



Technical Report - M9

D1.11

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Abbreviations and Acronyms:	
6P	Product, Process, Platform, People, Partnership and Performance
AI	Artificial Intelligence
AI REDGIO 5.0	Regions and (E)DIHs alliance for AI-at-the-Edge adoption by European Industry 5.0 Manufacturing SMEs
AV	Action Variables
EAI	Ethical Advisory Board
ECOGRAI	Enterprise Conception Graphs with Results and Actions Inter-related
EDIH	European Digital Innovation Hubs
EU	European Union
DIH	Digital Innovation Hub
DT	Digital Transformation
GA	Grant Agreement
HEP	Horizon Europe Program
KPI	Key Performance Indicators
SMEs	Small and Medium Enterprises
I4MS	ICT Innovation For Manufacturing SMEs
PC	Project Coordinator
TERESA	TEchnical and REgulatory SAndbox
V&V	Validation&Verification
WP	Work Package
WPL	Work Package Leader

Executive summary

This document provides an overview of the work progress achieved in the AI REDGIO 5.0 Project in the period (M1-M9) and an outlook on the activities of the next 6 months.

Launched on 1st of January 2022, AI REDGIO 5.0 project is run by a consortium of 34 partners, 3 associated partners from UK, 6 affiliated companies and is expected to be completed within 36 months. The project is co-financed by the European Union through the Horizon Europe (HORIZON) Program, Topic HORIZON-CL4-2022-TWIN-TRANSITION-01-06.

The Technical Report (deliverable D1.11) is released at month 9 to update the European Commission in view of Technical Review and to take stock of progress achieved. The report focuses on scientific technical development work and project management in the first 9 months.

Released by the project coordinator with significant contributions provided by all partners (especially Task and WP leaders), the Technical Report is a description of work carried out per WP and gives an overview of the project results towards the objective including summary of deliverables and milestones.

The report lists the specific objectives for the project as described in section 1.1 of the DoA and described the work carried out during the reporting period towards the achievement of each listed objective providing the value reached by M9 of the quantifiable indicators (KPIs) versus the corresponding M18 and M36 target for each Work Package and each Task.

The tables of the submitted Deliverables, reached Milestones and lists summarising meetings and dissemination are listed.

The report also tackles the use of resources (effort) to highlight any deviations from the plan contained in the Grant Agreement Annex I, related to person-months per Work Package.

The first 9 months of the project have seen the kick off of all the Work Packages and the structuring of the main work environments, management structures and administrative templates.

Through these months, the consortium partners have made progress towards all the project objectives. In the reporting period there has been two milestones, the first one has successfully been reached according to the expected date while the second milestone was slightly delayed. All the respective deliverables have all been produced.

Considering the warning threshold of $\pm 20\%$ actual vs. planned PMs and considering the effort consumption from the beginning of the project, the situation for the project is in line with the planned.

1. Introduction

1.1. Purpose and scope

Being part of the WP1, this deliverable D1.11 aims at granting a successful completion and delivery of results expected at M9 in a two-fold way:

- By managing the project's technical progress and execution in the reference period (M1- M9), so the risk of delay or missing work is avoided.
- By coordinating the progress of the project work-plan and administrative execution with respect to the project defined objectives and risk assessment.

For its purpose, the principal audiences targeted by this document are consortium partners and European Commission.

1.2. Relation to other project WPs and Tasks

This report aims at providing information about project management during the reference period, and for this reason, it is deeply related with all the other WPs and Tasks of the project. Figure below provides an overview of the relationship between the WPs in the AI REDGIO 5.0 project.

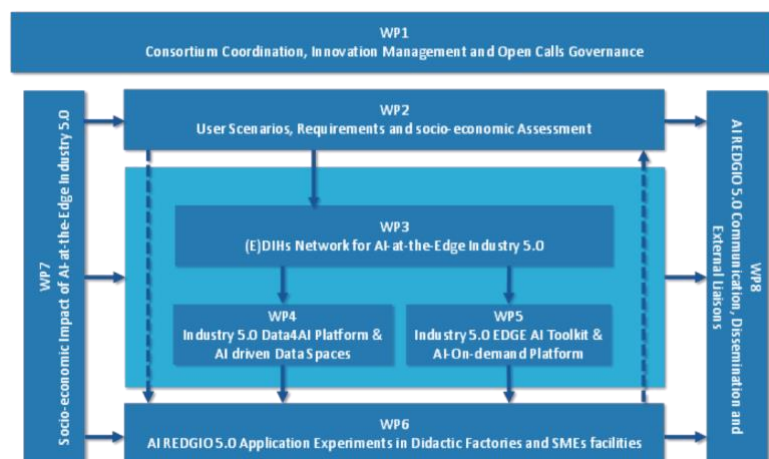


Figure 1: AI REDGIO 5.0 WPs Interdependence

First, as it represents an overview of the activities which are carrying by partners, it is based on input information about the current status from all the WPs. Furthermore, by providing an overview of all the activities it supports the other WPs in being aligned and coherent.

1.3. Structure of the document

This document comprises the following chapters:

Chapter 2 provides an overview of the project objectives of the period.

Chapter 3 provides an overview of the progress toward the objectives made in the reference period and activities, results and resources used for each Work Package (WP) within the reference period. The activities in each Work Package are reported with reference to the specific tasks in which they are structured.

Chapters 4-5-6 provide information on the current status of Project Management activities, i.e., eventual updates to the management plan, as well as an overview of the use of resources in the reference period timespan.

2. Project objectives

The AI REDGIO 5.0 project started the 1st of January 2023, has a duration of 3 years and a European financing of around 7.5 million. The consortium includes **43 partners from 18 Countries**. They also belong to **15 Vanguard Regions** (Efficient Sustainable Manufacturing and AI Pilot).

- **22 Regional Representatives** to mobilise regional and local resources towards Industry 5.0 and the adoption of AI-at-the-edge technologies by Manufacturing SMEs.
- **13 Technology Providers** providing the technologies to conduct experiments, and also providing deep knowledge about business models, legal and ethical issues
- **7 Industrial Cases SMEs** adopting AI-at-the-edge technologies for the development of Industry 5.0 main aims and Manufacturing Industry Twin Transition.

AI REDGIO 5.0 aims at renovating and extending the AI REGIO alliance between Vanguard EU regions and DIHs for a competitive AI-at-the-Edge Digital Transformation of Industry 5.0 Manufacturing SMEs.

1. The project will Enhance and combine existing reference models towards an architecture for end to end industry 5.0. The objective is to develop a secure computation continuum between edge and cloud and to implement Data Pipelines for Data Quality and Industry 5.0 and Data Spaces at different levels with standard Data Models and Ontologies. Then, the project will develop, validate and use a multi-disciplinary methodology which follows a structured Digital Transformation approach towards AI adoption in manufacturing 5.0 scenarios.
2. The project will develop an Industrial 5.0 **Data Space** (connected to existing manufacturing data spaces) with specific focus on sustainability and resilience aspects as well as Human-AI interaction (Collaborative Intelligence).
3. The projects will Develop an **Interoperability Framework** between regional DIHs resources and the AI-on- demand platform and contribute to the creation of a Manufacturing Industry vertical in the AI4Europe portal and experimentation platform.
4. The project will manage the transition from regional Dihs to a network of EDihs. An EDIH hubs will support SMEs in building, deploying and fully leveraging novel edge AI systems for manufacturing use cases, through access to tools, provision of training and consulting services, as well as focused AI integration services.
5. The AI REGIO Network of **Didactic Factories** will be extended especially in Eastern EU Countries and Regions,
6. The project liaises with existing platforms, projects and communities to develop a strong and vibrant ecosystem of relevant stakeholders around AI driven Industry 5.0.

In order to show and exploit the benefits of applying Artificial Intelligence in Manufacturing, three types of experiments will be conducted.

1. **(TERESA) experiments in the Didactic Factories** of 14 Regions. **Didactic Factories (DF)** offer **training and education** and perform test activities and experimentations, creating awareness and disseminating beneficial effects of the application of innovative digital technologies (i.e. Artificial Intelligence) in manufacturing applications. In the project, the Didactic Factory experiments will focus on **TEchnology and REgulatory SAndboxes (TERESA)**. A selection of innovative AI applications/tools/services for human-machine interaction will be tested/experimented on a limited scale and in a secure and controlled way, according to the “test before invest” paradigm (**technical sandbox**).

2. SME-driven experiments in selected 7 Regions to demonstrate the development and implementation of an **AI-based solution in a real industrial environment**. The beneficial impact of the use of AI will be evaluated through the monitoring of specific Key Performance Indicators (KPIs)
3. **20 additional SMEs-driven experiments** as outcome of the 1.2M two waves of **Open Calls**, with a 60k each funding

The AI REDGIO 5.0 work plan covers the project's research and technological activities as well as general project activities. The work plan is broken down in eight Work Packages. All administrative and management work is concentrated in WP1.

WP1 Consortium Coordination, Innovation Management includes well experimented procedures and tools for consortium coordination and risk management. Moreover, special attention is given to innovation management and organisation of two waves of Open Calls. Finally, being the focus on AI technologies, a specific task is devoted to ethics assessment and governance.

WP2 Needs, requirements, evaluation for AI-driven Industry 5.0 is intended to collect scenarios and requirements from the **14** Didactic Factories and **7** SMEs experiments, in order to better specify the AI REDGIO 5.0 tools and solutions (WP3-4-5). WP2 will last for the whole duration of the project, ready to receive feedback from the technical and experimentation tasks in order to better tune expectations and performance indicators.

WP3 (E)DIHs Network for AI-at-the-Edge Industry 5.0 is the conceptual and methodological WP aiming at implementing Industry 5.0 pillars (human centricity, resilience, sustainability) in Manufacturing SMEs thanks to the adoption of AI-at-the-edge solutions.

WP4 Industry 5.0 Data4AI Platform & Data Spaces implements the data viewpoint to the architecture. Data security in the edge-to-cloud continuum will be guaranteed by a state-of-the-art open source edge computing framework which will feed an Industrial Data Space. WP4 finally will integrate the AI REDGIO 5.0 Data solutions and be available to support SMEs selected through the Open Call mechanism.

WP5 Industry 5.0 EDGE AI Toolkit & AI-On-demand Platform (SUITE5) implements the software- service viewpoint to the architecture. On the one side, open hardware tools and solutions will enable the deployment of advanced AI solutions at the edge, on the other side interoperability with the AI-on-demand Platform will be implemented via flexible AI pipelines. Finally, Human-AI interaction patterns will be implemented and simulated to materialise the Industry 5.0 principles. WP5 finally will integrate the AI REDGIO 5.0 Hw/Sw solutions and be available to support SMEs selected through the Open Call mechanism.

WP6 AI REDGIO 5.0 Application Experiments (ARTER) is the experimentation and validation Work Package. Three types of experiments will be conducted: TEchnology and REgulatory SAndboxes TERESA experiments in the Didactic Factories of **14 Regions**; SMEs driven experiments in selected **7 Regions** by project's partners; 20 additional SMEs driven experiments as outcome of the two waves of Open Calls. All of them are super- visioned and coordinated by a common methodology and by a shared framework for defining and measuring KPIs.

WP7 Socio-economic Impact of AI-at-the-Edge Industry 5.0 (ENG) includes all the project activities to maximise its impact in the technology, economic and social landscapes. Beyond the exploitation preparation and the business launch activities, WP7 is also focussing on Standardisation preparation, Skills Development actions and analysis of legal, regulatory and ethical issues in the AI experiments.



WP8 AI REDGIO 5.0 Communication, Dissemination and Liaisons focusses on awareness creation and specifically addresses manufacturing SMEs, their Innovation Hubs and tailored specific skills developments programs. A specific task is devoted to International cooperation.

