PID IN PRACTICE 2: POLICY IMPLEMENTATION RELEVANT TECH RADAR ON AUTOMATION AND ROBOTICS

D.T2.3.3 – PID in practise 2 – Policy Implementation relevant Tech Radar on Automation and Robotics

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Document Control

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PP	Restricted to other programme participants	
RE	Restricted to a group specified by the consortium	
CO	Confidential, only for members of the consortium	CO

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11.2021	2.00.00	PIA	Working draft updated, for review
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Executive Summary

Project Overview

CEUP 2030 aims to generate stable innovation networks which foster better understanding on **C**entral Europe **A**dvanced **M**anufacturing and **I**ndustry **4.0** ("**CAMI4.0**") topics, to generate improved knowledge resource exchange on these technologies leading to an upgraded framework for policy-making and implementation.

Ultimately CEUP 2030 creates and tests a common method to promote improved knowledge dissemination to policy-making stakeholders using a collaborative exchange framework based in physical and digital-methods. These methods and the technology use-cases disseminated within the project, are harvested from existing, high-quality innovation know-how in the CE area.

The project focuses on:

- Identifying the highest-quality innovation know-how in the CE Area, on the CAMI4.0 Topics.
- Enhancing skills capabilities and knowledge of people in charge of local, regional, and (trans)national RTI Policies, associated to the CAMI4.0 Topics.
- Creating a sustainable structure for awareness-raising and shared, sustainable RTI knowledge resource use to enhance policy decision support.
- Anticipating and fast-tracking policy / strategy policy pilot actions to promote a joint RIS3 for CAMI4.0 Excellence in CE/EU.

Work Package and Activity Overview

The overall objective of WPT2 links to the project's specific objective of ensuring awareness and shared sustainable responsibility on using research, technology and innovation knowledge resources in CE/EU for enhancing policy decision support.

The challenge manifests in two sub-objectives which are:

- To coordinate technology experts across the CE/EU regions for solution-oriented trend monitoring (the Trend and Innovation Networks)
- To streamline, process and manage the knowledge for improved policy decision making, in a practicable and sustainable manner (Policy Intelligence Dashboard).

The specific activity which is of relevance for this document is Activity A.T2.3, which is a common activity for all WPs and covers the development of the project's Policy Intelligence Dashboard, which should translate the Trend & Innovation Network knowledge into future robust policy and strategy building. It is designed to establish strong partnerships around the 4 main CAMI4.0 topics in order to raise awareness and ensure a shared sustainable responsibility on using RTI knowledge resources in CE/EU for enhancing policy decision support. The Trend Innovation Networks (TIN) will be equipped with practicable, efficient policy tools, available on Policy Intelligence Dashboard (PID). Both those instruments will be exploited by the partners to select and channel appropriate decision-relevant information out of the daily big data cloud, assess it and provide understandable knowledge in a compact and high-quality format.

Specifically, the practical activities which are supported in this document are:

- Establishing links to key good – practice tools which can power the policy intelligence dashboard;
- Explain the process for the key requirements of the Policy Intelligence Dashboard;

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- Establish the working processes to develop these key requirements into a wireframe/base operating framework;
- Establish the working processes to develop the tech radar and risk heat maps on technology trends;
- Develop a link to the use-cases the Partners will develop on policy-instruments.

Project-Relevant Reference Material & Reading Prerequisites

(1) **CE1662 CEUP 2030 Application Form** (Version 1, 07/2019): The application form regarding CEUP 2030 for Interreg Central Europe

(2) **Guidance on Harvesting Agenda** (D.T2.1.1; Version final, 04/2020): A guidance document for A.T2.1 on harvested methodologies for the Trend & Innovation Networks and Policy Intelligence Dashboard.

(3) **Harvesting Agenda on CAMI 4.0 for Trend & Innovation Networks and Policy Intelligence Dashboard** (D.T2.1.2; version 2.0, 11/2020): A report and selection grid for best-in-class use of identified outputs and results in WPT2

(4) **Policy Intelligence Dashboard (PID) Design & Elaborate Technology Radar to improve CE/EU (DT.2.3.1.; version 3.0, 04/2022): A manual to establish the IT-based Policy Intelligence Dashboard, with CAMI4.0 Tech Radars and Industry Risk Heat Maps on Technology Trends**

All documents can be found on the project's central repository - Alfresco

Scope of Document & Deliverable Summary

Deliverable D.T2.3.3 is defined in the Application Form as a Trend Radar and Risk Heat Map on Automation & Robotics developed under joint Policy Intelligence Dashboard for the four 4 CAMI4.0 topics. The PID in Practise for Automation and Robotics represents a Tech Radar (TR) including a Risk Heat Map where policy-relevant data sources (use cases, policy instruments, organisations and networks) are identified and classified with a goal to transfer and deliver relevant content for decision makers. The database of use cases collects 10 the most representative case studies collected within CEUP2030 project, as well as recommended and varied by PPs policy instruments dedicated to CAMI4.0 topics and descriptions of flagships originating from the project partnership. To deliver the tool that is functional and answers the expectations of the varied stakeholders groups a model of PID is to be tested with a balance group of stakeholders. DT2.3.3 presents the scope of the survey and delivers feedback received (test transfer to practice among target groups; feedback loops with regional/national stakeholders. The structure of Trend Radar and Risk Heat Map on Automation & Robotics is in line with manual which provides the guidance required to establish an IT-based Policy Intelligence Dashboard which evidences CAMI4.0 Technology Radars and Risk Heat Maps on Technology Trends (DT.2.3.1)

This document contains the summary of PID in Practise demonstration testing and insights and conclusions collected valuable for further development of PID. It represents the "Policy Intelligence Dashboard in Practice", which highlight technology trends for Automation & Robotics – one of the four CAMI4.0 topics. The Document provides background insight necessary to deliver the Dashboards along with implementation procedures and testing

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procedures. The purpose of the PID in practice 2: Policy implementation relevant Tech Radar on Automation & Robotics (T2.3.3) is to provide the Partners the information which is required to create the Policy Intelligence Dashboard for automation and robotic technology. which is a part of the key output of WPT2.

