesboard&sys=startQuestionnaire The replies from SMEs have been being collected from August-October 2019 in the partnership, including Hungarian SMEs too		ADMA assessment - European commission (http://www.adma.ec/)
TECOS	**Digital Innovation Hub** (DIH) Slo-venia (https://dihslovenia.si/en/home-english/) **Jožef Stefan Institute Ljubljana** (IJS) (TECOS as an important pro-ject partner in the Smart facto-ries Strategic Innovation Partner-ship 'SRIP-ToP')	Various national and regional strategic communities…	ADMA assessment - European commission (http://www.adma.ec/)

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
IWU	Contributor	X
IMECH	Contributor	
ECIPA	Contributor	
PBN	Contributor	
TECOS	Contributor	
FB	Learner	
HGK VZ	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
IWU	• Staff consists of various computer scientists being very comfortable in the field of IIoT • Contributing IIoT solutions in many projects	• Forschungsfabrik[10] (= research factory) with many machines, robots, PLCs and an Automated Guided Vehicle (AGV) for conducting experiments
IMECH	• Considerable skills developed in the field of IIoT thanks to the development of research projects for its members • Structured network of experts, consisting of universities, consultants and suppliers	• Demo cases related to the work done for associate companies • Network of companies to carry out the development of use cases and their testing
ECIPA	• Network of experts, namely universities, consultants and suppliers • Networking skills in the specific field • Basic skills developed in the field thanks to pilot actions in funded projects	ExploreInnospaces platform (tool to match demand and supply of services 4.0 between SMEs and FabLab)
PBN	• With the cooperation of PBN an additive manufacturing center, called AM-LAB was established in 2017, and since then this laboratory has gained the DIH status. • The am-LAB is a service centre specialized on the application and presentation of most recent	• In AM-LAB non-conventional and creative product design is realized by our market leader model softwares, in a cost efficient way. Products are featured in a realistic virtual environment during any phase of the development.

[10] https://www.e3-fabrik.de/en.html (visited 17th October 2019)

	manufacturing technologies to develop smart end-user product in strong co-operation with our key customers. • Most recent methodologies and multinational corporate experience are contributing to applied product developments for medium sized production oriented businesses. Integration of sensors into the consumer products is a key element of smartification • Exploiting the digital devices of AM-LAB a monitoring system is set up for experimentation, including capacity, energy consumption and cost controlling applications. • In AM-LAB skilled and motivated multidisciplinary team of economists, engineers, medical staff, sales manager and international project coordinators work together who prefer lifelong learning	• Cost- efficient data access and process are enabled by integration of digital manufacturing solutions • Maximised production capacity, real-time simulation of manufacturing, integration the new machine into production line.
TECOS	- Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. the tooling industry - Excellent expertise in engineering services and applied industrial rese-arch - Excellent expertise in product and material development - Very good institutional and political connections (nationally and EU-wide) - Excellent industrial refferences wit-hin the EU: https://www.tecos.si/index.php/en/about-us/references - Experience from dozzens of success-fully executed technological projects	- Very good EU-wide connections to European technology partners and customers (product development) - Excellent connections to our tool-and-die cluster members - Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/about-us/equipment 22 highly skilled professionals emplo-yed full time, while also cooperating with many contractual external ex-perts

	- Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	
HGK VZ	• Established connections with regional companies and academic community	Platforms and networks available from other implemented EU projects https://greenomed.interreg-med.eu/

Conclusion provided by Crew Leader:

<1 page maximum>

6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
IWU	• No experience in initiating AND establishing a viable thematic network (= this Navigation Crew) on a European level
IMECH	• Lack of knowledge related to the needs of EU foreign companies about IIoT • Lack of links at European level to structure a transnational competence network about IIoT
ECIPA	• Lack of applied / demo EU cases with SMEs • Lack of links at European level to structure a transnational competence network about IoT
PBN	• Not sufficient and widespread knowledge yet to utilize the elements of Industrial IOT • The application of Industrial IOT knowledge should be improved,
TECOS	• While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain competences in this context. • Lacking knowledge in practical/technical establishment of Digital innovation plattforms. We would like to gain competences in this context.
FB	We would like to build up general knowledge in this area and how to connect it to our competences.
HGK VZ	• Lack of information and knowledge on IoT, especially on its application in industry

	• Lack of supporting infrastructure and technology, knowledge and international networking

Conclusion provided by Leader:

<1 page maximum>

6.2.3. Partner’s common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
IWU	• Initiate AND establish a viable thematic European network (= this Navigation Crew) of experts • Being able to identify the current state of potential SMEs regarding the implementation of IIoT competences in order to derive further steps
IMECH	• Create a transnational network of companies and experts in the field of IIoT • Identify the needs of companies at European level in order to start new collaborations in IIoT field
ECIPA	• Identify common strategies and approaches in order to better support companies - despite their dimension/size - in the field of IoT application • Spread culture/knowledge on the topic • Enhance the platform Exploreinnospaces increasing demo cases • Identify/train local experts through international network of experts
PBN	• Improve the knowledge of the internal staff regarding Industrial IOT • Establish the elements to create a useful Industrial IOT system in a company • Leading additive manufacturing technologies will be constantly monitored and followed, enabling the applications of the latest developments in the focus areas. • Cooperation worldwide with the leading manufacturers is a must to be up-to-date with the technologies and utilize Industrial IOT as effective as possible

TECOS	• Identify common strategies and approaches in order to better support companies - despite their dimension/size - in the field of IoT application • Spread culture/knowledge on the topic • Prepare documentation and network for IOT demo plants • Identify/train local experts through international network of experts • Develop needed skills assessment for IOT transfer and applications.
FB	We want to develop knowledge and skills in this area.
HGK VZ	• To comprehend the opportunities offered by industrial IoT, its application in industry and the changing needs of companies • To contribute to creation of an international network which gathers relevant companies and tech experts in this field • To raise level of specific knowledge and necessary skills in regional eco-system, especially business sector regarding IoT in industries • To raise awareness of companies to overcome the digitalization gap and improve intra/inter-regional and international collaboration

Conclusion provided by Leader:

<1 page maximum>

6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
IWU	• Organize a workshop at the IWU for transferring our potential analysis of digitalization to partners of this Navigation Crew • Showcase some concrete examples from the Forschungsfabrik • Exchange experiences with partners from this Navigation Crew
ECIPA	We would like to use the pilot action phase to a) showcase concrete examples to our members (would be ideal to identify a small enterprise "champion", to stay close to the nature of our members); b) try to develop a use case to understand the process of introducing IoT and demonstrate the benefits; c) connect to European entities (for instance Digital Innovation Hubs) that are already supporting small enterprises in this domain
PBN	Strong cooperation with PPs who are experts in the field of Industrial IOT simulation and modelling to improve our knowledge and might implement pilot

	action in this field. An Industrial IOT system might be created in a Hungarian company to reach higher degree of automation and optimize the process controls.
TECOS	• Needed skills assessment for IOT • Exchange fo best practices • Development of opportunities • Matchmaking • Organization of tailored events – technology shows, B2Bs, exchange of experiences • Development of IOT partnerships and value chains
HGK VZ	• To learn from other partners having expertise in the field of industrial IoT, to gain internal knowledge and comprehend opportunities for business sector • To cooperate with other partners and contribute to creation of an international network and connect with other EU entities relevant for this field. • To spread intra –regionally the new values and by implementation of foreseen activities contribute to modernization of SME's sector.

Conclusion provided by Leader:

<1 page maximum>

6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IWU	• Saxony is Vanguard region and Fraunhofer IWU is leading this region[11] • Staatsministerium für Wirtschaft, Arbeit und Verkehr (= state ministry of economy, work and transport)	• other viable European S3 stakeholders
IMECH	• Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	
ECIPA	- Region of Veneto (managing the regional RIS3) - Unismart - Uni PD (competence center) - CNA Digital Innovation Hub network at national level - Fablab network in Veneto - Veneto Innovazione	- Monitoris 3 (INTERREG Europe project) - Friuli Innovazione - NOITech Park Bolzano - Area Science Park
PBN	• 2 further offical DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics) • Ministry for National Economy • National Research, Development and Innovation Office • Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties	Looking for relevant actors and stakeholders in the field and establish new cooperations with them

[11] https://www.s3vanguardinitiative.eu/cooperations/efficient-and-sustainable-manufacturing-esm (visited 17th October 2019)

TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) • ADMA assessment – European commis-sion (http://www.adma.ec/) (TECOS as project partner, TECOS as impor-tant regional stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project par-tner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) • Slovenian Government office for deve-lopment and European cohesion policy (SVRK) • Technology Park Ljubljana	• Lombardy Intelligent Factory Association – AFIL • Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/)
FB	• Provincial government • Industrial Association • Economic Chamber • DIH-Ost • Haus der Digitalisierung	• Digital Forum 2019 • Digital Austria platform, FFG • Industry 4.0 platform
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated	Companies, experts and other relevant stakeholders will be involved in the later phase accordingly.

	partner and institution responsible for the national S3	

Conclusion provided by Leader:

<1 page maximum>

6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
IWU	• EU project TRINITY[12] • Regional Saxonian DIH Smart Systems Hub[13] • Regional Saxonian DIH InnoSax[14]	• Other viable European DIHs
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	
ECIPA	CNA DIH network	
PBN	• Good cooperation with the 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder)	Other regional DIH connections to be es-tablished…
FB	DIH-OSt: https://dih-ost.at/	Digital Makers Hub in St. Pölten and Digital Innovation Hub – West in Innsbruck

[12] http://www.trinityrobotics.eu/ (visited 17th October 2019)

[13] http://smart-systems-hub.de/en/home/ (visited 16th October 2019)

[14] http://innosax-smartproductionsystems.de/ (visited 16th October 2019)

	Haus der Digitaisierung: https://www.virtuell-haus.at/	
HGK VZ		

Conclusion provided by Leader:

<1 page maximum>

6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
IWU	• EU project TRINITY[15] • Regional Saxonian DIH Smart Systems Hub[16]	• Partners from the Regional Saxonian DIH InnoSax[17]
IMECH	• IOTTY project • BALLUFF project	• IOTTY S.r.L. • BALLUFF S.p.A.
ECIPA	• Labs4sme project (INTERREG IT-AT) • Talentjourney project (Erasmus KA2)	
PBN	• Future Internet LivingLab Association (SME) • 3D Printing Zrt LTD (R&D Center) • iQor Global Services Hungary Kft. (Large enterprise) • BPW-Hungária Kft.(Large enterprise)	Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.