The workplan is developed along 36 months in two main iterations: the former concluded at M18 (and completely reported at M21) and the latter lasting for the last 18 months and reported at M36. The project schedule is given in the chart below. The end of month M9 is indicated according to the Milestone M2.

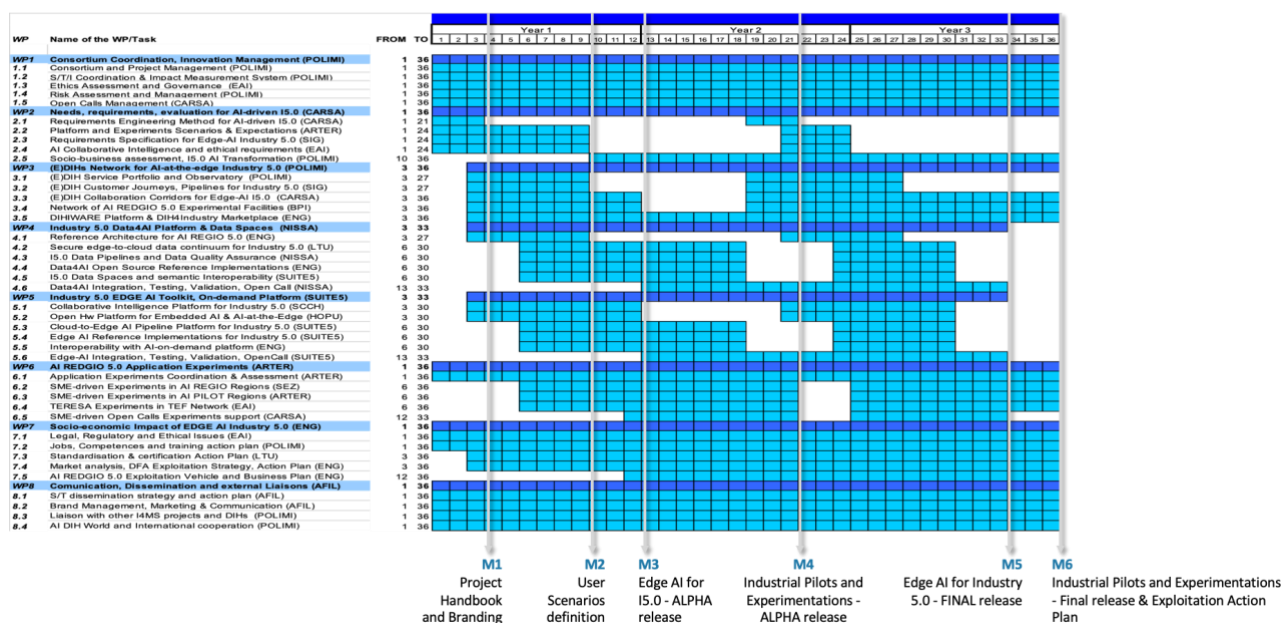


Figure 2: AI REDGIO 5.0 Workplan

According to the Annex 1, Description of Work, the main objectives for the project in this first reporting period (M1-M9) are:

- Kick-Off the project activities and coordinate the progress of the programme work plan and administrative execution with respect to the programme defined objectives and risk / ethical assessment outcomes granting a successful and timely completion and delivery of results (T1.1)
- Define a set of Scientific/Technical-Business-Innovation and SSH KPIs and start to regularly assess the socio-economic impact of the project supporting the innovation process from the perspective of exploitation (T1.2)
- Identify potential managerial problems before they occur and plan Risk mitigation activities (T1.3)
- Define the data management activities and planned associated actions, the Ethical Policy and start to monitor, assess and govern the project innovation results and their socio-economic-ethical impact (T1.4)
- Start to organize, coordinate and manage the first wave of Open Calls (T1.5)
- Develop the requirements engineering methods and tools to be used along the whole lifetime of the project (T2.1)
- Elicit needs / scenarios from DF and SME experiments and specify user requirements for the solutions in WP3-4-5 and formalise them, including Human-AI interaction patterns and express ethical requirements (T2.2, T2.3, T2.4).
- Conduct a D BEST service portfolio analysis with the ecosystem of (E)DIHs (T3.1).

- Start to define I5.0 inspired methods and tools for Service Portfolio analysis and Customer Journeys CJs as well as collaboration corridors among (E)DIHs to fill the service offering gaps evidenced by CJs (T3.2 and T3.3)
- Start to materialise a network of AI-at-the-edge Experimental Facilities where to perform experiments in WP6 (T3.4)
- Start to extend and integrate the existing DIHIWARE platform for Industry 5.0 (E)DIH networks (T5.4).
- Collect requirements, define design principles and create reference architecture for Industry 5.0 Data4AI Platform (T4.1).
- Start the development of a secure computation continuum between edge and cloud, to implement Data Pipelines for Data Quality and Industry 5.0 and Data Spaces at different levels with standard Data Models and Ontologies (T4.2, T4.3, T4.5)
- Start the implementation of the Reference Architecture via Open Source reference implementations (T4.4)
- Develop a collaborative intelligence platform through which humans and AI will be enabled to seamlessly collaborate and continuously enhance their skills and abilities (T5.1)
- Start to provide compatible hardware solutions to be installed on the edge to support different AI paradigms (T5.2)
- Start to define AI pipelines that are to be designed in the cloud and deployed and executed exclusively on the edge or partly in the cloud and at the edge (T5.3)
- Start to define a library of Edge AI reference implementations that address specific problems of Industry 5.0, in order to ensure interoperability with the AI-on-demand platform at different levels, bringing forward and contributing to the Manufacturing vertical (T5.4 and T5.5)
- Define a set of common methods and tools across the Didactic Factory-driven regional experiments and the SME-driven regional experiments, define proper KPIs to be used to monitor experiments development and deployment during the whole project duration and prepare the experimentations (T6.1, T6.2, T6.3 and T6.4)
- Plan and start the implementation of the socio-economic impact considering the EU-way to AI Legal Ethical issues (T7.1)
- Start the identification of Industry 5.0 re-skilling up-skilling needs to implement them in industrial cases (T7.2)
- Start the definition of a Standardisation & certification Action Plan (T7.3)
- Conduct the preliminary activities for a sound and successful exploitation plan (market / competition analysis, positioning, SWOT analysis, Exploitation Strategy and Agreements) (T7.4)
- Raise awareness around project activities supporting the engagement of stakeholders as well as to disseminate results and establish all the necessary promotion material and communication channels to ensure visibility and access to the stakeholders (T8.1)
- Create and grow the community around the project activities and foster interactions with other initiatives for collaboration, discussion, project development, scaling up, best-practice exchange and experience sharing adding value during and beyond the project lifetime (T8.3, T8.4).

In the first three months of the project the first milestone *M1 Project Handbook and Branding*, has to be achieved with the release of the definition of the *IA Scientific/Technical-Business-Innovation and SSH KPIs (D1.1)*, the *Risk Assessment and Management Action Plan - M3*, *D8.1 Brand Management, Marketing & Communication - M3*. At M9 the second milestones of the project, *M2 User Scenarios definition*, has to be achieved with the release of the *D2.3 User Requirements Specification for edge-AI Industry 5.0 - M6*, *D3.1(E)DIH Service Portfolio, Customer Journey and Pipelines - M9*.

3. Overview of the progress

The Chapter explain the work carried out during the reporting period (M1-M9). It Includes an overview of the project results towards the objective of the action in line with the structure of the Annex 1 to the Grant Agreement including a summary of deliverables and milestones.

3.1. Summary of Deliverables and Milestones

3.1.1. Deliverables

The following table presents the status of the deliverables related to this reporting period, from M1 up to M9 of the AI REDGIO 5.0 project.

WP	No	Name	Description	Lead Beneficiary	Type	Diss. Level	Due Date	Delivery Date
WP1	D1.1	IA Scientific/Technical-Business-Innovation and SSH KPIs - M3	Deliverable that defines the objectives and scope of the grids, indicators that support the control of the project at any level.	POLIMI	R	C-UE/EU-C	M3	M3
WP1	D1.2	Risk Assessment and Management Action Plan - M3	The risk plan document is released at M3 and M15 for the definition of the risk items and planned associated prevention and containment measures at M3.	POLIMI	R	C-UE/EU-C	M3	M3
WP2	D2.1	AI REDGIO 5.0 Requirements Engineering Methodology - M3	This Report describes the overall requirements engineering methodology to be used in WP2 and along the lifetime of the project. Version at M3.	CARSA	R	PU	M3	M3

WP	No	Name	Description	Lead Beneficiary	Type	Diss. Level	Due Date	Delivery Date
WP8	D8.1	Brand Management, Marketing & Communication - M3	This Report describes the communication material and web social presence of AI REDGIO 5.0 at M3.	AFIL	R	PU	M3	M3
WP1	D1.3	Data Management Plan - M6	The Open Research Data Pilot plan released at M6 for the definition of the data management activities and planned associated actions.	POLIMI	DMP	SEN	M6	M6
WP1	D1.4	Ethics Governance - M6	The first release contains AI REDGIO 5.0 Ethical Policy.	EAI	R	C-UE/EU-C	M6	M6
WP2	D2.2	Platforms and experiments AI Scenarios - M6	This Report describes the user scenarios in DF and SME experiments and a first matching with the WP3-4-5 platforms. Version at M6.	ARTER	R	PU	M6	M10
WP2	D2.3	User Requirements Specification for edge-AI Industry 5.0 - M6	This Report describes the user requirements from our experiments as well as technical specifications for WP3-4-5 developments at M6.	SIG	R	C-UE/EU-C	M6	M10
WP3	D3.1	(E)DIH Service Portfolio, Customer Journey and Pipelines - M9	This Report describes the Industry 5.0 service portfolio, customer journeys and pipelines for an (E)DIH at M9	POLIMI	R	PU	M9	M9

WP	No	Name	Description	Lead Beneficiary	Type	Diss. Level	Due Date	Delivery Date
WP4	D4.1	Reference Architecture for AI REDGIO 5.0 - M9	This Report provides the requirements analysis and specifies the reference architecture at M9.	ENG	R	PU	M9	M10
WP5	D5.1	Industry 5.0 EDGE AI Foundations - M9	This OTHER deliverable includes implementation of the Collaborative Intelligence Platform and the Open Hardware Platform at M9.	SUITE5	OTHER	PU	M9	M9

Table 1: List of Deliverables

This deliverable *D1.11 Technical Report M9*, is the Project Report M1-M9 prepared for the Technical Review Meeting at M9.

3.1.2. Milestones

In the first three months of the project the first milestone *M1 Project Handbook and Branding*, has been achieved according to the expected date with the release of the definition of the *IA Scientific/Technical-Business-Innovation and SSH KPIs (D1.1)*, the *Risk Assessment and Management Action Plan - M3 (D1.2)*, *Brand Management, Marketing & Communication - M3 (D8.1)*.

The second milestones of the project, *M2 User Scenarios definition*, will be achieved at M10 with a slightly delay with the release of the *User Requirements Specification for edge-AI Industry 5.0 - M6 (D2.3)*, *(E)DIH Service Portfolio, Customer Journey and Pipelines - M9 (D3.1)*.

These milestones are in the table below:

#	Milestone Name	WP	Means of Verification	Due Date	Delivery Date
1	Project Handbook and Branding	WP7, WP1	D1.1, D1.2, D8.1 submitted	M3	M3
2	User Scenarios definition	WP6, WP3, WP2	D2.3, D3.1 submitted	M9	M10

Table 2: Milestones

3.2. Objectives and KPIs

AI REDGIO 5.0 project objectives, as per project Grant Agreement, are grouped along the innovation action axis as follows.