Output O.T2.2	CEUP 2030 Policy Intelligence Dashboard – Refocusing technology trend insights for policy makers	The Policy Intelligence Dashboard monitors, fine-tunes and streamlines policy relevant data on technology trends for a fast-track assessment based on a solid data gathering and evaluation (Tech Radars, A.T2.3). The PID will be tested in a common transnational manner, established and anchored in the activated stakeholder scheme (PLLs, TINs). The PID methodology sets the base for the joint policy exploitation with pilots as well as a future planning for 2021-2027 in T3 and beyond project´s end.	S.O.1.1 - Number of tools and services developed and/or implemented for strengthening linkages within the innovation systems	1,00	11.2021

Audience

This document is directed at all project partnership members, because all PPs are asked to participate in the development of the Policy Intelligence Dashboard and in testing its content.

Change Control Procedure & Structure

The Deliverable Responsible: Association Industry 4.0 Austria **(PP3)** created this document and it is hosted on the Project's common repository in the appropriately named deliverable folder. The document is under project deliverable change control protocols whereby Partners are requested to give feedback on the Draft Version within five working days. Feedback will be incorporated and Final Version will be issued by PIA. Thereafter the PPs have five additional working days for any final comments. At any time, partners believe a project methodology should change, the request should be brought to the Deliverable Responsible (PIA/PP3) and the Work Package Leader (AFIL/PP6) to consolidate feedback from other partners, and then further integrate and disseminate the final agreed changes. A new version of the document should be created, and recorded in the document's "Document History" table.

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Abbreviations

Abbreviation	Explanation
AF	Application Form
ASP	Associated Partner (i.e. Strategic Partner)
CAMI4.0	Central European Advance Manufacturing and Industry 4.0
PI	Policy Instrument
PIF	Policy Implementation Framework
PLL	Policy Learning Lab
PP	Project Partner
RIS3	Regional Innovation Strategy for Smart Specialisation
S3	Smart Specialisation Strategy
SBU	Strategy Boost & Upgrade
TGP	Technology Good Practice
TIN	Trend & Innovation Networks
TTTDM	TIN Transnational Technology Dialogue Meeting

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1. Key background information

1.1. AT2.3 activity within CEUP2030 project

Within WPT2 and between work packages, Activity T2.3 Establish PID to translate TINs work into future robust policy & strategy building is highly embedded within the other work of CEUP 2030. This is primarily because the PID is the partnership lasting model of how to deliver insight (beyond workshops) in an ongoing and sustainable way to key policy-making stakeholders (and also other stakeholders) who are interested in the four CAMI4.0 topics specifically or Industry 4.0 and Advanced Manufacturing in Central Europe, more generally.