[15] http://www.trinityrobotics.eu/ (visited 17th October 2019)
[16] http://smart-systems-hub.de/en/home/ (visited 16th October 2019)
[17] http://innosax-smartproductionsystems.de/ (visited 16th October 2019)

	• Széchenyi University (Győr;) • BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS • PBN's currently running EU projects can be considered as synergic ones: • 4STEPS: Interreg Central Europe https://www.interreg-central.eu/Content.Node/4STEPS.html • DIH2: Horizon 2020 http://www.dih-squared.eu/ • CHAIN REACTIONS: (CE) https://www.interreg-central.eu/Content.Node/CHAIN-REACTIONS.html • Innopeer AVM: (CE): https://www.interreg-central.eu/Content.Node/InnoPeerAVM.html	
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner and key stake-holder) • Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project par-tner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') • Slovenian Government office for deve-lopment and European cohesion policy (SVRK)	• Members of the TECOS Tool-and-die tech-nology cluster (high-tech industrial com-panies, ranging from SMEs to LEs) • (https://www.tecos.si/index.php/en/ • membership/list-of-members) • ADMA assessment - European commission (http://www.adma.ec/) (TECOS as pro-ject partner and important regional stake-holder) • LUI (Ljubljana University Incubator)

	• Technology Park (TP) Ljubljana	• ABC Hub Ljubljana • (http://accelerationbusinesscity.com/) • Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) • Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) • (various other incubators, digital hubs and regional development agencies)
FB	• FH Burgenland • Akademie Burgenland • Wirtschaft Burgenland • Initiative “Start Up Burgenland” • Energie Burgenland • Project “Smart Up”, Interreg	• Haus der Digitalisierung • Project “Green energy lab - Open Data Platform”, FFG. • Educational and training centers • Special Interest Groups • Relevant SMEs and LEs
HGK VZ	• Faculty of organization and informatics https://www.foi.unizg.hr/en • Faculty of Geotehnical Engineering http://www.gfv.unizg.hr/en/index.html Current EU project: • Greenomed (Interreg MED) https://greenomed.interreg-med.eu/ Mediterranean Trans-Regional Cooperation for green manufacturing innovation	Companies, experts and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

<1 page maximum>

6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
IWU		
IMECH	• IOTTY project • BALLUFF project	• use the projects developed to show real implementations • use of the skills developed within the projects to develop new applications
ECIPA	Region of Veneto	ECIPA will be involved within the stakeholders group for the RIS3 monitoring and definition at regional level
PBN	IFKA Public Benefit Non Profit Ltd. for the Development of the Industry	• organize meetings (online, personal) • inform them regularly about project implementations • to discuss the future plans
TECOS	• Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner and key stake-holder) • Technology Park (TP) Ljubljana	• Multiplier concerning setup of a digital innovation platform Multiplier concerning Start-up community or spin-offs
FB	Regional Management Burgenland	We would like to involve the partner through an exchange of know-how and personal meetings. This should last for a longer period of time to be efficient.
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	We will keep the ASP contact person duly informed and involved in project activities where necessary and consult the ASP as institution responsible for S3 in Croatia

NAVIGATION CREW

Innovation in a Circular Economy

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	
1.0.3	Review of template document	Knežević Vernon, Hančič	11.12.2019

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – INNOVATION IN CIRCULAR ECONOMY

3.1.1. SPECIFIC TOPICS

Open innovation community: Open innovation is a term used to promote an information age mind set toward innovation that runs counter to the secrecy and silo mentality of traditional corporate research labs [1].

The InnoCentive open innovation platforms publishes calls of enterprises. Innovative ideas related to those calls can be provided by organizations or individuals and are rewarded based on the quality of results [3].

Circular economy: A circular economy is an economic system aimed at eliminating waste and the continual use of resources. Circular systems employ reuse, sharing, repair, refurbishment, remanufacturing and recycling to create a closed system, minimising the use of resource input and the creation of waste, pollution and emissions [2].

Apple Inc. provides credit vouchers for old mobile devices and computers in order to achieve recirculation of such devices for their own production system [4].

Network of experts for design and engineering, manufacturing service providers and fab labs: an Internet-based platform in order to connect organizations or individuals which (1) provide services for the design and engineering of products, (2) are running production systems for production of prototypes, lot size one or low volume manufacturing provided to the public, (3) are running production systems which are accessible for the public to make things on their own.

Outsourcing and production democratization: modern technologies of (industrial) product design and production, like for example additive manufacturing (3D-printing), enable individuals and companies to significantly reduce production costs, improve product planning and prototyping processes, and enhance the quality and precision of products themselves. On-line platforms like 3Dhubs.com [5] offer cost-effective individual solutions for product production and provide instant quotes from additive producers globally. This means that individuals and small companies do not have to invest in expensive equipment anymore, but can basically outsource additive production and thereby let their prototypes and products be produced professionally outside their current scope of competencies or current production capabilities. This way even individuals and even the smallest companies (e.g. start-ups) can produce industrial products and, at least in technical terms, compete with larger competitors without high investments. This undoubtedly leads to what is known as democratization of industrial production.

4. Introduction

4.1. Motivation

In order to change the ecosystem of the creation of consumer products to sustainability a **circular economy** shall be established. Circular economy comprises an adapted form of innovation management (e.g., considering parts of fore-runner products), recycling strategies or upcycling strategies.

In addition the **fab foundation** has introduced a world-wide community of makers with access to emerging production techniques (e.g., 3D-printing, laser cutting, CNC-milling). **Contractual manufacturers** provide comprehensive services for designing, simulating, and manufacturing of parts with lot size one of small volume. Finally, on internet platforms there is access to a world-wide community of makers or service providers (**Gig-economy**) enabling open source development of products of spare-parts respectively profound know how with respect to product design or engineering.

Circular economy as such is rising in various fields ranging from optimization in manufacturing sector, to new business models, recycling and upcycling of products, but also innovative approaches to various products – for example plastics, furniture – all products made of high pollutants that can be significantly improved, made less pollutant for environment through innovation and cooperation.

Open innovation initiatives are becoming an increasingly relevant factor in a society with widely spread experiences and knowledge of highly educated people.

<table>
<tr><th>Crew Member</th><th>Why is the topic relevant at regional level</th><th>Why is the topic relevant at national level</th></tr>
<tr><td>CUAS</td><td colspan="2">Large variety of SMEs in the manufacturing industry – also a significant portion of contractual manufacturers – with large deviation concerning the utilization of Internet-technologies within the production process.
Less education of this topic in secondary level schools or at universities.</td></tr>
<tr><td>TECOS</td><td colspan="2">The topic is highly relevant at regional and national levels since the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and, expand the markets for external use of innovation, must clearly be an economic and societal priority. Within this context companies and individuals must get real-time access to information and democratized production. Furthermore the notion of circular economy is extremely relevant for the field of priority of TECOS: industry 4.0, plastics, moulding. Knowledge provision and information transfer must be accelerated on all levels.Efforts must be directed towards establishing as many Open Innovation Communities as lead best-practice examples as possible – regionally and nationally. This will provide transparency and availability of market and tech information and hence accelerate fair market competition, which shall ideally include all economic subjects.</td></tr>
<tr><td>HGK VZ</td><td colspan="2">This topic is highly relevant at regional and national level.</td></tr>
<tr><td>FB</td><td colspan="2">At the present time, the topic is of great importance regionally and nationally.</td></tr>
<tr><td>IWU</td><td colspan="2">A very important topic globally and also with regards to our production facilities in Germany.</td></tr>
</table>

4.2. Problem statement

Responsible representatives of enterprises have less awareness about this changing ecosystem. In terms of product innovation there is still a trend to complete replacement of forerunner products instead of planning reuse of existing and probably used parts. This possibility needs to be considered already during product design.

Particularly small and medium size enterprises (SMEs) are not aware about the Gig-community for outsourcing parts of their engineering without the loss of intellectual property.

Moreover, enterprises are not aware about the new way of engineering for additive manufacturing (e.g., 3D-printing).

Assuming a trend to reduced work time and more spare time due to automation in manufacturing there might be also an increasing trend to the construction and creation of own products, which may lead to small businesses beside a major occupation (prosumership). This trend also increases the need to provide respective education and a platform to this group of people

We can already register a noticeable global trend of work-time reduction with all its benefits, which is often still limited to well-developed economies. As we cite an example from New Zealand [6], it remains clear, that prosumership and production democratization will trigger a need for further special knowledge and lifetime education on individual level. Digital knowledge and information exchange platforms will therefore each time come into forefront and will remain relevant for decades to come.