- Obj. 1. Conceptual Framework and Reference Architecture for AI-at-the-Edge Industry 5.0 applications and Experimentations
- Obj. 2. Secure and Trustworthy edge-to-cloud continuum Data and Computational Space for highly distributed AI applications
- Obj. 3. Interoperability by Design with the pan-EU AI-on-Demand platform and its Ecosystem of H2020 & HEP Innovation Actions
- Obj. 4. Supporting the European way to Ai for Manufacturing by genuine EU Open Source frameworks, Implementing EU values and ethical principles in TERESA Sandboxes
- Obj. 5. Manage and Govern the Transition from regional DIHs to a network of EDIHs in Ai for Manufacturing
- Obj. 6. Test Before Invest Experiments in AI Didactic Factories and TEF
- Obj. 7. Validation and Evaluation in SME-driven AI for Manufacturing use Cases
- Obj. 8. AI-driven I5.0 Digital Transformation methods and tools, maturity assessment, 6Ps pathway Specification and AI skills for I5.0 development program
- Obj. 9. Sustainability, Ecosystem Development and Replication to SMEs Conceptual Framework and Reference Architecture for AI-at-the-Edge Industry 5.0 applications and Experimentations
- Obj. 10. Raised awareness and perception of the advantages and values of AI-at-the-Edge Industry 5.0
- Obj. 11. A validated approach for AI-at-the-Edge adoption by European Industry 5.0 Manufacturing SMEs within the project budget and timeframe

In the context of project management and coordination, the technical and scientific control is supported by a Verification and Validation methodology, which, thanks to a set of coherent and integrated performance indicators, allows alignment of all innovation activities and supports project risks minimization.

Starting from the project Objectives and corresponding indicators listed in the AI REDGIO 5.0 proposal, and included in the Grant Agreement, the strategic objectives and indicators have been instantiated in a performance management system integrated along the work break-down structure of the project, from WP to task level. The indicators devised at the time of the proposal have been revised, updated and integrated with additional ones by involving the coordination team, the WP and task leaders.

This section presents the value reached by M9 of the quantifiable indicators (KPIs) versus the corresponding M18 and M36 target for each Work Package and each Task.

3.2.1. WP 1: Consortium Coordination, Innovation Management

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
1.1	Consortium and Project Management (POLIMI)	% of KPIs above threshold in Project Management	≥80%	≥90%	N/A
1.2	Scientific/Technological Innovation Coordination & AI for Manufacturing Business Impact (POLIMI)	% of S/T and AI for Manufacturing Business impacts measured	≥80%	≥90%	90%
1.3	Risk Assessment and Management (POLIMI)	# of red/orange Risks occurred	<5	<2	0
		Risks mitigated	>90%	100%	100

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
1.4	Ethics Assessment and Governance (EAI)	# of EAB meetings (F2f or online)	≥3	≥6	0
		# of Ethical reviews of the project	≥1	≥2	0
		# of Meetings (Face-to-Face or Virtual Meeting) between the EAB, the Coordinator, the Ethics Mentor and/or the WP Leaders	≥5	≥10	5
1.5	Open Calls Management (CARSA)	# of Open Calls Participants and Winners	40, 10	80, 20	0

Table 3: WP1 KPIs

3.2.2. WP2: Needs, requirements, evaluation for AI-driven Industry 5.0

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
2.1	Requirements Engineering Method for AI REDGIO 5.0 (POLIMI)	# Of requirements engineering methodology in place	1	1	1
2.2	Platforms and Experiments Scenarios & Expectations (ARTER)	% of readiness of the THB template	100%	100%	80%
		%of KPIs identified	100%	100%	100%
		% of the as is scenarios identified	100%	100%	90%
		% of the to be scenarios identified	≥70%	100%	90%
2.3	Requirements Specification for AI-driven Human-Resilient-Sustainable Manufacturing (SIG)	# of Business Processes in TERESA experiments	≥10	≥14	13
		# of Business Processes in SME-driven experiments	≥7	≥10	0
2.4	Legal and ethical requirements for AI Collaborative Intelligence Scenarios (EAI)	# of Ethics Assessment	≥1	≥2	0
		# of Ethics Advisory Board established/running	≥1	≥1	0
2.5	Socio-business continuous assessment, 6Ps Industry 5.0 Digital Transformation (POLIMI)	# of AI Maturity Assessment Methods analysed	≥5	≥10	0
		# of AI Assessments	≥20	≥50	0
		# of Industry 5.0 Digital Transformation pathways	5	20	0

Table 4: WP2 KPIs

3.2.3. WP3: (E)DIHs Network for AI-at-the-Edge Industry 5.0

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
3.1	(E)DIH Service Portfolio and Observatory (POLIMI)	# of D-BEST services offered by the (E)DIHs of the network	≥90 (At least 1 service offered by each D-BEST category by the 18 initial (E)DIHs in the network)	≥180 (At least 2 service offered by each D-BEST category by the 18 initial (E)DIHs in the network)	185
3.2	(E)DIH Customer Journeys, Pipelines for Human Resilient Sustainable Manufacturing (SEZ)	# of customer journey matrixes configured by the (E)DIHs of the network	≥18 (At least 1 matrix configured, addressing the main customer typology of the (E)DIH. Considering the 18 initial (E)DIHs in the network).	≥36 (At least 2 matrixes configured, addressing the two main customer typologies of the (E)DIH. Considering the 18 initial (E)DIHs in the network).	32
3.3	(E)DIH Collaboration Corridors for AI-at-the-Edge Industry 5.0 (CARSA)	# of Collaboration opportunity inside the project # of Collaboration opportunity outside the project # of Collaboration scenarios factsheet	15 0 22	25 5 22	0 0 0
3.4	Network of AI REDGIO 5.0 Experimental Facilities (POLIMI)	# of DFs involved # of AI TEF Nodes & Satellites	15 4	30 + 8 +	22 0
3.5	5 DIHIWARE Platform & DIH4Industry AI-at-the-Edge Marketplace (ENG)	# of DIHs/EDIHs into the Catalogue # of Services showcased	≥ 9 ≥50	≥18 ≥180	N/A

Table 5: WP3 KPIs

3.2.1. WP4: Industry 5.0 Data4AI Platform & Data Spaces

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
4.1	Reference Architecture for AI REDGIO 5.0 (ENG)	# of Reference Industrial Architectures to be reviewed and considered	≥8	≥8	5
		# of Architecture views to be specified (following the 4+1 views model)	≥5	≥5	2
4.2	Secure edge-to-cloud data and computation continuum for Industry 5.0 (LTU)	# of Frameworks and reference architecture	≥ 4	≥8	2
4.3	Industry 5.0 Data Pipelines and Data Quality Assurance (NISSA)	# of Data Quality pipelines created	≥ 4	≥ 8	2
4.4	Data4AI Open Source Reference Implementations (ENG)	# of Blueprints for Industry5.0 Oriented Manufacturing Applications to be Specified	≥3	≥8	1
4.5	Industry 5.0 Data Spaces and semantic Interoperability (SUITE5)	# of Data Space Connectors to be developed	1	3	0
		# of Ontologies to be specified	1	2	0
4.6	Data4AI Integration, Testing, Technical Validation, OC support (NISSA)	# of Integrated Data4AI platform	0	1	0

Table 6: WP4 KPIs

3.2.2. WP5: Industry 5.0 EDGE AI Toolkit & AI-On-demand Platform

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
5.1	Collaborative Intelligence Platform for Industry 5.0 (SCCH)	# of Edge AI models to be trained (e.g. in the cloud, at the edge, or through federated learning) based on open data and/or AI REDGIO experiment data	8	22	3
5.2	Open Hardware Platform for Embedded AI and AI-at-the-Edge (HOPU)	Adoption of # standards for AI model interoperability	2	2	2
		# of Open source AI libraries/frameworks to build upon	3	3	2
		# of Open hardware Solutions	1	1	1

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
5.3	Cloud-to-Edge AI Pipeline Lifecycle Management Platform for Industry 5.0 (SUITE5)	# of AI assets and resources to be created within AI REDGIO # of Open source AI libraries/frameworks to build upon # of Edge AI pipelines templates (along with associated examples) Adoption of # standards for AI model interoperability	10 3 3 1	30 3 5 2	0 2 0 0
5.4	Edge AI Reference Implementations for Industry 5.0 (SUITE5)	# of Open Source frameworks considered	5	5	2
5.5	Interoperability with AI-on-demand platform (ENG)	# of Open source AI libraries/frameworks to build upon Interoperability with # initiatives for the exchange of AI assets # of AI Resources uploaded to AI-on-demand Platform # of AI pipelines in AI-on-demand Platform	2 1 4 3	5 3 10 8	1 0 0 0
5.6	Edge-AI Integration, Testing, Technical Validation, Open Call support (SUITE5)	# of Integrated Edge-AI platform	1	1	0

Table 7: WP5 KPIs

3.2.3. WP6: AI REDGIO 5.0 Application Experiment

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
6.1	Application Experiments Coordination & Assessment (ARTER)	# of meeting with mentors % of KPI defined % of THB structured	≥4 100% 100%	>10 100% 100%	N/A (will start after the open call) 100% 100%
6.2	2 SME-driven Experiments in AI REGIO Regions (SIG)	# of meetings between experiments and mentors % of Deliverables submitted in due time % of THBs filled in	≥4 ≥70% 	≥8 100% 	N/A (will start after the open call)

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
		% of end-users ALREADY involved in the development of the experiment/ end-users TO BE involved in the development of the experiment % of Experiment Validated	≥40% ≥40% -	100% ≥90% ≥90%	N/A (will start after the open call)
6.3	SME-driven Experiments in AI PILOT Regions (ARTER)	meetings with experiments and mentors % of Deliverables submitted in due time % of THBs filled in % of end-users ALREADY involved in the development of the experiment/ end-users TO BE involved in the development of the experiment % of Experiment Validated	≥4 ≥70% ≥40% ≥40% -	≥8 100% 100% ≥90% ≥90%	3 N/A 100% 0 0
6.4	TERESA Experiments in TEF Network (POLIMI)	#of meetings with winners % of Deliverables submitted in due time % of THBs filled in % of end-users ALREADY involved in the development of the experiment/ end-users TO BE involved in the development of the experiment % of Experiment Validated	≥4 ≥70% ≥40% ≥40% -	≥8 100% 100% ≥90% ≥90%	N/A (will start after the open call) N/A (will start after the open call) 50% 0 0

Table 8: WP6 KPIs

3.2.4. WP7: Socio-economic Impact of AI-at-the-Edge Industry 5.0

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
7.1	Legal, Regulatory and Ethical Issues (EAI)	# Consultations with Stakeholders	1	2	0
		# Fundament Rights Impact Assessment	0	1	0
7.2	Jobs, Competences and training action plan (POLIMI)	# of AI oriented profiles (mainly: worker level)	5	8	6 (roles – AI oriented) 4 (roles - I5.0 focused)
		# of AI-oriented skills development pathways	12	20	10 (it is ongoing activity)
7.3	Standardisation & certification Action Plan	Number of contributions to Standards	2	3	2
		Number of events about standardization that AI Redgio has participated	6	12	3
7.4	Market analysis, Exploitation Strategy and Action Plan (ENG)	#of market analysis	1	2	1
		#of Number of new markets entered	2	3	0
		# of Exploitation Model	≥2	≥4	0
7.5	AI REDGIO 5.0 Exploitation Vehicle and Business Plan (ENG)	# of AI DIH Participating in the Network	≥4	≥8	0
		# of AI Technology Providers Engaging in Network	≥5	≥10	0
		# of SME Manufacturers Engaging in the Network	≥5	≥10	0
		# of Business Models implemented	≥2	≥4	0

Table 9: WP7 KPIs

3.2.5. WP8: AI REDGIO 5.0 Communication, Dissemination and Liaisons

Task	Task description	Indicators	M18 Target	M36 Target	M9 Value
8.1	Scientific/Technological dissemination strategy and action plan (AFIL)	# of Conferences and Events # of Publications # of Articles # of Datasets	≥ 5 ≥ 2 ≥ 5 ≥ 3	≥ 10 ≥ 6 ≥ 15 ≥ 8	2 0 4 0
8.2	Brand Management, Marketing & Communication (AFIL)	# of Templates deliverables and ppt # of Website&logo development # of website publications # of newsletter # of followers in social media # of video # of flyer	1 1 ≥ 9 ≥ 3 ≥ 250 3 1	1 (update) 1 ≥ 18 ≥ 6 ≥ 600 6 1 (update)	1 1 6 0 LinkedIn 248 Twitter 97 0 1
8.3	Liaison with other I4MS projects and DIHs (POLIMI)	# of connections with other projects/ initiatives (internal meetings) # joint events organized with other projects	≥ 10 ≥ 10	≥ 20 ≥ 20	5 3
8.4	4 AI DIH World and International cooperation (POLIMI)	# of connections with other initiatives (internal meetings) # joint events organized with other initiatives	≥ 10 ≥ 10	≥ 20 ≥ 20	3 2

Table 10: WP8 KPIs

3.3. Explanation of the work carried per WP

In the subsections below the work carried out in the different WPs in the reporting period M1-M9 is described. The activities and results for each WP are described in details.