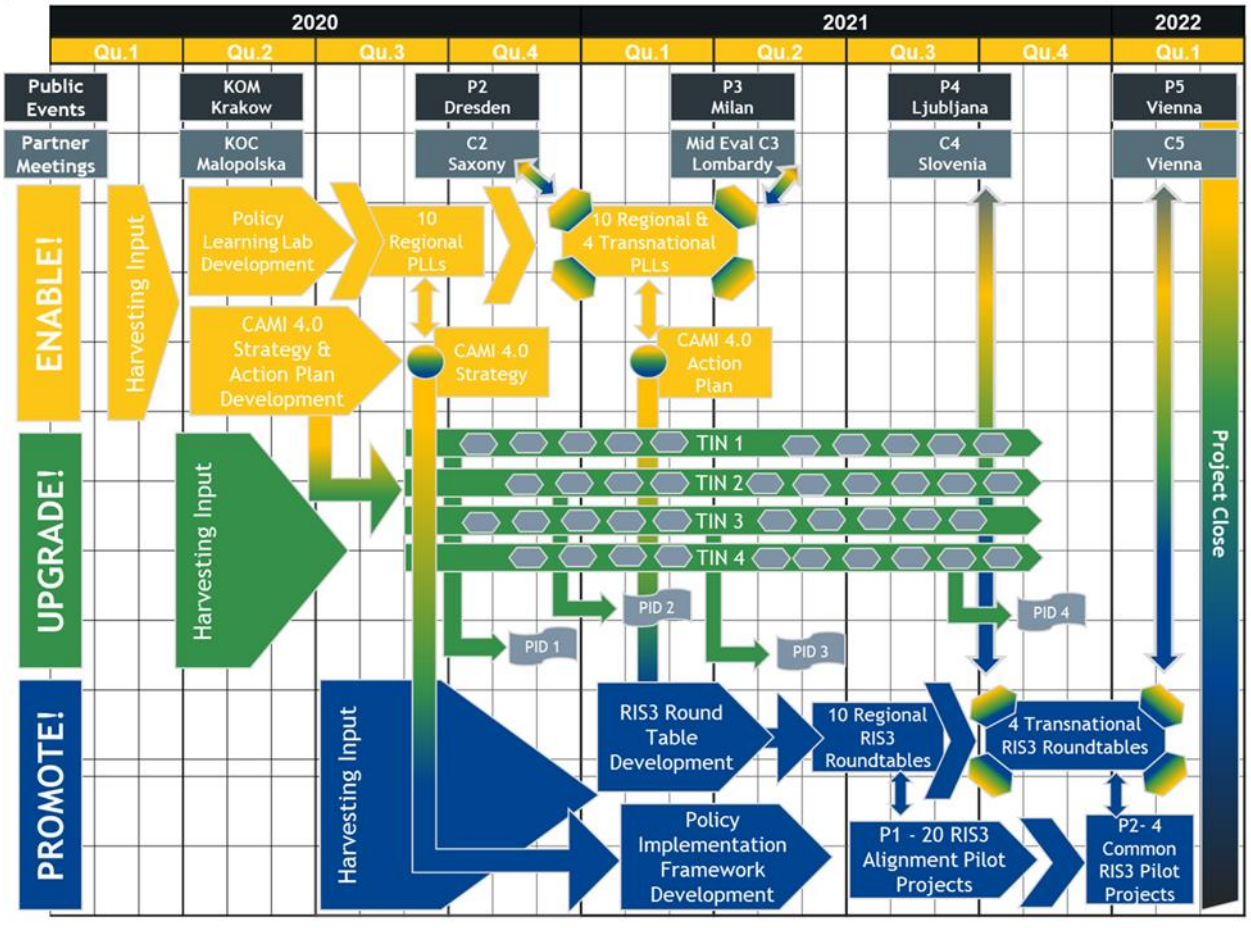

Figure 1 CEUP 2030 Plan on a Page (Source: Author Generated)

In particular, within AT2.3, four main activities have been performed:

- AT2.3.1 PID design & elaborate technology radars to improve CE/EU policy making (Responsible: PP1/KPT)
- AT2.3.2 PID in practice 1: Policy implementation relevant Tech Radar on B&RDP, Sensors (Responsible:PP10/HAMAG)
- **AT2.3.3 PID in practice 2: Policy implementation relevant Tech Radar on Automation and Robotic (Responsible:PP3/PIA)**

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- AT2.3.4 PID in practice 3: Policy implementation relevant Tech Radar on new materials (Responsible:PP8/PTP)

- AT2.3.5 PID in practice 4: Policy implementation relevant Tech Radar on Artificial Intelligence (Responsible:PP9/PBN)

1.2. AT2.2 - Connection to the Trend & Innovation Networks

The strongest connection exists between the PID and the Trend & Innovation Networks (TINs). This is because it is the insights, and input from the TIN Dialogue Sessions, which should be used to fill and validate the PID in Practice. The TINs are the "playground" where key foresight discussions should take place. These discussion points, technology foresight and development interpretations should be recorded within the PID in Practice. The TINs are directly connected to the Policy Learning Labs (AT1.2) and RIS3 Round Tables (AT3.2)

The PLLs and the RIS3 Roundtables (the consortia's workshop series with policy-influencing stakeholders, and the lasting policy-making stakeholder engagement forum), are key areas where the Partnership should gain insight on the PID in Practice key Target Group. It is via exchange and presentation of concepts within these forums that the Policy Intelligence Dashboard will gain its purpose & its relevance.

The Policy Intelligence Dashboard is connected to the Policy Implementation Framework (PIF) and the Strategy Implementation Blueprint (WPT1). The Partners should be working to align the information provided in the PID, particularly success stories, to those recommendations which are provided in the use-cases delivered in the final phase of the project. The insights provided in the PID should lead stakeholders reviewing the document, to a logical understanding about what is presented in the Policy Implementation Framework. For instance, by trying to capitalise on a specific good practice or by trying to align for specific support for an emerging technology area.

This also means that Partners should be using all conversations associated to the development of the draft use-cases for the Strategy Implementation Blueprint, to be considering what would be effective use cases to present in the Policy Intelligence Dashboard.

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2. Description and goal of the Policy Intelligence Dashboard

Policy Intelligent Dashboard is the most complete one-stop-shop for policy makers and policy influencing stakeholders as research technology organizations and enterprises operating around automation and robotic area. PID gathers in one place practical and streamlined knowledge and insight on technology trends and potential industry impact for the entire innovation eco-system. Automation and robotic area represents a Tech Radar including a Risk Heat Map, where policy-relevant data sources as use cases, financial instruments, flagships and organizations are presented with a goal to support, transfer and enrich policy decision making processes in the area of this technologies. The Automation & Robotics' Trend & Innovation Network (TIN) established under CEUP2030 project played a big role in creating the PID. Community of stakeholders representing different target groups established around automation and robotics discussed and shared trend and innovation foresights on the automation and robotics topic. This community built on the stakeholders involved in PLL in WPT1 and were enriched with key experts identified by each partner. In order to foster the discussion on trend and innovation foresight on the A&R topics, 10 TTTDM - TIN Tech Trend Dialogue meetings were organised by CEUP2030 partners involving the regional stakeholders identified in the community. Besides their regional configuration, TINs also had an interregional dimension thanks to action of PPs that guaranteed connections among the different network exploiting the synergies that emerged during TINs development. In particular, PPs contributed and fostered the identification and development of use-cases in each network that can be concretely implemented in flagship projects involving partners from different regions, either PPs or their stakeholders. In summary, 449 stakeholders from 7 countries were involved in expert workshops on Automation and Robotics. The workshops were held half online and half physically, and utilised plenary presentation, round-tables, and study visits to promote a co-creative atmosphere which allowed live discussion on the challenges and opportunities facing the central European manufacturing eco-system, providing an overview of the ecosystem on A&R at different levels (regional, national and European). providing insights on their progress and main challenges that need to be overcome, demonstrating what are the future trends and challenges, sharing best practices and showcasing initiatives to illustrate on the ongoing proposed solutions and experiments in the field of A&R. The A&R TTTDMs were also aimed at supporting the definition, development and submission of the A&R flagship projects, use cases and policy instruments. All these above mentioned feedback from stakeholders helped to create and developed the Policy Intelligence Dashboard. The PID is built around a core project principle, that policy-makers can directly benefit, and create onward benefits for the entire innovation eco-system, when they have practical and streamlined knowledge and insight on technology trends and potential industry impact.