Crew Member	Main Challenges
CUAS	1. Disseminating an appropriate method of design and engineering for additive manufacturing to the educational system respectively to enterprises. 2. Establishing an open innovation community under consideration of design and engineering experts, manufacturing service providers and fab labs by technical means of the Internet. 3. Introducing the idea of product design for a circular economy under consideration of Challenges 1. And 2.
TECOS	1. Considering theoretical and practical options on how to use digital technologies to boost innovation in circular economy solutions, and how to connect the two through products, services, solutions and business models. 2. Establishing effective and efficient open innovation communities (OICs) as a common mean of inter-regional cooperation in the future.

	3. Accelerating successful industrialization of ideas with shortened development-to-market times while considering all relevant aspects of a functioning circular economy.
HGK VZ	Circular economy as a concept aligned with concept of adoption of green practices in manufacturing by stimulating sustainable activity in key sectors includes comprehensive commitments on eco-design, the development of strategic approaches on plastics and chemicals and targeted action in areas such as plastics, food waste, construction, critical raw materials, industrial waste and offers new business opportunities.

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
[1]		https://en.wikipedia.org/wiki/Open_innovation
[2]		https://en.wikipedia.org/wiki/Circular_economy
[3]		https://www.innocentive.com/
[4]		https://www.apple.com/at/trade-in/
[5]		https://www.3dhubs.com/
[6]		https://www.theguardian.com/world/2018/jul/19/work-less-get-more-new-zealand-firms-four-day-week-an-unmitigated-success

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

The work of the Navigation Crew shall follow a road map as described in the sequel.

1. Common and individual objectives of each crew member shall be clarified first.
2. As a subsequent step existing experiences of each crew member are determined (strengths and weaknesses) are described in a competency map. At the same time the target groups and their needs are described as well as regional and global trends are determined (opportunities and chances).
3. The results of Step 2. are leading to a SWOT analyses resulting in measures to be commonly performed.
4. Appropriate case studies are selected amongst the crew members in order to evaluate the usability of taken measures.

Crew Member	Level 1	Level 2	Level 3
CUAS	Setup of a DIH with focus on design and engineering for additive manufacturing (circular economy covered as a cross-cutting issue)	Setup of periodic events together with partners from Styria	Joining to https://eitrawmaterials.eu/
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) SRIP Circular Economy (https://srip-circular-economy.eu/)	Various national and regional strategic communities…	ADMA assessment – European commission (http://www.adma.ec/)

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
CUAS	Contributor	X
TECOS	Contributor	
HGK VZ	Contributor	
FB	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
CUAS	• Fab labs in Villach and Klagenfurt connected as talent pipeline. Workshops based on those fab labs. • Active in open innovation projects. • Experiences on the level of supply chain integration.	• Fab labs in Villach and Klagenfurt connected as talent pipeline. • Access to Metal 3D-printing
TECOS	- Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. innovations in plastics, industry 4.0 - Excellent expertise in engineering services and applied industrial research - Excellent expertise in product and material development - Very good institutional and political connections (nationally and EU-wide) - Excellent industrial references within the EU: https://www.tecos.si/index.php/en/about-us/references - Experience from dozens of successfully executed technological projects - Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	- Very good EU-wide connections to European technology partners and customers (product development) - Excellent connections to our tool-and-die cluster members - Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/about-us/equipment - 22 highly skilled professionals employed full time, while also cooperating with many contractual external experts - Excellent embedment in Slovenian innovation ecosystem through membership of SRIP Factories o the Future, SRIP Circular economy, SRIP Materials as end products, SRIP Smart buildings and homes.

HGK VZ	- Established connections with regional companies and academic community	- Platforms and networks available from other implemented EU projects https://greenomed.interreg-med.eu/

Conclusion provided by Crew Leader:

<1 page maximum>

6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
CUAS	• Too less experience with design of products for a circular economy – but access to organizations with respective expertise.
TECOS	- Experience with circular economy on project level (incl. actual industrial application), less experience in wider practical applications. We would like to gain competences in this context. - While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain competences in this context. - Lacking knowledge in practical/technical establishment of Digital innovation platforms. We would like to gain competences in this context.
HGK VZ	- Lack of inhouse knowledge in circular economy - Lack of supporting infrastructure and international networking
FB	- We want to build up general knowledge in this area and how to connect it to our competences.
IWU	We want to increase our knowledge in this area, especially when it comes to re-production facilities.

Conclusion provided by Leader:

<1 page maximum>

6.2.3. Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
CUAS	Developing a digital platform which connects fab lab infrastructure, manufacturing service providers, design experts and product engineering experts together with the broad public. A shared knowledge base of open design patterns. Uplink to Gig-Platforms or open innovation platforms.
TECOS	Development options on how to effectively use digital technologies and circular innovations to enhance inter-regional cooperation within the EU (technology, society, environment) to reach a significantly higher state of development of circular economies and therefore environmentally friendly and accessible technologies for everyday lives.
HGK VZ	To comprehend the opportunities of circular economy models and the changing needs of companies To contribute to creation of an international network which gathers relevant companies and tech experts in field of circular economy To raise level of specific knowledge and necessary skills in regional eco-system, especially business sector regarding circular conomy application To raise awareness of companies and improve intra/inter-regional and international collaboration
FB	We want to develop knowledge and skills in this area.
IWU	We want to increase our knowledge in this area, especially when it comes to re-production facilities.

Conclusion provided by Leader:

<1 page maximum>

6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
CUAS	Curricula for students in primary level and secondary level schools. Research based on a CUAS-internal research group in cooperation with SMEs. Involvement of research results in courses at CUAS. Setup of an periodic event together with partners from Styria.
TECOS	• Exchange of best practices of digitalization and innovation in circular economy,

	• Fostering cooperation between partners, their stakeholders and companies • Preparation of a pilot testing facility action with transregional cooperation opportunities.

Conclusion provided by Leader:

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6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
CUAS	Kärntner Wirtschaftsförderungsfonds (KWF) Kärntner Betriebsansiedelungs- und Beteiligungsgesellschaft (BABEG)	Build Gründerzentrum Bildungsdirektion Kärnten Alpe Adria University
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) ADMA assessment - European commission (http://www.adma.ec/) (TECOS as project partner, TECOS as important regional stake-holder) Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) Slovenian Government office for development and European cohesion policy (SVRK) Technology Park Ljubljana Strategic research and innovation partnerships: Factories of the future, Materials as end products, Circular economy, Smart buildings and homes	3Dhubs electronic knowledge base (e-portal) (https://www.3dhubs.com) Lombardy Intelligent Factory Association - AFIL Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/) Etc…
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as	Companies, experts and other relevant stakeholders will be involved in the later phase accordingly.

	associated partner and institution responsible for the national S3	
FB	• Provincial government • Industrial Association • Economic Chamber • DIH-Ost • Haus der Digitalisierung	• Digital Forum 2019 • Digital Austria platform, FFG • Industry 4.0 platform
IWU	• Saxony is Vanguard region and Fraunhofer IWU is leading this region[1] Staatsministerium für Wirtschaft, Arbeit und Verkehr (= state ministry of economy, work and transport)	Looking for relevant actors and stakeholders in the field and establish new cooperations with them

Conclusion provided by Leader:

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[1] https://www.s3vanguardinitiative.eu/cooperations/efficient-and-sustainable-manufacturing-esm (visited 17th October 2019)

6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
CUAS		DIH established during the project.
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder)	Other regional DIH connections to be es-tablished…
HGK VZ		
FB	DIH-OSt: https://dih-ost.at/ Haus der Digitaisierung: https://www.virtuell-haus.at/	Digital Makers Hub in St. Pölten and Digital Innovation Hub - West in Innsbruck
IWU		

Conclusion provided by Leader:

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6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
CUAS	Interreg IT AT - E-Edu4.0 - engineering education Talente Pipeline - technical education of first level and secondary level students by the use of fab lab infrastructure AMAViS2 - Additive manufacturing in agile virtual systems for engineering of products and production processes	Makerspace Carinthia

TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') Slovenian Government office for development and European cohesion policy (SVRK) Technology Park (TP) Ljubljana Strategic research and innovation partnerships: Factories of the future, Materials as end products, Circular economy, Smart buildings and homes	Members of the TECOS Tool-and-die technology cluster (high-tech industrial companies, ranging from SMEs to LEs) (https://www.tecos.si/index.php/en/ membership/list-of-members) ADMA assessment – European commission (http://www.adma.ec/) (TECOS as project partner, TECOS as important regional stake-holder) LUI (Ljubljana University Incubator) ABC Hub Ljubljana (http://accelerationbusinesscity.com/) Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) (various other incubators, digital hubs and regional development agencies)
HGK VZ	Faculty of organization and informatics https://www.foi.unizg.hr/en Faculty of Geotehnical Engineering http://www.gfv.unizg.hr/en/index.html Current EU project: Greenomed (Interreg MED) https://greenomed.interreg-med.eu/ Mediterranean Trans-Regional Cooperation for green manufacturing innovation	Companies, experts and other relevant stakeholders will be involved in the later phase accordingly
FB	• FH Burgenland • Akademie Burgenland • Wirtschaft Burgenland • Initiative "Start Up Burgenland" • Energie Burgenland • Project "Smart Up", Interreg	• Haus der Digitalisierung • Project "Green energy lab - Open Data Platform", FFG. • Educational and training centers • Special Interest Groups • Relevant SMEs and LEs

IWU	• EU project TRINITY[2] • Regional Saxonian DIH Smart Systems Hub[3] Regional Saxonian DIH InnoSax[4]	To other European DIH

Conclusion provided by Leader:

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6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
CUAS	KWF BABEG Build	Funding of projects Multiplier concerning DIH setup Multiplier concerning Start-up community or spin-offs
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) Technology Park (TP) Ljubljana Strategic research and innovation partnerships: Factories of the future, Materials as end products, Circular economy, Smart buildings and homes	Multiplier concerning DIH setup Multiplier concerning Start-up community or spin-offs Multiplier related to disbursement of knowledge and tools, technology pool.
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	We will keep the ASP contact person duly informed and involved in project activities where necessary and consult the ASP as institution responsible for S3 in Croatia
FB	Regional Management Burgenland	We would like to involve the partner through an exchange of know-how and

2 http://www.trinityrobotics.eu/ (visited 17th October 2019)

3 http://smart-systems-hub.de/en/home/ (visited 16th October 2019)

4 http://innosax-smartproductionsystems.de/ (visited 16th October 2019)

		personal meetings. This should last for a longer period of time to be efficient. RMB will also be involved as a peer Reviewer.
IWU	Members of the smart[3] Network	Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.