3.3.1. WP1: Consortium Coordination, Innovation Management

WP1 includes the tasks related to project management and coordination, risk management, monitoring and assessing, governance of legal and ethical issues and innovation management to ensure quality in project execution.

The major result of WP1 is a successful set-up of the project, the information of the consortium about rights and duties, reporting, financial and contractual modalities, and communication rules, the election and launch of the consortium management bodies, the implementation of a collaborative infrastructure, including a set of templates as well as instructions and regulations how the quality of the project in general and the project results and findings in specific shall be guaranteed and treated.

The first release of the Data Management Plan, of the AI REDGIO 5.0 Ethical Police have been elaborated, the sample Information Sheet and Informed Consent prepared and the Ethics and Data Protection Impact Assessment Methodology finalized. The key dates for the open call, the profile of the applicants, the experiment tasks and deliverables have been defined.

The contract and the consortium agreement have been completed. The distribution of the first part of the advance payment from the EC to the partners has been processed according to the agreed rules.

T1.1 Consortium and Project Management

Responsible: POLIMI Contributors: All except affiliated entities

Objectives for the Reporting Period

The primary objective of this task is to ensure coordination, cooperation, and cohesion within the consortium regarding Management and Contractual matters related to the project. This WP aims to guarantee the smooth operation of the project, ensuring that the project carries out all activities according to the detailed project plan. This WP is responsible for interfacing with the European Commission and preparing all agreements and interfacing with external communities.

Progress during the Reporting Period

During the first weeks of M01, POLIMI as coordinator worked on setting up the project organization and on organizing the KOM of the project to “officially” start the project. Pre-Kick-Off Meetings between some of the partners have been organized to share scientific and technological background information in advance. The organizational structure of the project has been completed with a management structure tailored to the project context and the number of partners, in order to provide efficient and effective project management and ensure that all project objectives are achieved within time, cost, and resource constraints. The management structure is composed of different roles and bodies that will support the project coordinator in the implementation of the management activities to guarantee the proper execution of tasks and use of resources, the follow-up of deadlines, and the compliance with EC rules. Specific mechanisms to assure the coordination among the partners and the consecution of the objectives have been defined.

During the related period (M1-M9) POLIMI took care of the timely completion of the activities, monitoring the activities together with WP leaders in order to verify the appropriate accomplishment of the tasks in relation to the Grant Agreement. POLIMI organized periodical online meetings with partners – every month for the status meeting, plus dedicated meetings at the occurrence (e.g., Informal reviews and before the submission of deliverables). POLIMI also discussed progress reports provided by the single WP leaders, including input from the single partners, during online meetings. All minutes from each meeting are available upon request.

Results

A successful setting in motion of the project including the following specific results/findings:

- *A Project Management Handbook*. The document defines the managerial rules and procedures that will be followed by the consortium across the whole project duration. Moreover, this document gives instructions and regulations on how the quality of the project in general and the project results and findings in specific shall be guaranteed and treated. The document establishes a common management and coordination standard for the whole consortium. The Project Management Handbook is designed to be the document of reference for the functioning of the project and for the seamless implementation of its tasks and objectives.
- *An Internal Project repository*, accessible only to project members. The repository is hosted by POLIMI which has created a new collaborative space for the AI REDGIO 5.0 project. Every user has its own credentials to access the AI REDGIO 5.0 space. All the official documents relevant for the entire consortium will be stored in the document area of the top-level project. A subproject has been created for each Work Package allowing Work Package leaders to organize their working area according to their requirements.
- *Templates* (as download within the project area) for the following documents:
 - Template for Agenda
 - Template for Minutes
 - Template for Deliverables
 - Template for Progress Report
 - Template for PowerPoint Presentations

The templates will allow the consortium to perform the activities in a smooth and efficient way and furthermore provide a common and homogeneous image of the project deliverables, releases etc.

- *Data Management Plan - M6*, the Open Research Data Pilot plan released at M6 for the definition of the data management activities and planned associated actions.
- *D1.11 Technical Report - M9*, the deliverable is the M1-M9 Project Report for the Technical Review Meeting at M9

Next steps in the next Reporting Period

This task will be ongoing throughout the whole project and will guarantee a successful coordination of the project. The underlying structures, developed within these first six months, will rule the possible upcoming changes, deviations and turbulences.

T1.2 Scientific/Technological Innovation Coordination & AI for Manufacturing Business Impact

Responsible: POLIMI Contributors: ARTER AFIL ENG CARSA NISSA SUITE5

Objectives for the Reporting Period

The main objective of task T1.2 is to ensure the successful realization of the foreseen S&T activities and Business Objectives of AI REDGIO 5.0.

Progress during the Reporting Period

Within T1.2 the working methods and implementation routes adopted in AI REDGIO 5.0 have been applied toward the project objectives. Information coming from all AI REDGIO 5.0 partners have been collected and synthesized in order to monitor project achievements.

In the context of project management and coordination, the technical and scientific control is supported by a Verification and Validation methodology, which, thanks to a set of coherent and integrated performance indicators, allows alignment of all innovation activities and supports project risks minimization. Starting from the project Objectives and corresponding indicators listed in the AI REDGIO 5.0 proposal, and included in the Grant Agreement, the strategic objectives and indicators have been instantiated in a performance management system integrated along the work break-down structure of

the project, from WP to task level. The indicators devised at the time of the proposal have been revised, updated and integrated with additional ones by involving the coordination team, the WP and task leaders.

Results

- *D1.1 IA Scientific/Technical-Business-Innovation and SSH KPIs - M3*, the deliverable that defines the objectives and scope of the grids, indicators that support the control of the project at any level.

Next steps in the next Reporting Period

Continuous monitoring of technical and exploitation/dissemination activities following the methodology proposed towards the achievement of Project Objective to support the innovation process in the perspective of exploitation.

T1.3 Risk Assessment and Management

Responsible: POLIMI Contributors: AI REGIO regions

Objectives for the Reporting Period

Definition of a methodology to be followed during the Project.

Progress during the Reporting Period

During the reference period the methodology, the risk registry and the contingency planning, as well as the related processes and responsibilities have been defined. A first review/update of the risk items included in the GA has been performed in collaboration with the Consortium and the WP leaders, as documented in deliverable *D1.2 Risk Assessment and Management Action Plan - M3*.

Results

- *D1.2 Risk Assessment and Management Action Plan - M3*. The risk plan document for the definition of the risk items and planned associated prevention and containment measures at M3.
- The *Central Risk Register* has been established and is composed of a set of tables providing the cockpit of risk management. Each WP has a table as well as project-level risks.

Next steps in the next Reporting Period

Risk monitoring activities continue along the project evolution.

T1.4 Ethics Assessment and Governance

Responsible: EAI Contributors: AI REGIO regions

Objectives for the Reporting Period

During this reporting period the task was mainly directed in assisting the Consortium in raising awareness and following the ethics-by-design approach, in complying with the legislative landscape and in aligning the planning of the future operations, especially at pilot-level, with the current applicable regulatory systems and ethical mandates, following the responsible research ethics guidelines.

Progress during the Reporting Period

The Consortium elaborated and started the implementation of the AI REDGIO 5.0 Ethical Policy and defined the project-level sample of the consent form and information sheet to be used during the next phase of the action, in particular during the validation activities at the experiment sites. The partners also worked to check whether ethical approvals at national level was necessary to conduct the validation operations and to establish the Ethics Advisory Board of the Project and appoint the Ethics Pilot Managers. A continuous interaction was ensured between the ethics-related figures of the project and the technical team.

Results

The AI REDGIO 5.0 Ethical Policy was set, which is going to represent the reference point of all the legal and ethical activities throughout the project's lifetime by describing and providing guidance on the ethics-by design approach and the privacy-and-security-by design approach, analyzing the transversal

nature of the legal and ethics-related aspects within its workplan, thereby exploring the interrelations and synergies between different tasks and Work Packages, as well as by defining the ethical procedures and responsibilities in relation to human participation in the experiments and for compliance with data protection law. The appointment of the figures in charge of the ethical oversight of the action is ongoing, whilst initial considerations and hints for the comprehensive Ethics and Data Protection Impact Assessment methodology to be used in WP6 “AI REDGIO 5.0 Application Experiments” were outlined. The sample Informed Consent and Information Sheet were prepared and they will be fine-tuned by the experiments in the next phase of the project.

D1.4 “Ethics Governance”, including the Ethical Policy and the report of the performed activities and of the produced outcomes was submitted.

Next steps in the next Reporting Period

The interaction between the ethics-related figures and the technical team will be continued and the AI REDGIO 5.0 Ethical Policy will be further implemented, both in relation to the design and development of the technological assets and to their testing in the pilots’ framework.

The experiment leaders will fine-tune the sample Informed Consent and Information Sheet with context specific information and including specific references to the scenarios, use cases and other experiment-driven data.

T1.5 Open Calls Management

Responsible: CARSA Contributors: POLIMI, AFIL

Objectives for the Reporting Period

The objective of this task is to support the development of the AI REDGIO 5.0 network through the reparation, management and execution of the AI REDGIO 5.0 Open Call process. During the first nine months of the project the objective of this task is the definition of the main characteristics of the AI REDGIO 5.0 1st Open Call.

Progress during the Reporting Period

During the reporting period, the AI REDGIO 5.0 existing experiments have been analysed with the aim of identifying the gaps that the experiments coming from the 1st Open Call can fulfil. Additionally, basic characteristics, such as the key dates for the open call, the profile of the applicants, the experiment tasks and deliverables have been defined.

Results

The main result of this task until month 9 is the creation of a baseline document that defines the main characteristics of the AI REDGIO 5.0 1st Open Call including:

- Key aspects:
 - Key dates
 - Who can apply?
 - Eligibility criteria
- AI REDGIO 5.0 experiments
 - Experiment tasks
 - Experiment deliverables
 - Experiment timeline
 - Budget and financial support
 - Structure of the budget
 - Payments
 - What is in AI REDGIO 5.0 for the participants?
- Experiment design, submission and evaluation
- Support available for applicants

Next steps in the next Reporting Period

During the next months the final characteristics of the AI REDGIO 5.0 1st Open Call will be defined, including aspects such as the topics addressed by the Open Call. Additionally, the Evaluation Management System (EMS) platform, the platform through which the applicants will be able to digitally submit their proposals will be configured.

Once the EMS platform is in place, in December 2023, the 1st Open call will open for the reception of applications, and it will remain open until end of March 2024.