The Partnership will, in total, create four "PID in Practice", one for each CAMI4.0. This document presents D.T2.3.3 PID in practice 2: Policy implementation relevant Tech Radar on Automation & Robotics /PP3/PIA, due in March 2022

PID Automation and robotics represents a Tech Radar (TR) including a Risk Heat Map (RHM), where policy-relevant data sources (use cases, organisations, actors, instruments) are identified and classified with a goal to transfer and interpret to policy-decisions. Key use

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cases should be presented in an easy- way enabling interactive enquire of knowledge and understanding of the key technologies and with contact details to hosting organisation.

3. Policy implementation relevant Tech Radar on Automation & Robotics

Policy implementation relevant Tech Radar on Automation & Robotics is located on the website http://ceup2030pid.eu/ and integrate knowledge and insight developed from dialogue occurring within the Partnership's workshop series includes the following elements for each CAMI4.0 topics :

- Introduction
- Analysis of theTech Radar
- Risk Heat Map
- Summary of the flagships
- Interesting use-cases
- Policy instruments
- Tools

This document D.T2.3.3 PID in practice 2: Policy implementation relevant Tech Radar on Automation & Robotics includes all above mentioned elements.

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3.1. Introduction

Automation and Robotics support the "Factory of the Future" and enable realising efficient, effective production processes ranging from nano scale processes over collaborative robotic systems to complex adaptive production systems.

The following subtopics were selected as most relevant for CEUP 2030:

- **Robotic and Assistive Systems**: Robotic and Assistive Systems focuses on systems, which are combining human and machine interaction, intelligence and processing power, human expertise, and machine power. The aim of industrial Assistance Systems is to support human beings in a volatile, richly varied and highly flexible production. The cognitive abilities of these assistance systems are constantly being improved.
- **Machine Vision – Zero Defect Manufacturing for Automation**: The goal of any kind of quality control is to avoid defective parts. Technologies related to achieving this goal are summarized under the strategic topic of "Zero Defect Manufacturing".
- **Augmented and virtual reality, visualization**: Visual Computing combines established and scientific methods for position determination, tracking technologies and machine learning to drive innovation. This includes systems with higher-value perception and assistance options, smart devices and tools and collaborating robots.
- **Simulation and Modelling, Flexible Production Systems**: Flexibility and interoperability are becoming – in addition to price and quality strategies – an increasingly important competitive factor. Today's shopfloors and factories consist of networked machine and software. They also involve employees, suppliers and customers. At the moment, the design and engineering of software for decentralised and distributed socio-technical production systems is often reaching its limits. In order to address those limits, infrastructure and algorithms for flexible production systems are needed. These need to assist people in making decisions which can't be reached with methods based on experience alone. Plant operators can, for example, by means of model-based methods test system configurations that are most promising for a particular product version or the current process status.
- **Robots for non-industrial applications, human-machine-collaboration**: Robots for non-industrial applications, such as agriculture or medical robots, have a high potential to transfer industrial solutions into other domains. In that regard, the aspect of safety and the collaboration between humans and machines (robots) is very important.

Automation and Robots is considered a key technology for Industry 4.0 - it is impossible to imagine modern production plants without multi-joint robotic arms, and there are around 3 million industrial robots in use worldwide.

European nations are heavy users of robots and automation in production facilities. For instance, 40% of all Austrian production companies with more than 20 employees already used robots in 2018 (European Manufacturing Survey 2018).

Therefore, Automation & Robotics can be seen as a very relevant topic. Within CEUP 2030, trends in the area have been analysed and discussed, innovative approaches and

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use cases have been shared and policy instruments for the further development of the topic have been identified by the project partners.

3.2 Analysis of the Tech Radar

The Tech Radar and Risk Heat Map for Automation and Robotics under CEUP 2030 Policy Intelligent Dashboard offer open access to policy-relevant data sources as use cases, policy instruments, organisations and networks, technology trends in the most convenient, practicable and efficient way. They present impact of emerging technology and applications of A&R, with the most easy-to digest and streamlined knowledge and insight on technology trends and potential industry impact, as well as a socio-economic impact assessment of current and expected technologies use in field of Automation and Robotics.

It reflects also individual vision of Project Partners with some suggestions for how the negative impacts can be minimised, and the positive impacts maximised.