Conclusion provided by Leader:

<1 page maximum>

NAVIGATION CREW

Digital Marketing

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Kastelic, Willmann	5. 7. 2019
1.0.2	Review of template document	Pesenti, Jester	
1.0.3	Add content	Kremsner, Marhold, Zemlyak, Hofmann	21.11.2019
1.0.4	Changed directive, add content	Hofmann, Zemlyak, Kremsner	03.12.2019

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. NAVIGATION CREW – DIGITAL MARKETING

Digitalization leads to changes in several divisions of a company. Therefore, marketing is not only a specific business tool anymore, it needs to be included in the overall business strategy. The boundaries between the fields of operation of a company (e.g. production, customer service, logistics, etc.) blur and the digitalization in marketing helps to optimize the link between those fields (Lies 2019). Furthermore, Foroudi et al. (2017) identified that the relationship between digital technology and marketing is a key asset for the growth of SMEs. This highlights the importance of the topic "digital marketing".

Digital Marketing can be seen as the online-offline integration of marketing channels → Marketing 4.0, which is related to the digitalization of business processes and industry 4.0 (Lies 2019). It helps to improve brand equity, growth and sustainability of an enterprise (Dumitriu et al 2019).

The academic literature describes different digital marketing tools. However, Schaefer and Hetman summarized fifteen digital marketing spheres including the most common tools for companies (2019). The findings are shown in the table below:

Tabelle 1: **The Main Digital Marketing Tools**

Top	Marketing sphere	Marketing tools description
1	Analytics & Tracking	ClickMeter, Funnel.io, Google Analytics, Heap, Track Maven, UNAMO
2	Online Branding	Rebrandly, BrandYourself DIY Tool, Mention, Pixellogo, SurveyMonkey, Wisestamp
3	Blogging & Content Creation	WordPress, BuzzSumo, BuzzSprout, CoSchedule, Pocket, Grammarly, Hemingway Editor, Kahoot!, Medium, Piktochart, Qzzr, Zest
4	Collaboration	Slack, Asana, Cyfe, Dropbox, Google Drive, GoToMeeting, JIRA, Join.me, Quip, Trello, Traackr, Zenkit, Zoom
5	Customer Success & Support	Intercom, Drift, Emojics, Mopinion, Ramen, Respond (by Buffer), Totango, Zendesk
6	Design, Images & Video	Canva, Adobe Spark, Animatron, Balsamiq, Favicon Generator, Fluid UI, Genially, InstaQuote, InVision, Loom, Pablo, Powtoon, Snappa, Typ.io, Wistia
7	E-Commerce	Shopify, BigCartel, BigCommerce, Chargify, Gumroad, Selz, Magento, Oberlo, PrestaShop, Product Upsell, Squarespace, Volusion
8	Email Marketing	MailChimp, AWeber, Campaign Monitor, Constant Contact, ConvertKit, GetResponse, iContact, NEWOLDSTAMP, Revue, Scope
9	Marketing Automation	HubSpot, Zapier, Automate.io, IFTTT (If This Then That), Microsoft Flow, Pardot, Follow Up Boss
10	Event/Project Management	Eventbrite, AppInstitute, Bizzabo, Cvent, Eventsforce, Sli.do, Eventmobi, Gather, Wild Apricot, Indydesk, Bitrix24, ProofHub
11	Paid Advertising	Facebook Ads, AdEspresso, AdStage, AdRoll, Bing Ads, Driftrock, Google Adwords, Social Ads Tool, SpyFu, Twitter Ads
12	Productivity	1Password, Calendly, CheatSheet, Evernote, F.lux, Rescue Time, Momentum, StayFocusd
13	SEO Tools	Google Keyword Planner, Cocolyze, K-meta, Ahrefs, Alexa, Answer the Public, Copyscape, Google Trends, GTMetrix, Moz, OnPage.org, Screaming Frog, SEMrush, SERPChecker
14	Social Media Management	Meet Edgar, Buffer, Crowdfire, Dlvr.it, Earshot, Meltwater, Oktopost, SocialBee, SocialPilot, SproutSocial

15	Webpage Creation & Lead Capture	Optimizely, ClubRunner, Instapage, JotForm, M-Files, Sumo, Kickofflabs, Optinmonster, Sleeknote, Albacross, Typeform, Wix, Unbounce

Source: Schaefer and Hetman (2019), systematized and completed by authors based on research of Matthews, I. (2018)

The table above shows the variety of digital marketing tools available at the moment. In further literature, Karatum differentiates between one-way and multidirectional digital marketing (2017).

3.1.1. SPECIFIC TOPICS

In terms of this project, we would like to focus on the following specific topics:

1. Search engine optimization
2. Social Media Management/Marketing
3. Online market research

Within the navigation crew we will focus on different target goups. The main focus will be on stakeholders who have no experience in the topic (starters group). Additionally we will provide information that is also relevant for experienced stakeholders and try to involve professionals (expert group) on relevant topics.

3.1.1.1. Search engine optimization

DEFINITION

In terms of one-way digital marketing, we will focus on **sphere 13 - Search engine optimization** (SEO). “SEO is the procedure to improve the ranking of websites for particular searching terms on search engines by managing incoming links and characteristics of websites.” (Hung-Jia et al 2018 cited from Malaga 2010).

EXAMPLES

We show participants/companies the different search engine marketing (SEM) strategies and tools (GoogleAnalytics, Keyword Analysis tools, etc.).

3.1.1.2. Social Media Management/Marketing

DEFINITION

In terms of multidirectional digital marketing, we focus on **sphere 14 - Social Media Management/Marketing**. Social Media is a communication and marketing tool. The main concept is the direct interaction with the customer. Social Media Marketing includes several social platforms like Instagram, Facebook, Youtube and co. (Amoako, Okpattah and Arthur 2019).

EXAMPLES

We show the advantages and disadvantages of several social media platforms and help to identify the most relevant channels for the participating companies. If required we teach the companies how to use the specific platform and/or provide further information.

3.1.1.3. Online market research

DEFINITION

Online market research also belongs to the topic of digital marketing. It is used to obtain information from digital sources about customers and/or markets. Due to the increased usage of the internet, it is a common method in today’s economy (Poynter 2010). It helps companies to improve their market position and to explore existing markets or future trends and further, distinguish the companies from their competitors (Comley and Beaumont 2011). Online market research can be divided into primary and secondary market research. Secondary market research is the analysis of already existing data (internal or external). Primary market research is the collection of data for a specific purpose. This means, that you conduct your own study according to your needs.

EXAMPLES

There are several primary online market research methods. A list of the most common methods is provided below (Deutsches Institut für Marketing 2016):

- Online focus groups
- Online surveys
- Usability studies
- Online panel

4. Introduction

4.1. Motivation

<Motivate why the above described topic area/s is relevant at regional / national level? Motivation should be provided by each crew member and ideally supported by quantitative / qualitative evidence> Relevance can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.000 characters / member.

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
FB	In Burgenland more companies are active in the primary and secondary sector than in Austria on average. The most dominant sectors are health and social care followed by trading companies, freelance technical services and construction industry as well as accommodation and catering. Although Austria is generally characterized by many SMEs, this is most noticeable in Burgenland. Here is the lowest number of large companies in Austria.Therefore, it seems as if Burgenland companies are numerous, but can not compete with the large providers from neighboring states. The topic is therefore especially interesting for regional SMEs. Digital Marketing is an easy way to decrease external costs and reach a higher range of	In general, Austria is a country that is very clearly dominated by small and medium-sized enterprises. Not even 1% of all companies based here have a workforce of more than 250 people, which would classify them as large enterprises. In Austria, around 40% of all employees work in large companies with a workforce of at least 250 people, but not even 20% in Burgenland. Digital Marketing is important to fit in the developing economic structure and increase the competitiveness of enterprises. On a national level digital marketing helps to identify and analyse existing markets and gain information about new markets. It might also be used as a strategic tool for international marketing.

	customers compared to traditional marketing media (print advertising, etc.). Market research helps companies to gain more insights about customers' needs. Especially for SMEs, it is crucial to offer valuable products that can satisfy the needs of potential clients. However, for smaller companies, it is often not easy to carry out marketing or market research activities due to low resources (financial, personal, etc.). Therefore, the aim of this project is to help SMEs to start their digital marketing activities.	
bwcon	A carefully planned market strategy is indispensable for the success of a company and includes all measures necessary for the company to successfully position itself on the market. Through its positioning, the company defines the basis for a medium to long term market image in the eyes of its customers and competitors. Often the marketing resources allocated to this purpose are limited and should be use effectively. This is where digital marketing plays an important role, especially for SMEs that pursue to stablish in the market.	According to a Deloitte's study, 90 percent of the world's data has been produced in the last two years and more than 26 billion smart devices are now in circulation. Paradogically, in this era of unprecedented technological innovation, one of the study's central conclusions and recommendations for action in marketing is that those strategies should keep the human component in focus. Align with those global trends, the need of conceiving digital marketing strategies in the framework of long term sustainability would be an asset to improve international competiveness of german companies.
IWU	The region is dominated by SME's	Digital Marketing is a strong growing field of advertising. It increases the competitiveness of