Meetings

- Italian Pre- Kick-off Meeting (20 January 2023, on-line)
- Technical Pre- Kick-off Meeting (23 January 2023, on-line)
- Kick-off meeting at Politecnico di Milano (26-27 January 2023, Milan))
- 1st Plenary Meeting (28 June 2023, on-line)
- 2nd Plenary Meeting at Brainport Industries (6-7-8 September, Eindhoven)
- On -line Monthly WPs Status meetings
- Bilateral telcos and exchanges between the technical team and the EM/Ethics Pilot Managers.

Deviations

No deviation.

3.3.2. WP2: Needs, requirements, evaluation for AI-driven Industry 5.0

WP2 Needs, requirements, evaluation for AI-driven Industry 5.0 (M1-M36) is intended to collect scenarios and requirements from the 14 Didactic Factories and 7 SMEs experiments, in order to better specify the AI REDGIO 5.0 tools and solutions (WP3-4-5).

WP2 will last for the whole duration of the project, ready to receive feedback from the technical and experimentation tasks in order to better tune expectations and performance indicators, the implementation of Handbooks and 6Ps pathway are original tools supporting WP2.

The main objectives of WP2 are:

- To develop requirements engineering methods and tools along the whole lifetime of the project
- To elicit needs / scenarios from DF and SME experiments and specify user requirements for the solutions in WP3-4-5 and formalise them, including Human-AI interaction patterns and express ethical requirements
- To identify technical-social-business indicators and to measure them along the lifetime of the project
- To develop an AI-at-the-edge Digital Transformation model based on the 6Ps method for Industry5.0

During M1-M9 period, WP2 has been focused on the development of the Requirements Engineering Methodology, which has set the basis for the harmonised collection of all the information related to the technical Work Packages of AI REDGIO 5.0, which has led to the development of *D2.1 AI REDGIO 5.0 Requirements Engineering Methodology*. Additionally, the analysis of the scenarios and requirements of the AI REDGIO 5.0 experiments has been performed, together with the analysis of the applicable European and national legislation and ethical sources and the performance of the first iteration of the survey in relationship to the legal and ethical requirements. The results of these activities will be visible in *D2.2 Platforms and experiments AI Scenarios* and *D2.3 User Requirements Specification for edge-AI Industry 5.0*.

T2.1 Requirements Engineering Method for AI REDGIO 5.0

Responsible: CARSA Contributors: POLIMI SIG AFIL

Objectives for the Reporting Period

The objective of T2.1 during the first 9 months of the project is to design and put in place the Requirements Engineering Methodology, which will be used to capture the needs of the different WPs of the project and provide a common framework to guarantee the achievement of those needs and synergies among them.

Progress during the Reporting Period

CARSA, as the leader of WP2.1, worked closely with SIG, EAI and POLIMI (as WP2 Task leaders), NISSA (as WP4 leader), SUITE5 (as WP5 leader) and ARTER (as Task 2.1 and WP6 leader) in the design and definition of the Requirements Engineering Methodology to be applied along the duration of AI REDGIO 5.0. Within WP2.1, a set of meetings and discussions with these partners enabled the creation of *AI REDGIO 5.0 Requirements Engineering Methodology* (D2.1). The methodology is used to collect and harmonize scenarios, needs and requirements from the different pillars of the project, with the support of specific data structures (the Trial Handbook, (E)DIH Handbook and Techno Handbook) for sharing information along the entire requirements life cycle.

Results

The main result of Task 2.1 until month 9 has been the design, creation and application of the Requirements Engineering Methodology, which is defined and explained in *D2.1 AI REDGIO 5.0 Requirements Engineering Methodology*.

Next steps in the next Reporting Period

Looking towards the second iteration of the AI REDGIO 5.0 Requirements Engineering Methodology, which will start in M19, all the activities considered within the methodology are being monitored through different tools, namely the handbooks. This will enable the implementation of improvements and optimization of the methodology in the second iteration of this task in M19.

T2.2 Platforms and Experiments Scenarios & Expectations

Responsible: ARTER Contributors: All

Objectives for the Reporting Period

The objective of T2.2 is to analyse the AS and TO BE scenarios in collaboration with technology providers. Experiments owners needs will be defined for the solutions to be developed with focus on WP3-4-5.

Progress during the Reporting Period

The methodology for the definition of experiments' needs has been developed in T2.1: REM methodology, and in particular the Trial handbook has been used.

The Key performance indicators have been defined for all the 7 SMEs driven experiments and for the 14 Didactic Factory

With the application of the methodology, AS IS and TO BE scenarios have been depicted in WP6 for all experiments. Furthermore, in the reporting period, the mapping of experiments 'needs in terms of technology solutions, platforms, and business services is started and will be completed by October.

Results

The main results achieved in the first 9 months concern the REM methodology application and are described in D2.2, that will be completed at M10.

Next steps in the next Reporting Period

The second iteration of the mapping of the experiments needs and achievements will start in M21.

T2.3 Requirements Specification for AI-driven Human-Resilient-Sustainable Manufacturing

Responsible: SIG Contributors: All

Objectives for the Reporting Period

The objective of T2.3 is to analyse the scenarios of T2.2. In collaboration with technology providers user requirements will be defined for the solutions to be developed with focus on WP3-4-5. For WP3 requirements for new (e)DIH services will be identified. Further requirements will be mapped with the technological platforms concerning the data sharing spaces and trust confidentiality levels (WP4) as well as the AI applications and the interoperability with the AI-on-demand platform.

Progress during the Reporting Period

The methodology for the definition of user requirements for AI-driven Human-Resilient-Sustainable Manufacturing was developed and will be implemented on the scenarios of T2.2.

Results

The main results of T2.3 until M9 will be defined in the D2.3, namely the definition of user requirements and KPIs to be evaluated along the project.

Next steps in the next Reporting Period

The second iteration of the Requirement Specification for Edge-AI Industry 5.0 will start in M21. The user requirements will be evaluated and if necessary, adapted to the experiments and WPs current need according to the methodology.

T2.4 Legal and ethical requirements for AI Collaborative Intelligence Scenario

Responsible: EAI Contributors: POLIMI, CARSA, Industrial Users

Objectives for the Reporting Period

During the first 9 months of the project the task was directed to start the analysis of the ethical and regulatory framework, in conjunction with T7.1 development, to realize the first iteration of the survey with stakeholders and set the basis for performing the HRIA of the AI tools.

Progress during the Reporting Period

The activities were mainly directed to:

- examine the applicable European and national legislation and ethical sources relevant to AI REDGIO 5.0 technological development and testing activities;
- conduct the first iteration of the survey with relevant stakeholder of the manufacturing value chain for capturing their needs and expectations, relying on multiactor dialogues and exchanges. The survey provided useful insights and hints on specific topics and it is expected that the findings will be helpful both for guiding the technological development team to refine its future development work and validation activities and for the elicitation of the legal and ethical requirements for AI REDGIO 5.0 technology and experiments.
- to define the function, the approach and the structure of the Human Rights Impact Assessment for determining the expected impact of AI REDGIO 5.0 tools on fundamental rights at stake and the related mitigating measures for ensuring that all activities and results are citizen-respectful and compliant with the individual rights and freedoms promoted by the European Union.

Results

The first consultation with stakeholders was finalized and the findings were analysed. The approach and structure of the HRIA was defined and the survey on the ethical and legal framework was started with preliminary outcomes, to be further integrated in the next months.

Next steps in the next Reporting Period

The Human Rights Impact Assessment will be conducted. The second iteration of the consultation will be prepared and the legal and ethical landscape will be further analysed. The legal and ethical requirements for the AI REDGIO 5.0 technology and experiments will be elicited and described.

Meetings

MEETING	DATE	DESCRIPTION
WP2-WP6 Meeting: Industrial cases	22/02/2023	The objectives of the meeting were: • Present the Requirements Engineering Methodology including the objectives and the phases of the methodology, together with the synergies between WPs, the application for the AI REDGIO 5.0 experiments, (E)DIHs and Platforms and Data Spaces of the methodology and the next steps in relationship to the definition and application of the Requirements Engineering Methodology. • Presentation of the WP6 AI REDGIO 5.0 Application Experiments including an overview of Task 6.1. • Presentation of the AI REDGIO 5.0 Industrial Cases in which each experiment provided an overview including the general description, objectives, the social, economic and legal framework, the as-is and to-be scenarios and the foreseen implementation plan.
WP2 Task Leaders meeting	16/03/2023	The objective of the meeting was to analyse the activities performed during the first months of activity in relationship to Work Package 2. The WP leader presented an overview of the WP. Afterwards each task leader presented the status of each task and the next steps were discussed.
WP2-WP6 Meeting: Industrial cases	18/04/2023	The objectives of the meeting were: • Present the Requirements Engineering Methodology including the objectives and the phases of the methodology, together with the synergies between WPs, the application for the AI REDGIO 5.0 experiments, (E)DIHs and Platforms and Data Spaces of the methodology and the next steps in relationship to the definition and application of the Requirements Engineering Methodology. • Present the Technology Regulatory Sandboxes (TERESAs) and its application in AI REDGIO 5.0 Didactic Factory experiments. • Presentation of the WP6 AI REDGIO 5.0 Application Experiments including an overview of Task 6.1. • Presentation of the AI REDGIO 5.0 Didactic Factories Test before Invest Experiments (1st round), in which each experiment provided an overview including the general description, objectives, the social, economic and legal framework, the as-is and to-be scenarios and the foreseen implementation plan.
WP2-WP6 Meeting: Industrial cases	04/05/2023	The objectives of the meeting were: • Present the Requirements Engineering Methodology including the objectives and the phases of the methodology, together with the synergies between WPs, the application for the AI REDGIO 5.0 experiments, (E)DIHs and Platforms and Data Spaces of the methodology and the next steps in relationship to the definition and application of the Requirements Engineering Methodology. • Present the Technology Regulatory Sandboxes (TERESAs) and its application in AI REDGIO 5.0 Didactic Factory experiments. • Presentation of the WP6 AI REDGIO 5.0 Application Experiments including an overview of Task 6.1.

		Presentation of the AI REDGIO 5.0 Didactic Factories Test before Invest Experiments (2nd round), in which each experiment provided an overview including the general description, objectives, the social, economic and legal framework, the as-is and to-be scenarios and the foreseen implementation plan.
Task 2.4	Continuous	Bilateral exchanges between the technical team, the Ethics Mentor and/or the Ethics Pilot Managers.

Deviations

Within the first 9 months of AI REDGIO 5.0 two deliverables of WP2 have been delayed. *D2.2 Platforms and experiments AI Scenarios* (Leader: ARTER) and *D2.3 User Requirements Specification for edge-AI Industry 5.0* (Leader: SIG) have been delayed due to the fact that the experiments officially started at month 6 of the project. Due to the high number of experiments, 21 experiments, it has been necessary to organise a series of meetings to discuss the concept of the experiments, collect the as-is and to-be scenarios and map their needs. Additionally, the extraction of the requirements for D2.3 are derived from the needs.

Moreover, due to the flood that heavily hit Emilia-Romagna in May/June, ART-ER personnel suffered damage that has slowed down T2.2 activities.

3.3.3. WP3: (E)DIHs Network for AI-at-the-Edge Industry 5.0

WP3 will consolidate the EDIH network inherited from AI-REGIO project and further validating the methodology that has evolved through different project with the aim of creating a framework to support the EDIHs and DIHs specialized in manufacturing in their service provisioning and in their contact with other members of the ecosystem. That's why each task of the WP3 will address different pillars of this methodology labelled METHODIH (a methodology for DIHs).

The first task will be dedicated to the offering side and the configuration of service portfolios. The second will focus on the demand side and the configuration of customer journeys and services pipelines. The third task will focus on the creation of collaboration corridors between the digital innovation hubs, and the last task will consolidate a platform to make public and available the project results with the aim of making them available for the entire manufacturing ecosystem.