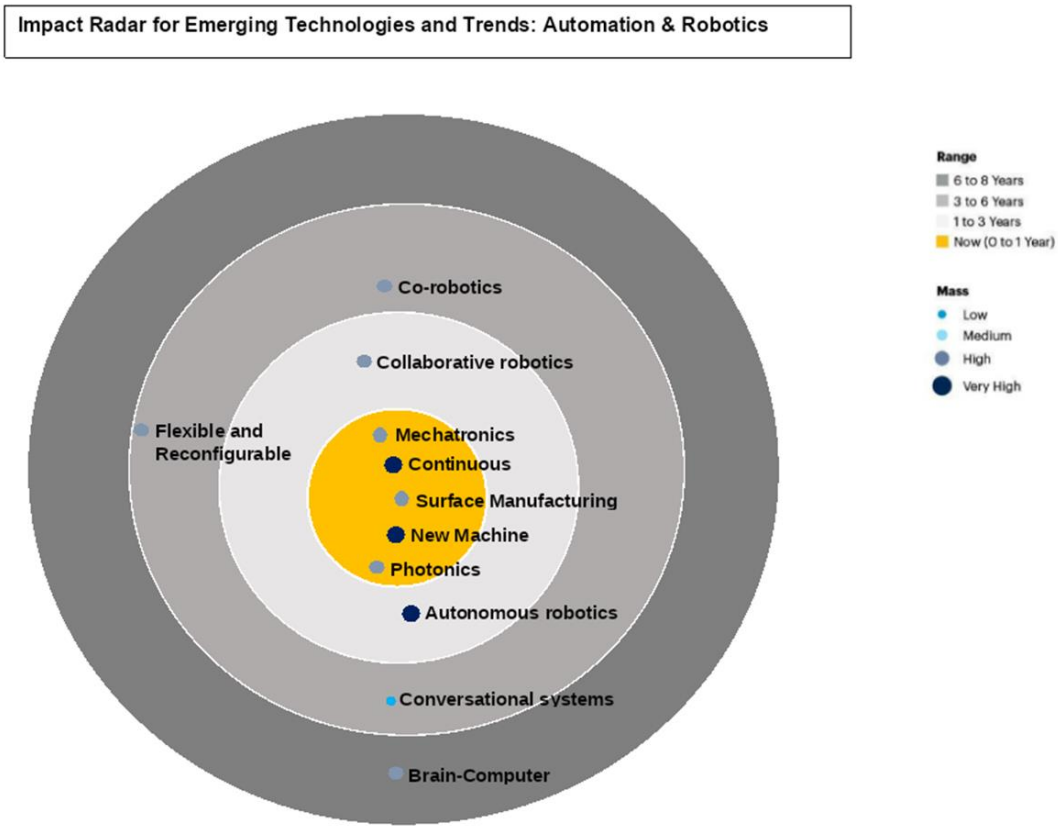

Figure 2: Tech Radar for emerging technologies and trends automation and robotics

Source: Gartner Top Strategic Technology Trends for 2022

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The Tech Radar (TR) is part of Policy Intelligent Dashboard developed by consortium of CEUP2030 project in order to generate and share practical and streamlined knowledge including reference use cases and insights on technology trends, policy instruments and potential industry impact in all four CAMI4.0 topics with policy influencing stakeholders and policy makers. The TR describes current and future technology developments or trends that will impact our everyday activities and businesses. This tool helps to understand the uses and impacts of four CAMI4.0 topics: Automation & Robotics, Intelligent Production Systems, Smart Materials and Artificial Intelligence.

There are several significant emerging trends in the world of industrial automation and robots that have a big impact on a wide variety of industrial sectors.

1) **Increasing ease of use, deployment and maintenance**

Automation and Robotic technology has undergone various technological advances in the recent years. The robots are commonly used for the automotive industry but for industries that are relatively new to automation, programming robots are still a challenge. The fourth industrial revolution "Industry 4.0" that was referred to as high technology strategy that aims to automate and computerize complete industry or complete environment at the highest technological level. Now within the fifth industrial revolution the challenge is how to harmonize human-machine collaboration and support those SMEs which are still in process of targeting Industry 4.0 revolution to support them in complete digital transformation. Referring to conclusions generated during Policy Learning Labs (D.T1.2.2 and DT1.2.3) and Technology Innovation Network activities (AT2.2.) more and more companies find that robots are within their affordability budgets. The challenge they have to overcome is ensuring complexity of programming and designing robotic systems as well as synchronization of the data. It also a question of highly skilled workforce to deploy, operate and maintain.

2) Human-Robot Collaboration

Collaborative robots are robots designed to work in direct human company. Equipped with a number of sensors and additional protective elements, they can work without fencing in the immediate vicinity of the operator. One of the advantages of such a robot is space saving and increased safety. For safety reasons, these robots operate at much lower speeds than conventional robots closed in fenced areas. An example of a collaborative robot is the Kawasaki Duaro equipped with two arms, which is used in applications requiring precision and the use of various tools - e.g. when assembling electronic systems that can be picked up by the operator directly from the robot for further processing or quality control. Close collaboration between humans and robots, working on assembly lines and in other applications, is already part of business operations.

3) New ways of working with robots

The next step in automation and robotics transformation is ensuring connectivity between human resources and robots that support them (and vice versa) and managing them from any device, anywhere with an Internet connection to simplify all stages of robot interaction (design, sales, installation, commissioning, operation, oversight, and service).

4) Improved ROI

Today's modern industrial robots offer relatively quick return on investment. They reduce injuries in the workplace, increase the competitiveness of companies in a fierce global market, elevate the quality of affordable products, increase profits, and create a whole new ecosystem of high-paying jobs. Based on a huge body of evidence, experience and common sense, it is clear that the companies that adopt robots realize huge financial benefits in longer run. Integrating robots increase productivity, reduce overhead, provide flexibility, reduce waste, and increase quality.

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5) Training the robot employees of the future

Industrial robots have created a whole new ecosystem of high paying and rewarding jobs. Designing, building, marketing, selling, installing, operating and maintaining robots creates jobs that didn't exist before robots. Robots allow companies to remain cost competitive even while maintaining production in a high cost country as opposed to moving operations to a low cost country. This preserves jobs in the high cost countries that would otherwise be entirely shifted to the low cost countries.

As companies seek to not just survive but to thrive in these disruptive times, many are looking to automated systems for their warehouses and distribution centers.

For many companies automation is a key part of their business strategies. The pandemic accelerated the business case for full-enterprise automation solutions and, consequently, robotics-based solutions are more and more in usage.

What's clear is that robotics isn't about replacing workers, it's about creating opportunities. Many developed countries are facing near and long-term labor shortage. In many cases, robotics can help fill that need allowing companies to continue to meet customer demand.

And rather than taking away jobs, robotic automation creates roles for workers in operation support and maintenance — higher paying, more rewarding jobs that can help companies attract and retain valued employees.

The future for robotics isn't binary (as in, either people or robotics), but a shared "cohabitation" ecosystem, where humans and robots interact in a shared space. Autonomous Mobile Robots (AMRs) provide an excellent example of this. AMRs have many applications, but one of the most obvious is transporting materials within a facility instead of conveyor or monorail. This provides greater flexibility and opens up valuable space. AMRs can safely coexist with dynamic features to navigate around people, equipment, and inventory. In this case, robotics become an extension of a successful work environment.

Tthe future with robotic applications, advancement in both productivity and safety depends on software, specifically developments in Machine Learning (ML) and Artificial Intelligence (AI). ML allows robotic systems to learn and adapt without following explicit instructions, but instead by using algorithms and statistical models to analyze and draw inferences from patterns in data. AI empowers robotics systems to improve by continuously fine-tuning operational processes.