	Learn from best practice examples Reach a wider range of possible customers	SME's and also large companies. SME's are a huge industry impact factor for Germany.
KPT	As far as Malopolska region is concerned the percentage of companies using actively social media for busines purposes is high in big cities (Krakow, Tarnow, Nowy Sącz, Nowy Targ, Tarnów, Oświęcim, Zakopane, Wadowice) where apart from local companies there is a huge number of international companies and their operating offices. It very differs outside main cities where the strategic approach to digital tools is still not very popular and widespread. The participation of social media in business will definitely be more and more common, as well as everything related to this communication channel due to internationalization, exchange of best practises among Polish and foreign companies. In general, we can expect growth and better competence in the field of digital marketing. Our aim is to increase all SMEs digital marketing knowledge and help to start some activities. KPT has best practices in digital marketing an could help SMEs in promotion.	Poland is one of the leaders when it comes to using Facebook in business activities by SMEs (it's about 87%). But the situation changes outside big cities, in small regions. SMEs usually know that social media communication is important, but they don't have time and possilbilities to carry it out. According to the Fanpage Trends report, which analyzes social networking sites from a commercial perspective, Facebook has 15.44 million users in Poland, of which 7.48 million are men and 8 million are women. The most numerous age groups are between 19 and 25 years and 26 and 33. They are significant consumer groups. The percentage of companies using social media in Poland is still not satisfactory. Despite the growing number of Facebook, YouTube, Snapchat or Instagram users, only about 15-20 percent companies take advantage of the opportunities offered by these services - according to the estimates of Sotrender. However, experts estimate that this percentage will grow dynamically. Companies will also be increasingly familiar with social media functionalities. https://wwwsrc.sotrender.com/resources/
HGK VZ	Cost-effective investment in digital maketing, better understanding of custumer needs and achievement of the	Digital marketing is a necessity in coping with the changes in world of communication and new digital customers.

	better sales results are important for all SME's, also for manufacturing companies based on more slow paced industry to adjust the to the recent changes. Regional companies have to adopt new practices and change their marketing approach by integrating digital marketing into traditional marketing communication in order to provides maximum impacts on awareness and preference building and stay in line with current trends.	

4.2. Problem statement

<Are there any specific challenges that can already be identified by crew members. Please note and remember that a specific need assessment activity will be done under Activity 1.2. therefore, this first overview should ideally provide the main directions that will guide the need assessment activity. Again, each crew member should provide its point of view.

Challenges can be summarized in a table like the example provided below. Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Max. 1.500 characters / member

Crew Member	Main Challenges

FB	• Many small businesses in Burgenland have neither the resources nor the knowledge to compete with their businesses through digital media. Many lack access to neutral technical advice to start implementing basic digital technologies.
	  ○ Teaching the companies how to use digital marketing tools (e.g. social media channels) in a sustainable way
	• The consulting services in Burgenland for companies is multilayered but not strategically coordinated. Many companies are insufficiently familiar with the funding landscape and advisory options. A network of relevant stakeholders should be established.
	  ○ Using the right channels to contact/inform relevant stakeholders
	  ○ Using the available resources of the stakeholders in the best possible way

bwcon	• Digital marketing strategies outside sustainable frameworks • lack of basic know-how in digital marketing concepts • Data management concerns
IWU	• SME's don't know how to get started with Digital Marketing • They have no experiences in useing Social Media for their businesses • There are worries about the legal rights (f.e. using photos etc.) and data storage • Get started in the field of digital market research! Especially with regional (Saxony) SME's
KPT	• Encourge companies of Polish Investment Zone to use KPT's promotion channels

	• Deliver tailored knowledge base that can be used by SME's located in smaller cities where the access to social channels is less popular and widespread.
HGK VZ	• Gain companies` attention and awareness raising about benefits of digital marketing justifying time investment and considering it high cost effective for achieving the business results • Insuficiently skilled SMEs' staff to adopt the right knowledge and expertise to carry out digital marketing with success • Lack of knowledge to follow rapid changes in top digital trends and related necessary tools

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

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Schaefer, M., & Hetman, O. (2019). Effective tools of digital marketing implementation. University Economic Bulletin, (41), 67-74. https://doi.org/10.31470/2306-546X-2019-41-67-74

Document title	Release	Location
Deloitte's new Global Marketing Trends Report	2019	https://www2.deloitte.com/de/de/pages/technology/articles/global-marketing-trends-2020.html?gclid=Cj0KCQiAoIPvBRDgARIsAHsCw0-meWfvwJbpZROOaSLRPR1RvchYdUY6Sa0VXy7lE6ZGXxQi86WQgUoaArQAEALw_wcB
Venture Development Toolkit: Leveraging your Venture to Success	2017	https://www.venture-dev.de/shop/

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

Each Navigation Crew will be asked to run a Needs Assessment activity under AT1.2. While a detailed description of how each Crew will run this action will be provided under that Activity, partners should investigate here if and which validated tools / methods they have to

1) identify RIS3 relevant, practical actions + digitalization needs to support the T2 action plans: these tools and methods should be used with SMEs, Les, BSOs and RTDs (Level 1)

2) identify RIS3 benchmarks and digitalization needs/gaps at policy levels (Level 2)

3) compare RIS3 monitoring initiatives at EU level with their regional / national context (Level 3)

This list should help Crews to accelerate later on the needs assessment work (AT1.2). Partners may also consider to investigate the ADMA assessment method that has been validated at EU level and which has been offered to S3HubsinCE as a complementary tool to be used in case no other tools should be available OR in case Crews should decide to adopt an already transnational validated assessment method (which the EASME Agency is currently evaluating for a wider adoption within DG Growth).

<Description of methods or tools which are applied in order to achieve the thematic topics are specified here.>

To collect these tools / methods (where available), the table below should be used.

Crew Member	Level 1	Level 2	Level 3
FB	• Special Interest Groups (SIG) • KMU Digital, KMU Digitalberater: https://www.digitalberater.at/ • DIH-OSt: https://dih-ost.at/ • Haus der Digitaisierung: https://www.virtuell-haus.at/ • Digital Makers Hub in St. Pölten and Digital Innovation Hub - West in Innsbruck	• National RTI Strategy (FTI Strategy) • Monitoring and evaluation institutions of public funding • Strategic task forces for FTI evaluation • Innovation Hub - West in Innsbruck	• Eye@RIS3 • RIS3 Key
bwcon	Special Interest Groups (SIG)	DIGIHUB Südbaden: https://www.digihub	Smart Space (Alpine Space)

		-suedbaden.de/digitalisierungs-check	
IWU	Cooperation with Makerspace SLUB Dresden DIH Innosax (https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool/-/dih/1505/view)		HORIZON 2020 Project TRINITY (https://www.iwu.fraunhofer.de/de/Ueber-uns/netzwerke/internationale-netzwerke/eu-projekte/eu-projekt-trinity.html)
KPT	Social media search / survey Set of questions linked to the questionnaire addressed to SMEs related to other thematic Navigation Crews KTP is involved in	Workshops	

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
FB	Leader	X
bwcon	Contributor	
IWU	Learner	
KPT	Learner	
HGK VZ	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
FB	Considerable Know-How in digital marketing: Website Analysis, Strategic Social Media Marketing, etc. Structured network of experts, consisting of universities, consultants and suppliers	Large network of companies (SME, LE) with experience in the field of innovation Network of training and education institutions Laboratory facility for website analysis and eye tracking
bwcon	Experience in technology transfer from research to industry and open innovation trainings	Strong network of companies (including SMS and small companies) Established network of industry experts and researchers
IWU	Experienced in Knowledge transfer and Science Communication Well structured cross-disciplinary network in the field of future materials (industry, science, policy)	Established Network (www.smarthoch3.de) Certified by EU with the Bronze label 'Excellent Cluster Management Organization'
KPT	Knowledge on the expectations and needs of SMEs in big cities in the area of digital marketing Best practices, experts in the promotion team and KPT ecosystem; a well-organised social media system, comunication strategy	
HGK VZ	Established connections with regional companies among which some excel in digital marketing.	