The objectives of the tasks as described in the project proposal are:

- To create an ecosystem of (E)DIHs active in AI-at-the-edge for Manufacturing Industry 5.0
- To define I5.0 inspired methods and tools for Service Portfolio analysis and Customer Journeys CJs as well as collaboration corridors among (E)DIHs to fill the service offering gaps evidenced by CJs
- To materialise a network of AI-at-the-edge Experimental Facilities where to perform experiments WP6
- To extend and integrate the existing DIHIWARE platform for Industry 5.0 (E)DIH networks

Regarding the progress and finalized tasks for this iteration, were completed as expected, with a positive rate of KPIs expected for the first 9 months of the project. 14 service portfolios out of 19 were configured successfully by the EDIHs members of the project network, and 32 customer journeys were configured focalizing in the cases of tech users and tech providers. Both pillars of the methodology that were addressed for this first period were completed successfully, meaning a solid base to fulfil the KPIs expected for the month 18.

T3.1 (E)DIH Service Portfolio and Observatory

Responsible: POLIMI Contributors: All Regions

Objectives for the Reporting Period:

AI-REDGIO 5.0 project established a new network of EDIHs, with members inherited from the AI-REGIO network and new members from the manufacturing ecosystem. The current EDIH network counts with 19 organisations between DIHs and EDIHs and the objectives of the Task 3.1 was to configure the service portfolios of the 19 members of the new network focusing on services for the implementation of the AI on the edge technology and considering an Industry 5.0 scenario. Configuring service portfolio meaning organizing its services according to D-BEST framework of services in order to share a common language with other members within and outside the network.

Progress during the Reporting Period

The progress of the activities of the task 3.1 was developed from March (M3) to September (M9), activities that were reported in the D3.1, and consisted in the conduction of methodology workshops with all the members of the EDIH network to provide them with the main tools of the METHODIH methodology. After the methodological workshop, each DIH/EDIH configured its own service portfolio according to the DBEST taxonomy. In AI-REDGIO 5.0, to conduct this activity, we implemented new service portfolios questionnaires in Qualtrics, to provide our network members with a friendlier and simply tool to undertake these activities.

As a complementary activity of the Service portfolio configuration and considering that the human factor is key to start collaborating within members of the network, basic information from each organization was gathered with the aim of launching a EDIH Network Booklet. The collected information consisted of technological focus, economic sectors, flagship services, foreseen challenges, among others. This with the aim of creating the first points of personal contact and mutual interest between the members of the project network.

Results

As results of the activities, 14 services portfolios were configured, as well as 19 booklet templates were compiled, one for each network member, in line with the KPIs established at the beginning of the project.

Next steps in the next Reporting Period

Next steps consist in discussing with the network members, strengths, and weaknesses of the service portfolio structure that it's been utilized as well as its service taxonomy. Expected outcome is the enhancement of the methodology to be utilized in the second iteration of the task, as well as in future projects.

T3.2 (E)DIH Customer Journeys, Pipelines for Human Resilient Sustainable Manufacturing

Responsible: SIG Contributors: All Regions

Objectives for the Reporting Period

T3.2 aims to study the demand side of the EDIHs/DIHs and to model different interaction phases between a customer and a (E)DIH through service pipelines configured in service matrixes. As the methodology establishes, different typologies of customers can be modelled (technology providers, students, policy makers, among others) but in the AI-REDGIO 5.0 project, the focus will be centered in Technology users (manufacturing SMEs) and Open Calls winners.

Progress during the Reporting Period

The progress of the activities of the task 3.2 was as well developed from March (M3) to September (M9), and its activities were as well reported in the D3.1. The activities of T3.2 were introduced during the methodology workshops with all the members of the EDIH network, and since they represent the second pillar of the methodology, they were developed after the service portfolio configuration (first

pillar). Each DIH/EDIH configured their own customer journeys matrixes according to the DBEST taxonomy. In AI-REDGIO 5.0, new matrix templates were implemented using the MURAL platform, to provide our network members with a friendlier and simply design tool to undertake these activities.

Results

32 customer journeys were configured by the network members. In most of the cases the services pipelines were also provided. In this first iteration, the requested matrixes to be compiled were centered in technology users and technology providers, which are usually the most common typology of customers of a DIH/EDIH. In the second iteration, and with the experiments in a most advanced status, the matrix for the experimenters will be also configured.

Next steps in the next Reporting Period

As indicated in the description of action, the next steps for these activities are the preparation of services pipelines for different typologies of manufacturing SMEs with respect to the adoption of AI-at-the-edge. Best Practices and Success Stories will also be instantiated on the Manufacturing SMEs involved in the consortium and on those selected in the Open Calls. This with the aim of utilizing the customer journey and service pipeline tool to represent as well concrete cases that can be used as examples of the benefits of being part of the network as well as act as a showcase of the project outcomes.

T3.3 (E)DIH Collaboration Corridors for AI-at-the-Edge Industry 5.0

Responsible: CARSA Contributors: All regions

Objectives for the Reporting Period

Task 3.3. intends to define structured ways that (E)DIHs can use to collaborate across collaboration corridors for AI-at-the-Edge Industry 5.0. To achieve this objective, one of the first steps to take is to identify possible collaboration opportunities that can be established between the hubs.

Progress during the Reporting Period

During the first 9 months of the project CARSA has analysed the service portfolio of each (E)DIH with the aim of identifying possible collaboration opportunities between the hubs involved in the project. Additionally, the main criteria to guarantee a smooth implementation of a collaboration among (E)DIHs have been defined, namely geographical proximity (the area in which the hub operates), sectoral coverage (the sectors in which the hub operates) and technological focus (the technologies on which the hub is focused), together with the services provided by each of the (E)DIHs and their expectations to develop new services.

Results

The main result obtained until month 9 is the analysis of the service portfolio of each (E)DIH, together with the definition of the criteria that influences the collaborations among them.

Next steps in the next Reporting Period

The information related to each of the criteria mentioned above will be analysed for each of the (E)DIHs. This information will be used by CARSA to measure the compatibility rate that the hubs would have if they collaborated. In this line, the development of a fact sheet for each of the 18 hubs taking part in the AI REDGIO 5.0 project will be generated. This document will contain information on possible collaboration opportunities and will identify which hubs are the most suitable ones to collaborate with given greater compatibility on the different factors.

Additionally, D3.1 Collaboration Corridors for AI-at-the-Edge (E)DIH will be delivered in December 2023.

T3.4 Network of AI REDGIO 5.0 Experimental Facilities

Responsible: BPI Contributors: POLIMI, All Regions

Objectives for the Reporting Period

Task 3.4 intends to mobilise and involve the users of the technologies and in particular the Manufacturing SMEs. A network of SME oriented experimental facilities has already been created by AI REGIO and it is called “Didactic Factories network”. In this first reporting period, the transition between the AIREGIO and the AI REDGIO 5.0 project was the most important objective, while extending the network even more.

Progress during the Reporting Period

During the first nine months of the project BPI has continued facilitating the Didactic Factories (DF) network. We have extended the network from the AIREGIO project towards the AI REDGIO 5.0 project. During our monthly meetings we have shared knowledge and expertise on several topics, for instance a demo on how to integrate different applications and systems independent of their brand/type.

Results

In terms of KPI's, the network has grown in nine months from 15 to 22 Didactic Factories across Europe. This is already above expectations if you extrapolate it to our goal of 30+ DFs at the end of the project.

Next steps in the next Reporting Period

In the upcoming reporting period, our task will initially focus on the value proposition of our network since the transition of AIREGIO into AI REDGIO 5.0 is now in place. We will then also focus on the Deliverable D3.3 which is due on M12 (December 2023). Furthermore, we are keen on extending and expanding the network across Europe. We are especially on the lookout for countries that are not yet part of the network, such as France and Eastern Europe.

Besides that, we would like to start with the integration of the AI Testing and Experimental facilities into this task. Given the AI MATTERS project, consisting of 7 nodes and 1 satellite, we will explore the possibilities of how to connect the DF network to this powerful network of organizations.

T3.5 DIHIWARE Platform & DIH4Industry AI-at-the-Edge Marketplace

Responsible: ENG Contributors: POLIMI, All Regions

Objectives for the Reporting Period

With the aim of improving the Industry 5.0 aspects of the (E)DIH services, support the (E)DIH activities and contribute in the definition of structured ways that (E)DIHs can use to collaborate through Collaboration Corridors for AI-at-the-Edge Industry 5.0, the T3.5 takes charge of providing specific environments and tools enabling such activities. Starting for the DIHIWARE platform, developed within previous research projects and evolved through specific AI REGIO Tasks, specific customizations and new developments will be drawn up, with the help of the Consortium, carrying out an in-depth study of the objectives that can be achieved through the use of this Platform.

In particular, the DIHIWARE instance dedicated to the DIH4INDUSTRY will hold an AI (E)DIHs section populated with the AI services coming from the AI REDGIO (E)DIHs Network.

Progress during the Reporting Period

During the first 9 months of the project the existing features of the platform (DIHIWARE) have been shown to the main beneficiaries (DIHs) and we have also started to supervise the process requirements' specifications led by the WP2 intended to guide the new releases of the DIHIWARE Innovation and Collaboration Platform. Moreover, the AI REDGIO 5.0 project has been added between the projects involved in the DIH4INDUSTRY environment.

Results

Predisposition of the AI (E)DIHs section into the DIH4INDUSTRY. Initial requirements' specifications analysis.

Next steps in the next Reporting Period

Starting to collect and showcase the AI REDGIO 5.0 services offers via DIH4INDUSTRY. Definition of the objectives achievable through the use of the platform and functional specifications.

Meetings

Meeting	Date	Content
Monthly meeting 1	28/04/2023	- A glimpse of the main milestones during the first year of AI-REDGIO 5.0 (M3-M12) - Brief Presentations of the AI-REDGIO 5.0 EDIH Network members - A brief introduction and suggested updates to the DIH/EDIHs & DFs booklet - A brief introduction to the METHODIH methodology and a Doodle to settle on a date for the 1st workshop
Monthly meeting 2	26/05/2023	- General Information of WP3 Tasks 1-5 and a brief introduction to the expected outcomes of D3.1 - An overview of the repository and discussing the common problems that meet partners - A brief introduction and suggested updates to the DIH/EDIHs & DFs booklet - A short discussion regarding METHODIH methodology and proposing the re-conduction of the workshop to align with other partners who couldn't attend the 1st one.
Monthly meeting 3	30/06/2023	- An overview of the Network's updates by the addition of a new DIH to be the 19th partner. - An overview of the booklet's updates that involve the suggestion of an index providing information about the linking partners and contact points. - A focus on the progress of the partners filling the Customer Service Portfolios, Customer Journey Matrices, and service pipelines, which is the main source of data for D3.1.
Monthly meeting 4	21/07/2023	- A re-cap of the recent updates regarding the network and booklet. - Re-clarifying the issues met by partners during the configuration of Service Portfolios and Customer Journey Matrices and Service Pipelines and urging partners to submit the required data before the end of July. - Cancelling the next meeting to be handled during the General Assembly Meeting.
Monthly meeting 5	29/09/2023	- A review of the timeline of WP3 to highlight the status of D3.2, D3.4, D3.5 - An overview of the status of D3.1 to be submitted by the end of September in accordance with the set deadlines - Urging the T3.4 leaders to submit the missing data to complete D1.11 in time. - Announcing a workshop to be conducted for "DIHIWARE Platform & DIH4Industry AI-at-the-Edge Marketplace" by T3.5 leaders.

Deviations

No deviations.

3.3.4. WP4: Industry 5.0 Data4AI Platform & Data Space

WP4 is responsible for the development of the reference infrastructure for the realization of the selected pilots and experiments. Main focus is on data processing pipelines and data storage.