Software is the key to the future flexibility, so it's vital for companies to have a partner – integrator who will be with them every step of the way — from design and implementation to operation and eventual upgrades.

3.3. Risk Heat Map

Within PLLs and TTTDM dedicated to CAMI4.0 Automation and Robotics, the consortium Project Partners have identified several risks and challenges:

- Managing large volumes of data

Managing large volumes of data can be difficult and time-consuming. The key to managing large volumes of data is data automation. The challenge which appear in the data automation is data quality and data accuracy.

- Ensuring and maintaining security and privacy

One of the challenges of adopting business process automation is keeping information and data flowing between departments inside organizations secure and maintaining a high level of information privacy without endangering the process being performed.

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- Lack of skilled labour

One of the most significant challenges in process automation is the ability to have trained people that can complete the automation project on time while retaining high-quality outcomes. A shortage of trained resources will jeopardize project delivery and indirectly impair quality, lowering employee satisfaction.

- Lack of budget to invest in automation

There are many challenges that make harder implementation of A&R, especially for SMEs originating from some CE regions. These companies have limited resources and make mistake when deciding at random to invest in automation without understanding whole process. Harmonization of the automation process requires the employment of specialists capable to design the complex digital transformation business model, engage appropriate software in order to provide the flexibility and adaptations required to complete the tasks. Furthermore, in-house personnel must be trained on how to use these technologies to get the most out of them.

- Lack of time for continuous improvement

Organizations are always striving to improve their business processes and reduce costs. One way that organizations can do this is by having continuous improvement meetings and audits. However, many companies struggle with the time it takes to conduct these meetings and audits resulting in little to no improvements being made.

- Integration and compatibility of legacy systems

To fully automate a process, you must be able to integrate with the various business line applications used by your firm to complete the process cycle. Older systems do not allow for integration, thus you will almost certainly end up with human intervention and negating the objective of your aim being attempted.

- Change management

Today's business world is constantly changing, and it takes an incredible amount of time for an organization to smoothly adapt to these changes. This is especially true when the company has a large number of employees, or when there are numerous departments with varying levels of influence. With this in mind, it can be difficult to keep up with all of the organizational changes happening around you

- Lack of Stakeholders' buy-in can badly affect the implementation

One of the most important challenges of business process automation is the lack of interest from stakeholders which can badly affect implementation. Without the buy-in of key stakeholders and employees, this process can be disrupted by a lack of understanding and resistance. to change.

- Cost and time for implementation
- Complexity of standardization and synchronization process

Business processes are the foundation of any business. Without them, it would be difficult to run a company. However, despite the importance of these processes, they often take up a significant amount of time and energy for organizations.

Future of robotics.

Trends 2022

Collaborative robotics. The change can be seen in factories: the demand for mobile robotics to work autonomously in warehouses, sharing space with operators, has multiplied exponentially.

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Ease of use. Good news for end users. Simplifying the implementation of industrial robotics is another clear trend for 2022, although for Robotnik, this aspect has always been a priority. Software and hardware architecture work towards intuitive and simple configuration, installation and interface.

Artificial Intelligence, 5G, IoT. The maturation of these 3 technologies, among others, allows the development of more intelligent robots that perform more precise tasks.

Interoperability. The communication of different robots with each other -fleets of robots- and with other external systems, increases safety and productivity.

New industries are rapidly adapting to automation through robotic systems. What will robots do in the future? Fundamentally, they will adapt to the needs of users. There is a new post-pandemic consumer behaviour and therefore companies are addressing new ways of responding.

3.4 Summary of the flagships

An integral part of the CEUP 2030 project is the development of so-called Flagships. Flagships are projects that the CEUP 2030 project partners have designed throughout the project. Ideally, the Flagships will soon be implemented – provided the necessary funding for most of the projects materializes.

On the topic of Automation & Robotics, 5 Flagships have been provided by the project partners. Therefore, 20% of all CEUP 2030 Flagships are in Automation & Robotics.

In the following paragraphs the 4 Flagships are further described. The projects are highly diverse. However, all of them plan to use robots for solving societal challenges and for improving the project partner's regional economies within a bigger European ecosystem.

Underwater robots cleaning the Croation ocean

HAMAG is the Croatian Agency for SMEs and Investments. HAMAG's Flagship within the CEUP project combines technology with the need to support the environment:

The North Adriatic coast, especially the Istria region, is frequently polluted by jelly fish. Further south, on the island of Krk there is pipe gas plant and the port of Rijeka, the biggest port in the Adriatic. In the central Adriatic, in Šibenik area, there used to be heavy industry which polluted the soil with heavy metals, which are still present in the soil and affecting the local ecosystem. Industrial pollution affects the whole eco chain in the Adriatic region and undermines the prospects of eco agriculture, tourism, and fishery

One of the ways to tackle that issue is through the deployment of underwater robots which clean the seafloor and monitor the level of pollution. The robots can also measure relevant parameters important for marine research which is conducted in the research stations on both sides of the Adriatic. The underwater robots could be deployed in tourism-heavy areas, providing continuous remote access to water quality, sea state, beach, harbour, and waterway data.

The key goal is to develop and implement a marine robotic system consisting of a modular autonomous catamaran coupled with an ROV (remotely operated underwater vehicle) on the three Adriatic nodes: north mid and south in both sides of the Adriatic – Croatian and Italian.

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A Polish European Digital Innovation Hub focusing on Robotics

The Krakow Technology Park (KPT) is a physical hotspot for technology in Poland. KPT's Flagship within the CEUP 2030 project builds on this strength.

The hub4industry (h4i) project is focusing on manufacturing SMEs from southern Poland. It's built around the KPT ecosystem. The network of KPT encompasses more than 230 manufacturing clients, about 120 IT tenants and 80+ graduates of Industry 4.0 acceleration programs.