6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
FB	• Lack of links at European level to structure a transnational competence network in the field of digitalization • Strengthening competencies in SEO and SEA • Strengthening competencies in Social Media Advertising
bwcon	• As FB, to consolidate competencies in SEO/SEA as well as payed Social Media Advertising
IWU	• Get started with SEO and SEA (starter kit is needed)
KPT	• methods of engaging companies in promotional activities • building awareness of the role of marketing tools among SMEs in smaller cities
HGK VZ	• To be introduced to digital marketing tools in general • Properly channel the acquired/ knowledge on digital marketing toward regional companies

Conclusion provided by Leader:

<1 page maximum>

6.2.3. Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
FB	• Provide information on needs and barriers for national policy stakeholders. • Enhance national platforms for digital innovation and increase pilot actions • Merging national strategies and stakeholders trough a regional information platform. • Identify the needs of companies at European level in order to start new collaborations. • The common goal is to help SMEs in the program area to carry out online marketing and market research activities. The stakeholders/SMEs are available to use the tools according to their needs.The stakeholders will benefit from the project and the offered activities/workshops.
bwcon	• Strengthening knowledge exchange to address current challenges and best practices in the implementation of digital marketing strategies within SMEs.
IWU	• Exchange best practices and implement knowledge of digital marketing within SME's.
KPT	• The common goal is to help SMEs in the program area to carry out online marketing activities.
HGK VZ	• To adopt general and specific knowledge regarding digital marketing benefits and use of specific tools in order to adopt and implement current digital marketing trends • To raise awareness of companies to accept digital marketing and integrate digital marketing acitivities into their strategic plans • Increase the level of use of digital marketing tools among regional companies

Conclusion provided by Leader:

<1 page maximum>

6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
FB	The following actions are identified: • Develop a portfolio with actions in the field of digital marketing such as: ○ Workshops, Information events, Initial Consultations/consulting sessions, Blended learning sessions for SMEs on digital marketing, open lectures, marketing guides (information folder on relevant topics), best practice examples, Etc. • Identify regional stakeholders (institutional and policy makers) • Start cooperation with regional DIHs • Build a national information platform. • Carry out regional workshops and conferences in cooperation with relevant stakeholders. • Support national stakeholder networks in the field of digital marketing
bwcon	Specifically, bwcon looks forward to: • Organize and promote tailored transfer events, as well as participate in relevant stakeholder events • Provide support to our regional ecosystem network of small and medium companies by pinpointing digital marketing topics • Exchange transnational best practices and foster cooperation with other Project Partners in digital marketing to exchange know how and develop joint pilot actions.
IWU	• Information events for SME's • Running Workshops with interested stakeholders • Create own best practices (as multipliers)
KPT	1. To prepare digital marketing knowledge base for SME (how to use SM) 2. To apply Forschung Burgenland business promotion experience in Germany in KPT's activities

	3. To develop a catalogue of best practices on digital marketing among SMEs of Malopolska region 4. To support regional SMEs organization and chambers of industry and commerce in sharing know-how on digital marketing approach elaborated under Navigation Crew member cooperation
HGK VZ	• To learn from other partners having expertise in field of digital marketing. • Increase the level of awareness and knowledge about digital marketing benefits/tools among regional companies • Map the regional companies` digital marketing competencies • Carry out some specific pilot actions targeting regional SMEs

Conclusion provided by Leader:

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6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
FB	• Provincial government • Industrial Association • Economic Chamber • DIH-Ost • Haus der Digitalisierung	• Digital Forum 2019 • Digital Austria platform, FFG • Industry 4.0 platform
bwcon	Ministerium für Wirtschaft, Arbeit und Wohnungsbau	
IWU	Sächsisches Staatsministerium für Wirtschaft und Arbeit	
KPT	• Cooperation with media & promotion agencies and media houses • Cooperation with start-ups and SMEs from IT & ICT sector Cooperation with chambers of industry and commerce and SMEs organisations	• External Speakers, Webinars or Workshops
HGK VZ	No established connections yet.	Companies and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

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6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
FB	DIH-OSt: https://dih-ost.at/ Haus der Digitaisierung: https://www.virtuell-haus.at/	Digital Makers Hub in St. Pölten and Digital Innovation Hub – West in Innsbruck
bwcon	Digital Hub Südbaden (DIGIHUB Südbaden) Stuttgart Media University MFG Baden-Württemberg	
IWU	Innosax TRINITY	
KPT	KTP is a regional DIH acting as a one-stop-shop, serving companies within their local region and beyond to digitize their business. KTP DIH is based on a clear understanding of actual needs of the stakeholders. Main task of KTP DIH is to inspire industrial enterprises to implement innovative digital solutions related to Industry 4.0 and actively support and co-create them in implementation at various stages: from diagnosis, needs analysis and conceptualization to post-deployment testing. KTP DIH partners: • Universities: AGH University of Science and Technology, Cracow University of Technology, Jagiellonian University, University of Economy • SMEs: Autenti, Kangur Electronics, Astor, Protech, ES-System, Game Desire, Velis • LE: Comarch, Fideltronik, EC Group, Woodward Poland, Transition Technologies, Merit Poland, Wisniowski	• to initiate and develop cooperation with Automation and Robotics Hub (ARH), Warsaw • to initiate and develop cooperation with Silesia Competence Centre Industry 4.0, Katowice

	• Małopolska Regional Development Agency Cooperation with regional authorities Municipality of Krakow, Marshall Office of Malopolska Region	
HGK VZ	No connections established yet.	

Conclusion provided by Leader:

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6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
FB	• FH Burgenland • Akademie Burgenland • Wirtschaft Burgenland • Initiative “Start Up Burgenland” • Energie Burgenland • Project “Smart Up”, Interreg	• Haus der Digitalisierung • Project “Green energy lab - Open Data Platform”, FFG. • Educational and training centers • Special Interest Groups • Relevant SMEs and LEs
bwcon	Special Interest Groups (SIG)	
IWU	Wirtschaftsförderung Sachsen Kompetenzzentrum Mittelstand 4.0	
KPT	• Universities: AGH University of Science and Technology, Cracow University of Technology, Jagiellonian University, University of Economy • SMEs: Autenti, Kangur Electronics, Astor, Protech, ES-System, Game Desire, Velis • LE: Comarch, Fideltronik, EC Group, Woodward Poland, Transition Technologies, Merit Poland, Wisniowski • Małopolska Regional Development Agency Municipality of Krakow, Marshall Office of Malopolska Region	
HGK VZ	Faculty of organization and informatics https://www.foi.unizg.hr/en	Companies and other relevant stakeholders will be involved in the later phase accordingly.

Conclusion provided by Leader:

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6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
FB	Regional Management Burgenland	We would like to involve the partner through an exchange of know-how and personal meetings. This should last for a longer period of time to be efficient. RMB will also be involved as a peer Reviewer.
bwcon	Wirtschaftsregion Stuttgart	To use it as partner and multiplier for companies, specially SMEs, in shaping digitization in the region
IWU	Sächsisches Staatsministerium für Wirtschaft und Arbeit	To use it as multiplier for companies (door opener)
KPT	Marketing companies from the KPT's ecosystem	Involve companies into workshops for SME
HGK VZ	The Croatian Ministry of Economy, Entrepreneurship and Crafts as associated partner and institution responsible for the national S3	We will keep the ASP contact person duly informed and involved in project activities where necessary

Conclusion provided by Leader:

<1 page maximum>

NAVIGATION CREW

Design & Engineering for Additive Manufacturing

Content

1. Introduction

1.1. Change history

Release	Subject of change	Author(s)	Date
1.0.1	Submission of template document	Willmann	21. 11. 2019
1.0.2.	Added information on TECOS	Hančič, Knežević Vernon	18.12.2019

Table 1: Release history of this document.

3. Crew: definitions and examples

3.1. Design & Engineering for Additive Manufacturing

3.1.1. SPECIFIC TOPICS

Nowadays, enterprises struggle with appropriate consideration of the principles of additive manufacturing in their product development process. Consequently, for instance economic benefits of 3D-printing are not yet sufficiently understood and thus utilized. Moreover, 3D-printing (or more general “additive manufacturing”) is not useful for all purposes. Therefore, also regional manufacturing enterprises are not willing to bear the significant costs of investment in high-end 3D-printing equipment and 3D-printing operations. There are contractual manufactures and specialized prototyping service providers on the market that provide such expertise. However, involving those experts in the internal product innovation process is not affordable (e.g., SMEs with small volume sizes or single parts production as well as Start-ups) or violates IP-issues. Moreover, the problem case is not limited to the product innovation process but is also useful in terms of process innovation (e.g., improvement of incoming logistics due to spare parts of equipment maintenance or process improvement due novel equipment components for better production process performance).

Education and training in design for additive manufacturing: Roll-out of curricular for students, teachers (train the trainers) and employees. The focus is on the printing techniques fused deposit material (FDM), stereo lithography (STL), selective laser melting (SLM) on polymers, ceramics, metals and mixed material approaches.

Roll-out of **design patterns knowledgebase** for 3D-printing: Roll-out of a knowledgebase for design approaches with respect to 3D-printed structures or functional printed components. Such structures comprise functional grouping of components, topology optimization, combination of electrical conductors and mechanical elements or meta-materials. The knowledgebase supports designers and engineers during their development process of new products.

Network of service providers: a network of service provides with respect to contractual manufacturing, engineering and simulation services, research labs as well as fab labs for self-service activities. Also existing 3d-printing hubs shall be integrated.

4. Introduction

4.1. Motivation

Crew Member	Why is the topic relevant at regional level	Why is the topic relevant at national level
CUAS	There is a lack of knowledge about the economic aspects for application of AM. It is essential to consider the strengths of AM already during the design and engineering phase of new products to make full use of the potential.	

<table>
<tr><td>IMECH</td><td>Lombardy Region is the third region of Europe for value added and the first one for number of companies, therefore application and exploitation of additive manufacturing to improve flexibility and to reduce costs will become a question of competitiveness. In terms of business change, the key outcomes will be:
Realization of more complex and customized components, without construction constraints
Reduction of prototyping time and design time
Reduction of material waste</td><td>Lombardy is the first region of Italy for value added and the first one for number of companies and employees. Lombardy is the best practice for Italian regions in manufacturing fields concerning innovation, economic growth and development.</td></tr>
<tr><td>TECOS</td><td colspan="2">Developing and producing more innovative, higher quality industrial machinery in less time and at lower cost is the definition of success in today’s competitive machine design market. Achieving this success requires a level of automation that is only possible through the use of integrated 3D design technologies, concurrent workflows, total data compatibility and management, and the ability to completely leverage 3D design data across all vital functions. By utilizing an integrated, 3D development ecosystem for machine design, validation, manufacturing, quality control, assembly, and documentation, you can boost efficiency, control costs, and improve quality — all at the same time.

The topic is highly relevant at regional and national levels since the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and, expand the markets for external use of innovation, must clearly be an economic and societal priority. Within this context companies and individuals must get real-time access to information and democratized production.