In a distributed architecture that spans from the cloud to the edge, it is required to facilitate data processing throughout every layer of the ecosystem. All layers need to share a real-time understanding of the data, and any layer should be able to run in isolation in the event of loss of connectivity.

This means, there is a need for a database that natively distributes its storage and workload across the various tiers of an edge architecture. The database must also have the ability to instantly replicate and synchronize data across database instances, whether they're in the cloud or in an edge data center.

In addition, the database needs to be embeddable. Data storage should be integrated directly to the edge device in order to facilitate data processing when completely offline. As such, the embedded database must be able to operate without any central cloud control point, and it must automatically synchronize with the rest of your data ecosystem when connectivity returns.

Furthermore, synchronization must be bi-directional and controllable in order to provide a secure and optimal flow of data throughout your edge architecture. For example, in a smart factory scenario, high velocity data captured from an assembly line can be processed and analyzed at the edge, but – for network bandwidth efficiency – only aggregated data is synchronized to the cloud for ultimate storage.

Main objectives:

- To develop the Reference Architecture for AI REDGIO 5.0
- To develop a secure computation continuum between edge and cloud, to implement Data Pipelines for Data Quality and Industry 5.0 and Data Spaces at different levels with standard Data Models and Ontologies
- To implement Reference Architecture via Open Source reference implementations (FIWARE APACHE)
- To integrate and test the Data part of the Architecture at disposal also of Open Calls winners

T4.1 Reference Architecture for AI REDGIO 5.0

Responsible: ENG Contributors: All Technological Providers

Objectives for the Reporting Period

- Collect requirements,
- Define design principles and
- Create reference architecture

Progress during the Reporting Period

Analysis of the related initiatives. Providing reference architecture.

The main concept is **“local cloud”** which depicts the possibility to have an efficient computing infrastructure locally (edge, shopfloor), which is of a big importance for manufacturing SMEs. Furthermore, the framework should implement the **edge-could paradigm**, allowing the deployment of applications on both sides with particular emphasis to the edge with the enabling of edge.

Understanding the role of the **Arrowhead framework** local cloud system of systems.

Work on functional (provided by use cases) and esp. non-functional requirements (Scaling, Types of devices, Application footprint, Operating speed, Disconnected, Security / Safety)

Results

- Reference Architecture (deliverable D4.1)

Next steps in the next Reporting Period

- Applying the architecture in real use cases
- Refinement of the architecture

T4.2 Secure edge-to-cloud data and computation continuum for Industry 5.0

Responsible: LTU Contributors: All Technological Providers

Objectives for the Reporting Period

The objectives of this reporting period were the following:

- Investigate deployment of secured solutions at the edge
- Investigate computation monitoring at the edge to balance load

Progress during the Reporting Period

During this period, T4.2 has investigated the idea of auto generating .X509 certificates because of the resource demanding process of manually generating keys and certificates at deployment and operation. The latter has to do with the maintenance of certificates for each software and each hardware deployed. It seems that the perception of being behind a firewall is an excuse to avoid using security deployment. Related to this is the idea that one must insure that deployed software is not malware. Malware can for example expose all certificates to an external source. A current example is the US military having potential malware. Our current investigation looks into the requirement of certified software to be granted an authentication certificate.

Closely related to this mechanism to verify the origin of a software, we have investigated means to monitor resource consumption on edge devices. The idea is to run as much at the edge and move processes to the cloud when the load is too high. For this purpose, we have been comparing two implementations of the Arrowhead framework: the official one in Java and an unofficial one in Google Go as test examples to the issue at hand.

Results

- Software certification trials
- Resource consumption and startup time comparisons.

Next steps in the next Reporting Period

During the upcoming period, our objective is to explore alternative authentication mechanisms aimed at reducing both deployment and maintenance costs, while simultaneously ensuring a seamless cybersecurity continuum from edge devices to cloud infrastructure. Additionally, we aim to demonstrate the successful integration of these mechanisms with existing cloud security protocols.

Concurrently, we will extend our investigation into the computation continuum by examining its compatibility with other frameworks.

T4.3 Industry 5.0 Data Pipelines and Data Quality Assurance

Responsible: NISSA Contributors: All Technological Providers

Objectives for the Reporting Period

Goal: To develop services for creating data pipelines and ensuring data quality

- Collection and analysis of requirements
- Definition of data pipelines
- Definition of the data quality principles

Progress during the Reporting Period

Following the requirements for the platform development defined and specified in WP2, this task performed a detailed analysis of the outcomes from previous WPs to develop data pipelines. The basis for the development is AI REGIO Data4AI Platform, which offers a framework for developing and managing complex processing pipelines. Main challenge is the design of the pipelines for being deployable and run on local clouds.

Results

Data pipelines architecture (focus on data quality)

Data observability layer design. Data observability layer must be able to monitor and alert for the following pillars of observability (Freshness: is the data recent? Distribution: is the data within accepted

ranges? Is it properly formatted? Is it complete? Volume: has all the data arrived? Schema: what is the schema, and how has it changed? Who has made these changes and for what reasons? Lineage: for a given data asset, what are the upstream sources and downstream assets which are impacted by it?)

Input for D4.1

Next steps in the next Reporting Period

Various edge-related frameworks, like TinyML, will be used. This development will be tailored to the needs of manufacturing SMEs, who will benefit from having efficient processing close to the machines (shop-floor). This will include the methods for estimating the quality of existing data, esp. their potential for the process improvement

An effective, proactive data observability solution will connect to your existing data platform quickly and seamlessly, providing end-to-end lineage that allows you to track downstream dependencies.

Additionally, it will automatically monitor your data-at-rest without requiring the extraction of data from your data store. This approach ensures you meet the highest levels of security and compliance requirements and scale to the most demanding data volumes.

T4.4 Data4AI Open Source Reference Implementations

Responsible: ENG Contributors: All Technological Providers

Objectives for the Reporting Period

- Preparing the open-source implementation of the Industry 5.0 Data4AI Platform
- Analysis of the relevant initiatives
- Defining the roadmap

Progress during the Reporting Period

- Leveraging on the state-of-the-art open-source components and related communities, the framework is based on open source (FIWARE, APACHE, Eclipse) building blocks
- Supporting (and contributing if necessary) the smart data models initiative for describing data.
- Analysis of the best of breeds European standards and technologies for Data Sovereignty and Trusted Data Sharing

Results

Preliminary implementation decision (part of D4.1)

Next steps in the next Reporting Period

1. Define how to manage data flow among Edge Servers and Cloud
2. Select the open-source technologies
3. Integration of external components [M18]
4. Preliminary version for Industry 5.0 Data4AI Platform [M18]

T4.5 Industry 5.0 Data Spaces and semantic Interoperability

Responsible: SUITE5 Contributors: All Technological Providers

Objectives for the Reporting Period

The objectives of this reporting period were the following:

- Initial state-of-the-art on existing Data Spaces and relevant frameworks, blueprints, implementations
- Identification of user needs and extraction of AI REDGIO 5.0 Data Space requirements
- High-level architecture design of AI REDGIO 5.0 Data Spaces
- Experimentation with selected open-source solutions

Progress during the Reporting Period

During this period, T4.5 made the foreseen progress according to plan. Initial state-of-the-art (SotA) research was performed, with focus on relevant to Data Spaces, including reference implementations,

architectures and blueprints, design principles and open-source solutions. Furthermore, an analysis on the work performed in the context of WP2 and WP6 was performed to outline the business needs of the experiments from Data Spaces in the AI REDGIO 5.0 project. These business needs combined with the design principles compiled from the SotA were transformed in an initial set of requirements and a high-level design of the AI REDGIO 5.0 Data Spaces architecture, outlining the internal components but also illustrating some indicative connections with the other tools of the project, but also possible connections with the legacy systems and applications of the foreseen users. Finally, after evaluating existing open-source solutions for the implementation of Data Spaces, based on aspects such as openness, compatibility with frameworks and technologies to be used in other Tasks (such as Arrowhead), we have selected candidate solutions and initiated the experimentation with them to identify if they fit the AI REDGIO 5.0 needs and will provide the basis for the development activities of T4.5.

Results

- SotA
- Initial AI REDGIO 5.0 requirements specification
- AI REDGIO 5.0 Data Spaces high level design

Next steps in the next Reporting Period

During the upcoming reporting period we plan to continue with the evaluation of the EMVDS as a viable open-source solution for the needs of the AI REDGIO 5.0 Data Spaces, though hands-on experimentation and customisation. Additionally, in collaboration with T4.1 the draft architecture design of the Data Space and its placement within the AI REDGIO 5.0 Reference Architecture will be refined. These activities will lead to the development and delivery of the AI REDGIO 5.0 Data Spaces that will be available to the experiments facilitating secure data exchange.

Meetings

Meeting: Industrial cases	22/02/2023	Connection to Application Experiments and Industrial Cases
Meeting: Industrial cases	18/04/2023	Connection to Didactic Factories Test before Invest Experiments

Deviations

The Task T4.1 has been impacted by WP2 deliverables delay and it was still on going at M9 with 1-month's delay for the paper and public version of deliverable D4.1 that will be delivered at M10 (initially envisaged for M9).

3.3.5. WP5: Industry 5.0 EDGE AI Toolkit & AI-On-demand Platform

WP5 worked during this reporting period to lay the foundations of the infrastructure and the technical solutions that will be offered to the pilots for designing, deploying and running their AI solutions to cover the needs of their use cases. As such, research in WP5 during this period was on the definition, specifications and initial designs of the Collaborative Intelligence platform, the AI Pipeline Lifecycle solution and its interoperability with the AIoD platform, and the Open hardware.

T5.1 Collaborative Intelligence Platform for Industry 5.0

Responsible: SCCH Contributors: All Technological Providers

Objectives for the Reporting Period

The objectives of this reporting period were to:

- Understand the needs of the Pilots in relation to their Collaborative Intelligence (CI) needs.

- Proceed with the literature review of the state-of-the-art in CI, with special emphasis on Human-in-the-Loop solutions.
- Preliminary design of the platform that will integrate the CI component.
- Identify CI needs for Open Call

Progress during the Reporting Period

During this period, T5.1 made progress on all open fronts. A round of interviews was conducted with the technical managers of the Pilots, which allowed to understand their needs in terms of CI and other technical aspects of how to integrate the human operator. A literature survey was performed on the existing solutions to implement CI in industrial environments, being our focus on Human-in-the-Loop approaches. In addition, the task advanced in the requirements gathering and design of the final infrastructure that will integrate the CI solution and during this process a list of recommendations to help in the Open Call design was obtained

Results

- Initial design of CI component
- Initial design of the integration of the above-mentioned component in an Edge environment
- State-of-the-art CI solutions in the manufacturing environment

Next steps in the next Reporting Period

For the next reporting period, one more iteration on the design of the CI component will be performed, while work will focus on its integration into the platform. In addition, the Pilots will have already available their data, so the task will be ready to start working on the adaptation of our platform to facilitate the prototypical implementation of the various solutions. In addition, T5.1 will be able to make public the CI solution, so that they can be used by the Open Call participants.

T5.2 Open Hardware Platform for Embedded AI and AI-at-the-Edge

Responsible: HOPU Contributors: All Technological Providers

Objectives for the Reporting Period

During this phase, the primary goal was to assess the selected hardware's capabilities and its proficiency in executing artificial intelligence models, specifically focusing on TinyML models. This involved designing, developing, deploying, and documenting an AI to validate the hardware's performance and compatibility with such models. In principle, the steps that were targeted to reach this objective were the following

1. Designing the AI Model. Purpose: To create a model that can efficiently run on the chosen hardware and perform the required tasks.
2. Developing the AI Model. Purpose: To translate the design into a functional model capable of making predictions.
3. Deploying the AI Model. Purpose: To integrate the developed model into the selected hardware and ensure its seamless operation.
4. Documenting the Process. Purpose: To maintain a detailed record of the entire process, from design to deployment, for future reference and improvements.
5. Verification of Capabilities. Purpose: To confirm the hardware's ability to run TinyML models efficiently and to validate the accuracy and reliability of the deployed AI model.