The proposed Digital Innovation Hub focuses on various technologies connected to the term "4.0". A special focus of the proposed project lies in robotics and communication (including 5G). Furthermore, thanks to a broad network of partners, h4i offers also support in implementing AR/VR, AI, IoT, cybersecurity solutions, and various software solutions to manufacturing. The hub should provide companies in the region with skills and trainings as well as "Demonstration and Test Before Invest" services.

For the digital maturity assessment of companies, the ADMA methodology is applied relying on a proven track record in Poland: In last four years KPT has supported 80+ pilot projects of innovative solutions to be tested in real life facilities of 15+ corporate industrial partners.

The key goals of the Flagship are:

- Provide companies with skills, capacities and resources to implement innovative robotization technologies in their factories
- Increase the level of expertise and competences of the companies
- Increase the level of innovativeness of the Polish manufacturing sector
- Increase the amounts allocated for innovativeness in the manufacturing sector

Connecting industrial testbeds in Austria and the Czech Republic

The Platform Industry 4.0 Austria (PIA) has built an extensive network of companies and academic institutions on manufacturing. Different organizations often lack certain machinery to test innovative applications, with their Flagship PIA wants to change that.

In PIA's experience, even today the concepts of Industry 4.0 are still only vaguely understood, and each company may understand something different by it. PIA therefore believes it is necessary to create a solid framework that standardizes the view of Industrie 4.0 and thus leads to a more concrete understanding of Industrie 4.0 among the general public.

The leading players in Industrie 4.0 are currently in many cases universities and specialized departments of top companies. At academic institutions, so-called testbeds (in Austria called pilot factories) have emerged in recent years, which have both in-depth expertise and modern infrastructures.

The aim of the Testbed Exchange project is to survey these testbeds and to create a sustainable network in which intensive communication, mutual learning and exchange of experience takes place.

One goal of the proposed Flagship project is to create and implement a strategic plan to identify key areas of interest and plan concrete collaborations among the cooperating pilot

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factories. The second goal concerns the transfer and publication of expertise. This will be done through seminars. The seminars are designed for cooperating testbeds, SMEs, students and partner universities, as well as the general public.

Human-centered robotics on Austrian factory floors

PROFACTOR (PRO) is a highly specialized Austrian research institution focusing on robotics. Therefore, PRO's proposed Flagship project has a strong focus in this area as well.

The era of mass customization demands small lot size production from the manufacturing sector. Also, Europe is experiencing a demographic change with growing concern over the retiring workforce and a subsequent skill drain.

To keep up the high quality of produced goods and the need of optimized assistance for the workers in the factory, flexible assistance systems are being developed. The goal of those systems is to assist users at the factory floor both physically (e.g., using robots) and cognitively (e.g., through an intelligent guidance system).

However, dealing with the factory floors involves multiple working stations and users. Therefore, such solutions could tackle multiple users and varying production workflows (needed for mass customization) which could involve multiple robots. Such assistance systems could also be re-configurable (to accommodate production changes) according to the situation in the factory floor and cater to users accordingly.

The proposed Flagship project called "CoRTeam" aims at implementing a reconfigurable framework to deploy and configure multiple collaborative teams of workers, robots and machines in manufacturing processes. This should be achieved by a human-centered approach, studying behaviors and practices at work, informing a digital simulation environment that can optimally and dynamically allocate roles of agents (humans, robots) and initiate the required collaboration to improve the overall productivity at the factory floor level. The project should promote a humanistic perspective to robotization (introduction of robots to carry out industrial tasks).

In order to reach its goals, the project should focus on safety holistically.

3.5 Interesting use-cases

Fortunately, Central Europe is full of interesting companies and projects in the area of automation and robotics. The CEUP 2030 project partners have provided examples for use cases in order to showcase the diversity of solutions and activities in the field:

Augmented Reality (AR) in advanced manufacturing in Lombardy

As a leader for industrial imaging, Canon has developed a system to capture 3D content with the goal of simplifying the entire stereoscopic acquisition process by enabling users to develop immersive content for virtual reality solutions. This, integrated with AR, could allow to work hands-free, without having supporting paper documents and communications,

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strongly increasing task efficiency and effectiveness. TeamViewer is working in this direction as well, using smart glasses to control, manage and repair machines and components.

This solution has been implemented in different applications: in the automotive sector for manual assembly, in logistics activities for sorting envelopes and packages and for the training of workers for the assembly of luxury watches.

Industrial robots for the production of toys in Hungary

Two Hungarian companies, one in the field of robotics (Robo-Tech Service), the other one in the field of toy production (Artrade Ltd.), are participating in a common research project.

Artrade Ltd. is an internationally leading designer, developer, and producer of toys dominantly made of injection molded plastic components. Robo-Tech Service Ltd. offers maintenance services as main activates and can deliver turn key solutions on automation system design and simulation, programming, preventive maintenance, status monitoring, life cycle assessment, testing and diagnostics, refurbishment and reconditioning services.

Together, the partners are planning a research project.

Increasing the potential of industrial robotics through safe and fenceless robots

Today, most industrial robots are operating within a cage or behind a fence to avoid human injury and to keep the shopfloor safe. However, operating robots this way leads to limitations in their application. The Austrian company Blue Danube Robotics aims to change that with AIRSKIN. AIRSKIN is a soft pressure sensitive safety skin for industrial robots and tools. It consists of individual pads whose deformation (e.g., when humans are in the way of the robot) causes the rise of internal air pressure issuing a safe stop of the robot. The product turns an industrial robot into a fenceless robot, combining the advantages of an industrial robot with the advantages of fenceless collaborative applications.

AIRSKIN is a certified product (CE mark) fulfilling modern security standards, has won several awards and works with different manufacturers of robots.

Bin picking in the Automotive Industry

"Bin picking", the handling of misshapen and unsorted presented parts, is a challenge for automation. The iRob Feeder®, jointly developed by PROFACTOR and IH Tech, can detect different workpieces in different positions, grab them and position them for further processing. The partners have implemented several robotic handling systems in the automotive industry.