TECOS can provide broad expertise in this technology field (‘Machinery’ in general, automation, simulation, material and product design, data integration etc.). Therefore it remains highly relevant for us as we would like to actively contribute, not only as a national player, but also above that - inter-regionally - as this navigation crew is set up.</td></tr>
<tr><td>PBN</td><td>The goal is to support the re-industrialization process in Western Hungary. Currently, the</td><td>One of the horizontal priorities of the Hungarian National RIS 3 Strategy is ICT and Services. Besides, advanced</td></tr>
</table>

	region is located at a relatively low end of the manufacturing value chain, and the goal is to realize its upgrade. Since mechatronics is decisive in the region, material science related to that, new material and composited development, additionally power train improvements are important. Autonomous vehicle drive testing and its applications are also in the focal point of the developments. SMEs and large enterprises located in the region must keep abreast of the technological development of the market, therefore the exploitation of digital innovation technologies will be crucial fields of the near future in the region. The main motivation is to: • increase the knowledge of digital innovation methodologies of companies in the region	technologies in the vehicle and other machine industries are listed as sectoral priorities in the national strategic document. These priorities (horizontal + sectoral as well) include lot of subtopics, but digital innovation is a crucial area in the strategic document.
FB	In times of digitization, the region and thus the small and medium enterprises (SMEs) have to adapt to current circumstances. Design and Engineering for additive manufacturing is a highly important topic to remain competitive in the future. Therefore, the topic is highly relevant at regional level. In order to keep up with the international competition, companies in Austria must gradually improve their business activities. Therefore, this navigation crew is of great national relevance.	

4.2. Problem statement

Crew Member	Main Challenges
CUAS	1. Disseminating an appropriate method of design and engineering for additive manufacturing to the educational system respectively to enterprises.

	2. Establishing an open innovation community under consideration of design and engineering experts, manufacturing service providers and fab labs by technical means of the Internet.
IMECH	1. Application and implementation of additive manufacturing technologies to the business processes of our member associated to solve real-work problems. In this way they can improve their competitivity on the market according to Intellimech mission: "An environment where our partners can catch the opportunities offered by new technologies". 2. To spread an innovation culture in the SMEs of Lombardy territory. Nowadays lack of competences represent the principal gap in the implementation of additive manufacturing in italian SMEs. 3. Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics.
TECOS	1. Considering new trends in additive manufacturing – how to shorten the time of production and how to connect stakeholders effectively (e.g., 3dhubs.com [5]). 2. Considering theoretical and practical options on how to use digital technologies to reduce information asymmetry in economic systems and grant real-time information to all economic subjects.
PBN	• The main barrier can be the permanently changing technological background, namely that digitalization processes are so fast that it is very hard to find out what the real needs of SMEs are. Doing a research about the exact needs of SMEs has to be very fast and actions have to be made as fast as possible. • According to the current statistics and analysis of the (Western) Hungarian companies are not developed and competent enough to utilise Industry 4.0 elements, including Additive Manufacturing, so there is a principal gap between the current status and the desired status of the implementation of these technologies. • Spreading the information of the innovation technologies within digital innovation, such as Additive Manufacturing to SMEs is challenging

4.3. References

References should be understood as any external document used by Crew members to motivate their answers.

This document uses partially or in total the content of documents as shown in Table 2.

Document title	Release	Location
[1]		https://www.3dhubs.com/
100 Radical Innovation Breakthroughs for the future	European Comission	Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf Dowloaded by PBN
National Smart Specialisation Strategy November 2014	National Research, Development and Innovation Office	
Slovenian Smart Specialisation strategy	Government office for development and European cohesion policy	chrome-extension://gphandlahdpffmccakmbngmbjnjiiahp/https://www.eu-skladi.si/sl/dokumenti/kljucni-dokumenti/s4_strategija_v_dec17.pdf
Action plan of Strategic research and development partnership Factories of	SRIP TOP	chrome-extension://gphandlahdpffmccakmbngmbjnjiiahp/http://ctop.ijs.si/wp-content/uploads/file-manager/Dokumenti%20SRIP%20ToP/SRIP_ToP_Akcijski_nacrti_7_7_2017_Povzetek.pdf

the Future		
Establishing decision by UNESCO on Center for Artificial intelligence research, to be located in Slovenia	Institute Jožef Stefan	http://pmis.ijs.si/sl/2019/11/27/generalna-konferenca-unesco-potrdila-sedez-mednarodnega-raziskovalnega-centra-za-umetno-inteligenco-v-ljubljani/

Table 2: Documents, which are referenced by this document.

5. Methodological Approach

The work of the Navigation Crew shall follow a road map as described in the sequel.

1. Common and individual objectives of each crew member shall be clarified first.
2. As a subsequent step existing experiences of each crew member are determined (strengths and weaknesses) are described in a competency map. At the same time the target groups and their needs are described as well as regional and global trends are determined (opportunities and chances).
3. The results of Step 2. are leading to a SWOT analyses resulting in measures to be commonly performed.
4. Appropriate case studies are selected amongst the crew members in order to evaluate the usability of taken measures.

Crew Member	Level 1	Level 2	Level 3
CUAS	Setup of a DIH with respect to “design and engineering for additive manufacturing” Trainings and workshops with students (primary and secondary level), teachers, engineers of enterprises. Fab lab infrastructure for makers and the public in general. Integration of local and regional fab lab and research lab infrastructure.	Establishing network with manufacturing service providers or engineering service providers from Styria and Slovenia	ADMA assessment - European commission (http://www.adma.ec/)
IMECH	Test Industria 4.0 - DIH (https://www.testindustria4-0.com/)	Regional Strategic community - AFIL (Work in progress)	ADMA assessment - European commission (http://www.adma.ec/)
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/)	Various national and inter-regional strategic communities…	ADMA assessment - European commission (http://www.adma.ec/)

		Strategic research and Innovation partnership - SRIP Factories of the future	
PBN	In the framework of another EU project of PBN called 4STEPS (further details can be seen here: https://www.interreg-central.eu/Content.Node/4STEPS.html) a transnational tool has been developed which measures RIS3 relevant SMEs in the point of view of needs and the level of adaptation to I4.0 themes. The transnational tool (online questionnaire can be filled here: https://4stepscrm.com/index.php?kitoltesboard&sys=startQuestionnaire The replies from SMEs have been being collected from September-December 2019 in the partnership, including Hungarian SMEs too		ADMA assessment – European commission (http://www.adma.ec/)

Table 5: List of available tools / methods.

6. Structure of the Navigation Crew

6.1. Navigation Crew Members

Crew Member	Role of Project Partner (Contributor / Learner)	Is Navigation Crew's leader
CUAS	Contributor	X
IMECH	Contributor	
TECOS	Contributor	
PBN	Learner	
FB	Learner	

Table 6: Structure of the Navigation Crew.

6.2. Strength and weaknesses

6.2.1. Partner's strengths in the selected thematic areas

What competences / assets / resources do crew members have? They should focus on what they can share or further exploit with other crew members.

Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Competences & assets (intangible)	Assets & Resources (tangible)
CUAS	• Fab labs in Villach and Klagenfurt connected as talent pipeline. Workshops based on those fab labs. • Active in open innovation projects. • Experiences on the level of supply chain integration.	• Fab labs in Villach and Klagenfurt connected as talent pipeline. • Access to Metal 3D-printing
IMECH	• Considerable skills developed in the field of additive manufacturing thanks to the development of research projects for its members and thanks to its participation in funded projects • Structured network of experts, consisting of universities, consultants and suppliers	• Demo cases related to the work done for associate companies • Network of companies to carry out the development of use cases and their testing
TECOS	- Excellent knowledge and familiarity within various industrial/engineering sectors like e.g. the tooling industry - Excellent expertise in engineering services and applied industrial research - Excellent expertise in product and material development - Very good institutional and political connections (nationally and EU-wide) - Excellent industrial references within the EU: https://www.tecos.si/index.php/en/	- Very good EU-wide connections to European technology partners and customers (product development) - Excellent connections to our tool-and-die cluster members - Own production line for product development and testing, small-to-medium sized production lots: https://www.tecos.si/index.php/en/ about-us/equipment - 22 highly skilled professionals emplo-yed full time, while also cooperating with many contractual external experts

	about-us/references - Experience from dozens of successfully executed technological projects - Good and ongoing connections with academic institutions (generating knowledge transfer etc.)	
PBN	• With the cooperation of PBN an additive manufacturing center, called AM-LAB was established in 2017, and since then this laboratory has gained the DIH status. • The am-LAB is a service centre specialized on the application and presentation of most recent manufacturing technologies to develop smart end-user product in strong co-operation with our key customers. • In AM-LAB skilled and motivated multidisciplinary team of economists, engineers, medical staff, sales manager and international project coordinators work together who prefer lifelong learning • Applied physics, sensor technology, modelling, ICT are representing the core technical competencies, while data analysis and visualization, project engineering, ROI calculations of the business perspectives. Sensor technology applications, polymer printing integration, strong interactions of smart production technologies ensure the smart character of the products and services offered by the aM-LAB team	• In AM-LAB non-conventional and creative product design is realized by our market leader model softwares, in a cost efficient way. Products are featured in a realistic virtual environment during any phase of the development. • Cost- efficient data access and process are enabled by integration of digital manufacturing solutions - Maximised production capacity, real-time simulation of manufacturing, integration the new machine into production line.