The 3D algorithms used to play out their strengths very well, especially in the case of crankshafts. Robotic handling has also been integrated into the XRob software platform - the corresponding technology module is called XRobFeeder.

Industrial robots for the production of saunas

In Slovenia, a research project called “Agile Robotic assembly for Smart Sauna Factory“ has been proposed.

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The goal of the project is to automate a robotic handling and assembly process and upgrade robotic systems for the FIWARE platform to achieve agile robotic manufacturing. The proposed solution consists of two robots with a tool changer, a single-axis robot positioner with two working stations, multiple containers for input material, material tracking systems and a machine vision system for intermediate and final quality control of the products (sandwich walls / panels).

Operating robots and autonomous navigation

Romb technologies is a is Croatian high-tech SME focusing on robotics and autonomous navigation. The company is specialized in designing autonomous navigation modules to power the next generation of load transportation vehicles.

The modules are written in ISO-standard C++11 and are available as precompiled libraries on a variety of platforms. The Romb technologies provide Robot Operating System (ROS) wrappers for seamless integration into existing ROS-based systems.

Their products include: forklift conversions, navigation software development, autonomous mobility for intelligent greenhouses, Soft4AVG.

3.6.Policy instruments (PIs) which might influence the development of the flagships

One of CEUP 2030's main goals is to exchange information and good practice examples regarding policy instruments that are being used and deployed in Central Europe. The CEUP 2030 project partners have provided examples for policy instruments that have the potential to influence the development of the CEUP 2030 Flagship projects.

Italian policy instruments for the development of robotics & automation

The regional policy instrument in Lombardy called **"Manifestazione di interesse Regione Lombardia e Uniocamere"** supports projects aimed at:

- enhancing and consolidating the productive chains, services and industrial, productive, and economic ecosystems existing in Lombardy
- identify new supply chains and new ecosystems emerging in the region
- stimulating business combinations and synergies by encouraging the exchange of skills and the achievement of common objectives for consolidation and development of industrial ecosystems and supply chains
- innovating and improving the quality of the production process of the supply chain and increase the competitiveness and attractiveness of industrial, productive, and economic sectors and ecosystems on national and international markets.

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A Croatian policy instrument in the realm of robotics & automation

The Croatian policy instrument "**Commercialization of Innovation**" will be launched in April 2022 by the Ministry of Economy and Sustainable Development through the National Recovery and Resilience Program 2021-2026.

The Call will encourage the investments necessary for the commercialization of innovation and research and development results. Innovative projects with the highest probability of commercial success will be encouraged, which will start business activities and production based on the applied solutions. The results of the project are market-ready innovations.

Available amount of funds: 380,000,000.00 HRK i.e. 50 million Euros.

German funding opportunities regarding robotics & automation

Funding opportunities by the German Ministry of Education and Research (BMBF) include among others:

- the "Microelectronics Framework Programme Germany"
- the establishment of the "Federal Agency for Disruptive Innovation (SPRIND)" which creates spaces for innovators, where they can take risks and think radically different
- the possibility for strategic international collaboration which is fostered by specific bilateral calls (2+2 Projects) and via dedicated ERA-Net programs

Shaping the digital transformation in a just and employee friendly way

With its "Digitisation Fund Work 4.0", the Austrian chamber of labour (AK) puts people at the centre of digitisation. The fund supports projects that illuminate digitalisation from the perspective of employees and shape it in their interests. The Digitisation Fund is part of the AK's "Future Programme 2019 – 2023", 150 million euros are spent to make Austria's working world fit for the future. For the year 2022, AK Vienna provides 4 million euros in two funding rounds as part of the funding scheme. The funding is used to support projects to shape digitalisation from the perspective of employees.

Projects that want to receive funding need to focus on one of five leverage points:

- Knowledge and awareness
- Technology development
- Regulation
- Experimenting
- Science

The next Digitisation Fund funding round will take place in autumn 2022.

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4. Conclusions & Next Steps

Deliverable D.T2.3.3 is defined in the AF as a Trend Radar and Risk Heat Map on Automation & Robotics developed under joint Policy Intelligence Dashboard for the four 4 CAMI4.0 topics.

The structure of Trend Radar and Risk Heat Map on Automation & Robotics is in line with manual (DT.2.3.1) that provides the guidance required to establish an IT-based Policy Intelligence Dashboard to evidence CAMI4.0 Technology Radars and Risk Heat Maps on Technology Trends. To deliver the tool that is functional and answers the expectations of the varied stakeholders groups a model of PID was tested with a balance group of stakeholders. Testing as a critical part of the PID in Practice exercise covered 40 surveys cross the full partnership, with each Partner facilitating a minimum of 4 stakeholders to review the PID in Practices.

The tests were addressed to the community built within CEUP2030: those organisations who were attending the PLL and RIS3 Round Table and also new actors from business, RTO and RTD. The Project Partners gained insight from 4 stakeholders for each PID in Practice.

These experts provided feedback on the process of gathering content for input into the PID in Practice concerning on the functionality, usability and quality of content.

To ensure simplicity and effectiveness of the PID in Practise validation process, test survey will be organised using Microsoft Forms.

The summary of PID in Practise demonstration testing, insights and conclusions collected valuable for further development of PID will be attached as Annnex to the deliverable _D.T2.4.2- Interim Evaluation& Impact Assessment Report on TIN and PID in CE/EU policy context

5. Call to Action

The model, associated to each CAMI4.0 topic, which the PPs delivered for the PID have been tested with a balanced group of stakeholders and the recommendation and insights collected should be analyzed, verified and implemented if relevant. The scope of modification of PID content will be agreed by relevant Deliverable Responsible Projects Partners and Lead Partner.

6. Next steps

KPT and PBN will integrate the recoommended list of improvments on PID in brochure and PID website platform.

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