Conclusion provided by Crew Leader:

<1 page maximum>

6.2.2. Partner's weaknesses in the selected thematic areas

What are crew members looking for (what would they like to learn)? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	What would I like to add to my current knowledge / competences?
CUAS	No DIH setup yet
IMECH	• Lack of knowledge related to the needs of EU foreign companies about additive manufacturing • Lack of links at European level to structure a transnational competence network about additive manufacturing
TECOS	• While highly technically competent, we lack the ability to act as consultants in business/commercial terms. We would like to gain competences in this context (relevant to later, dissemination stages of the project). • Lacking knowledge in practical/technical establishment of Digital innovation plattforms. We would like to gain competences in this context.
PBN	• Not easy to carry out digitalization development in most of the companies because they are not competent enough
FB	• We would like to investigate the possibilities of additive manufacturing in small and medium enterprises together in the research consortium. In addition, we want to exploit identified potential.

Conclusion provided by Leader:

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6.2.3. Partner's common goals in the selected thematic areas

Taking in consideration the goals of the project, what would crew members like to jointly investigate, develop, implement during project implementation? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	
CUAS	Developing a digital platform which connects fab lab infrastructure, manufacturing service providers, design experts and product engineering experts together with the broad public.

	A shared knowledge base of open design patterns. Uplink to Gig-Platforms or open innovation platforms.
IMECH	• Create a transnational network of companies and experts in the field of additive manufacturing • Identify the needs of companies at European level in order to start new collaborations in additive manufacturing field
TECOS	• Establishing an open innovation community of design and engineering exper-ts, manufacturing service providers etc. to support a broad project stake-holder map. • Improve skills of staff and the member companies • Identify and develop mechanisms to answer the needs of companies and start new collaborations and exchanges.
PBN	• Improve the knowledge of the internal staff regarding additive manufacturing and industries→ e.g.:Take part in relevant (international) conferences and meetings • Contact experts in regional, national, or international level to establish new co-operations in the field of digital innovation and industries and improve our knowledge as well as experience good practices • The goal is the integration of the additive manufacturing – based on wide spectrum of polymer printers and expertise - into the research and development, prototype production and into mass customized manufacturing.
FB	We want to develop knowledge and skills in this area.

Conclusion provided by Leader:

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6.2.4. Partner's clear actions they shall run

Taking in consideration the goals of the project, do crew members have already some specific actions / initiatives / concrete services in mind they would like to develop during the project? Please note that in case your Crew has more than 1 topic, 1 table for each topic should be delivered.

Crew Member	Actions / initiatives / services
CUAS	• Research on design patterns for systematic application of additive manufacturing approaches. • Research on semi-automated recommender system for engineers. • Education in applying the developed method. • Providing 3d-printing infrastructure in general. • Integration of regional and trans-regional AM-services offers.

IMECH	• Some pilot actions will be carried on to spread an innovation culture and raise awareness and skills about the main issues of advanced production • Creation of network of expertise enabling of a virtuous ecosystem where companies can share their knowledge and experience concerning innovation topics. • Exchange transnational best practices and foster cooperation with other Project Partners in advance manufactory systems to exchange knowledge and develop joint pilot actions. • Disseminate the project to policy stakeholder in order to create a European awareness concerning digitalization
TECOS	• Create awareness actions towards open innovation system in additive manufacturing, • Develop new pilots with partners and stakeholders, • Share best practices, foster collaboration of companies across the transregional area.
PBN	Strong cooperation with PPs who are experts in the field of additive manufacturing to improve our knowledge and might implement pilot action in this field

Conclusion provided by Leader:

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6.3. S3 and DIH network

6.3.1. Partners current links to S3 policy stakeholders

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
CUAS	Kärntner Wirtschaftsförderungsfonds (KWF) Kärntner Betriebsansiedelungs- und Beteiligungsgesellschaft (BABEG)	Build Gründerzentrum Bildungsdirektion Kärnten Alpe Adria University
IMECH	• Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) ADMA assessment – European commission (http://www.adma.ec/) (TECOS as project partner, TECOS as important regional stake-holder) Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') ISTMA World - International Special Tooling & Machining Association (https://www.istma.org/) (TECOS as important regional stake-holder and representative) Slovenian Government office for development and European cohesion policy (SVRK) Technology Park Ljubljana	3Dhubs electronic knowledge base (e-portal) (https://www.3dhubs.com) Lombardy Intelligent Factory Association – AFIL Lakeside Science & Technology Park Carinthia (AUT) (https://www.lakeside-scitec.com/) Etc…

PBN	• 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics) • Ministry for National Economy • National Research, Development and Innovation Office • Chamber of Commerce and Industry Vas; Zala and Győr-Moson-Sopron Counties	Looking for relevant actors and stakeholders (SMEs, BSOs..) in the field and establish new cooperations with them
FB	• Provincial government • Industrial Association • Economic Chamber • DIH-Ost • Haus der Digitalisierung	• Digital Forum 2019 • Digital Austria platform, FFG • Industry 4.0 platform

Conclusion provided by Leader:

<1 page maximum>

6.3.2. Partners current links to DIHs

Crew members should list which already available connections they have in the selected thematic topic areas, and which connections will be established

Crew Member	Available connections	Connections that have to be established
CUAS	GPS (metal-based 3D-printing) Makerspace Carinthia Campus 02 Material Center Leoben (MCL)	DIH established during the project.
IMECH	• Lombardy Digital Innovation Hub • Lombardy Intelligent Factory Association – AFIL • Italian national intelligent factory cluster - CFI	-
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder)	Other regional DIH connections to be established…
PBN	• Good cooperation with the 2 further DIHs in Hungary (Dig-i-HUB and Budapest University Of Technology And Economics)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections might be established with DIHS outside Hungary as well
FB	DIH-OSt: https://dih-ost.at/ Haus der Digitaisierung: https://www.virtuell-haus.at/	Digital Makers Hub in St. Pölten and Digital Innovation Hub – West in Innsbruck

Conclusion provided by Leader:

<1 page maximum>

6.3.3. Other relevant stakeholders or projects

Crew members should list other stakeholders and synergic projects that could be connected to the crew: they should limit the list to only those actors and projects that could be really useful, and involved.

Crews should remember that the list of stakeholders should include Enterprises, Policy Makers Universities and RTD facilities.

Crew Member	Current stakeholders	Stakeholders that need to be involved
CUAS	Interreg IT AT – E-Edu4.0 – engineering education Talente Pipeline – technical education of first level and secondary level students by the use of fab lab infrastructure AMAViS2 – Additive manufacturing in agile virtual systems for engineering of products and production processes	Makerspace Carinthia
IMECH	• material replacement of a distributor through additive technologies	-
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) Jožef Stefan Institute Ljubljana (IJS) (TECOS as an important project partner in the Smart factories Strategic Innovation Partnership 'SRIP-ToP') Slovenian Government office for development and European cohesion policy (SVRK) Technology Park (TP) Ljubljana	Members of the TECOS Tool-and-die technology cluster (high-tech industrial companies, ranging from SMEs to LEs) (https://www.tecos.si/index.php/en/ membership/list-of-members) ADMA assessment - European commission (http://www.adma.ec/) (TECOS as pro-ject partner, TECOS as important regional stake-holder) LUI (Ljubljana University Incubator) ABC Hub Ljubljana (http://accelerationbusinesscity.com/) Faculty/University of Mechanical Enginee-ring (in Ljubljana and Maribor) Faculty/University of Electrical Enginee-ring (in Ljubljana and Maribor) (various other incubators, digital hubs and regional development agencies)
PBN	• Future Internet LivingLab Association (SME) • 3D Printing Zrt LTD (R&D Center) • iQor Global Services Hungary Kft. (Large enterprise) • BPW-Hungária Kft.(Large enterprise)	In Hungary there are three official DIHs (AM-LAB (this is PBN's spin-off company) ; Dig-i-HUB; Budapest University of Technology and Economics), we are in good cooperation with them, but further connections

	• Széchenyi University (Győr;) • BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS • PBN's currently running EU projects can be considered as synergic ones: • 4STEPS: Interreg Central Europe • https://www.interreg-central.eu/Content.Node/4STEPS.html • DIH2: Horizon 2020 • http://www.dih-squared.eu/ • CHAIN REACTIONS: (CE) • https://www.interreg-central.eu/Content.Node/CHAIN-REACTIONS.html • • Innopeer AVM: (CE): • https://www.interreg-central.eu/Content.Node/InnoPeerAVM.html Further relevant stakeholders (SMEs, Policy Makers, Universities, and RTD facilities) shall be addressed and be involved in the later phase of the project to discuss project implementation and results.	might be established with DIHS outside Hungary as well
FB	• FH Burgenland • Akademie Burgenland • Wirtschaft Burgenland • Initiative "Start Up Burgenland" • Energie Burgenland • Project "Smart Up", Interreg	• Haus der Digitalisierung • Project "Green energy lab - Open Data Platform", FFG. • Educational and training centers • Special Interest Groups • Relevant SMEs and LEs

Conclusion provided by Leader:

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6.3.4. Involvement of associated partners

Crew members shall list how they plan to involve associated partners.

Crew Member	Name of Associated Partner	What is the plan to involve the AP?
CUAS	KWF BABEG Build	Funding of projects Multiplier concerning DIH setup Multiplier concerning Start-up community or spin-offs
TECOS	Digital Innovation Hub (DIH) Slovenia (https://dihslovenia.si/en/home-english/) (TECOS as project partner, TECOS as key stake-holder) Technology Park (TP) Ljubljana	Multiplier concerning DIH setup Multiplier concerning Start-up community or spin-offs
PBN	IFKA Public Benefit Non Profit Ltd. for the Development of the Industry	• organize meetings (online, personal) • inform them regularly about project implementations discuss the future plans
FB	Regional Management Burgenland	We would like to involve the partner through an exchange of know-how and personal meetings. This should last for a longer period of time to be efficient. RMB will also be involved as a peer Reviewer.

Conclusion provided by Leader:

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