Progress during the Reporting Period

The progress achieved during this period included:

1. Designing the AI Model. Process: Involved understanding the requirements, selecting appropriate algorithms, and structuring the neural network to meet the example needs.
2. Developing the AI Model. Process: Included coding the model, selecting and preprocessing the training data, and training the model using suitable machine learning techniques.

3. Deploying the AI Model. Process: Involved converting the model to a format compatible with the hardware, configuring the hardware settings, and loading the model onto the device.
4. Documenting the Process. Process: Included recording each step of the design, development, and deployment phases, noting any challenges encountered and solutions applied.
5. Verification of Capabilities. Process: Involved feeding real-world data to the model and analyzing the predictions or classifications made by the model, comparing them against expected outcomes.

Results

The main results recorded based on the progress steps, were the following:

1. Designing the AI Model. Outcome: A conceptual framework for the AI model, ready for development and training.
2. Developing the AI Model. Outcome: A fully trained AI model, optimized and ready for deployment.
3. Deploying the AI Model. Outcome: The AI model successfully installed and operational on the hardware, ready for real-world application.
4. Documenting the Process. Outcome: A comprehensive documentation providing insights into the model's creation and implementation, serving as a valuable resource for future developments.
5. Verification of Capabilities. Outcome: The hardware demonstrated its capability to run the AI model effectively, confirming its suitability for implementing TinyML models.

Next steps in the next Reporting Period

The next steps consist of applying the knowledge acquired to carry out a similar process but this time applying it to a more industrial environment and its integration within a framework on the edge.

T5.3 Cloud-to-Edge AI Pipeline Lifecycle Management Platform for Industry 5.0

Responsible: SUITE5 Contributors: All Technological Providers

Objectives for the Reporting Period

The objectives for this reporting period have been:

- Understanding the user needs relevant to AI and ML algorithms to use
- Evaluate different solutions to facilitate the needs of the project relevant to edge/hybrid cloud execution of AI
- Design the architecture of the AI Pipeline Lifecycle Management Platform

Progress during the Reporting Period

During the reporting period, the current task progressed according to plan. User needs and requirements have been extracted by dedicated interviews with the experiments and through online and physical workshops held in the frames of the consortium meetings, and these requirements have been transformed in technical requirements that should be covered by the platform to be developed. In parallel, an investigation of candidate solutions to be used as the basis of the development took place, evaluating both the coverage of the requirements coming from users, as well as the architectural requirements such as the need to deploy models on the Open Hardware, etc. Finally, the design of the architecture diagram of the AI Pipeline Lifecycle Management Platform has commenced.

Results

The results of T5.3 during this period have been:

- Interpretation of user requirements to technical needs
- Evaluation of different alternatives for the AI pipeline design and deployment
- Initial selection of frameworks for AI execution (Python + Tensorflow)
- Initial designs on the architecture to be used.

Next steps in the next Reporting Period

For the upcoming reporting period the foreseen steps have to do with the further development of the AI Pipeline Management platform and its population with different AI models to make it available for integration and to be provided to the AI-REDGIO 5.0 experiments in order to run and manage their AI-models

T5.4 Edge AI Reference Implementations for Industry 5.0

Responsible: SUITE5 Contributors: All Technological Providers

Objectives for the Reporting Period

The objectives for this reporting period was to:

- Design the overall process of information retrieval and treatment
- Identify specific assets that shall be Included in the description of each AI reference implementation to be recorded
- Discuss on the classifications of the AI reference solutions to be included
- Design a template for collecting information

T5.4 aims at collecting reference implementations of Edge AI models and assets in manufacturing business cases, coming from open-source initiatives and the partners' background and experience (e.g. previous AI projects). Such reference implementations will be complemented by specific Edge AI models and pipelines that will be created in the AI REDGIO 5.0 project to address concrete problems on which the experiments focus. The portfolio of Edge AI reference solutions in T5.4 shall be described in a model-interoperable format (e.g. ONNX, PFA), whenever needed, and classified in a sound manner, across their breadth of intelligence, their learning ability and paradigm, the targeted manufacturing problem type, and the AI asset type.

Progress during the Reporting Period

During this reporting period, the team of T5.4 worked towards designing the required template for collecting the information to formulate the pool of reference AI solutions to be documented, and defined the process of collecting the information, the possible sources out of which this information will come and the technical infrastructure to be used for storing this information

Results

The main results recorded include:

- Definition of an information collection table, which is based on a high level taxonomy to be used for classifying the different solutions to be recorded.
- Initial identification of data sources that will be used for retrieving material
- Deployment of an online wiki to store the information

Next steps in the next Reporting Period

The next steps relevant to this task have to do with the actual collection of information by all engaged partners, the uploading of the material to the wiki and the proper classification of the information, to make it available to the project as well as to other interested parties

T5.5 Interoperability with AI-on-demand platform

Responsible: ENG Contributors: All Technological Providers

Objectives for the Reporting Period

For the reporting period the objective were:

- Exploring interoperability opportunities with the AI on Demand Platform
- Starting the study of open-source AI libraries to enhance interoperability and evaluating their ease of use
- Conceptualize preliminary interoperability solutions

Progress during the Reporting Period

During the reporting period, all tasks proceeded as planned. An analysis of the AIoD platform was conducted to identify interoperability opportunities within the portal layer, data layer, and experimentation layer. Particular emphasis was placed on comprehending the services that the AIoD platform exposes to facilitate the exchange of AI modules and AI solutions. Concurrently, activities for disseminating information about the AIoD platform were carried out to provide guidance to project partners on its utilization and contribution. Furthermore, a study was undertaken concerning open-source AI libraries and frameworks that implement interoperability standards. The primary objective of this task was to ascertain how these AI libraries can be employed and how interoperable standards can be leveraged to ensure the future assets of AI REDGIO 5.0 are compatible with other platforms. Lastly, amalgamating this information, an initial concept for interoperability solutions was formulated and presented to project partners.

Results

The conducted activities led to the following results:

- Identification of the ONNX library as a fast and framework-agnostic solution for interoperability.
- Organization and conduction of a webinar regarding the AIoD platform
- Individuation of two ways to exchange data and AI models with AIoD
- Preliminary design of two connectors to access AIoD bidirectionally using the AI REDGIO 5.0 Pipeline Manager

Next steps in the next Reporting Period

During the upcoming reporting period, studies will be undertaken to explore additional open-source AI libraries and assess opportunities for interoperability with the AIoD platform. Furthermore, the two aforementioned connector designs will be subjected to additional validation procedures subsequent to their full development and integration into the AI REDGIO 5.0 Pipeline Management platform. Following the development and testing of the connectors, the commencement of AI asset and AI pipeline exchange will become feasible.

Meetings

Apart of the plenary meetings of the project, WP5 held bi-weekly teleconferences, while ad-hoc telcos were also scheduled.

Deviations

No deviations to be reported during the Reporting Period

3.3.6. WP6: AI REDGIO 5.0 Application Experiments

WP6 is the experimentation and validation Work Package. Being the Work Package where all experiments are deployed, it has a strategic role in the project and collaborates with all other Work Packages.

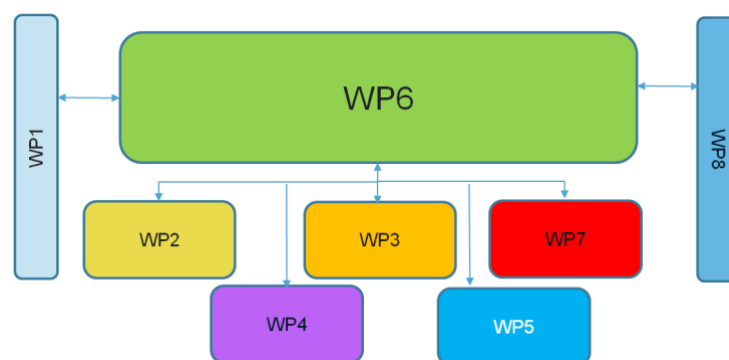


Figure 3: WP6 role in the project

In the reporting period the activities were focused on developing the methodology and indenting KPIs – T6.1. The experiments, described here below in T6.2, T6.3, T6.4, started in month 6, while T6.5 will start in month 12.

T6.1 Application Experiments Coordination & Assessment

Responsible: ARTER Contributors: POLIMI

Objectives for the Reporting Period

To supervise and coordinate the 7 AI REDGIO 5.0 SME-driven Experiments plus the 14 Didactic Factories, defining common methods, tools, KPIs to foster their deployment and to evaluate their achievements

Progress during the Reporting Period

In the first 9 months of the project, T6.1 was in charge to develop the methodology for coordinating and supervising the experiments.

The tools developed consist in:

- The application and refinement of the REM methodology (developed in the framework of WP2), and particularly the preparation of a Trial Handbook aimed at monitoring the experiments and their progress. (see WP2 for further details)
- The development of a template for describing in deep the experiments and their deployment, and to map their needs in terms of architecture to be developed/adopted; components to be developed for integration into the platform/s and needs towards EDIH – technology and business services.

In March and April, therefore before the start of the experiments, 3 meetings were organized in which the experiment owners presented their experiment and described the scenario as is and to be.

The meetings were moments of fruitful discussion and comparison between the experiments, as well as the opportunity to explain the methodology to be adopted.

Finally, in June and September, the experiments and their progress made in the deployment were presented in plenary project meetings.

Results

- The Methodology for the monitoring of the experiments has been developed
- Chapter 1 and chapter 2 of the Trial handbook have been filled out by almost experiments

- All experiments started in due time and are running
- All experiments depicted As IS and TO BE scenarios

Next steps in the next Reporting Period

- Continuous monitoring and support of the experiments
- D6.1 AI REDGIO 5.0 Experiment Plan - M12

T6.2 SME-driven Experiments in AI REGIO Regions

Responsible: SIG Contributors: AI REGIO regions, Technology Providers, SCAMM PERNOUD POLYCOM

Objectives for the Reporting Period

Three SME-driven experiments in AI Regio Regions will be conducted by SCAMM, PERNOUD and POLYCOM. In T6.2 the experiments are planned, prepared and executed. Further monitoring and evaluation will be done according to the methodology and KPIs defined in T6.1

Progress during the Reporting Period

According to the methodology As-Is and To-Be values were defined for each experiment and continuously checked for progress. Further monitoring was done via the Progress check, a Sprint Burndown chart and a measurement for human centricity for each experiment.

Results

The experiments started timely and are running. If experiments were lacking in KPI adjustments were made accordingly to progress.

Next steps in the next Reporting Period

The experiments will be continuously monitored and achievements as well as lessons learned evaluated. Further business requirements will be matched with experiment needs and reported at M18.

Industrial Pilot I: SCAMM

Objectives for the Reporting Period

For SCAMM as an END-USER:

- Increase productivity
- Decrease waste production
- Reduce operating costs
- Improve quality by reducing variations among products

For SCAMM as a PROVIDER:

- Expand the value proposition with additional services (monitoring and anomaly detection, process parameters optimization, predictive maintenance)
- Increase market competitiveness
- Decrease maintenance costs

For Intellimech:

- Deepen its knowledge concerning AI support tools for manufacturing and expand its business offering
- Achieve a scalable and flexible tool that can be extended to other IMECH partners with similar needs

Progress during the Reporting Period

A requirement analysis has been performed:

- Identification of relevant parameters impacting on quality, e.g. lubrication
- Necessity to storicize process parameters that are currently available only from the PLC
- Necessity to manually storicize some process parameters
- Necessity to implement a Data Lake to storicize quality data (synthetic index and images) and process parameters
- Necessity to improve the prototype developed during the DIGITbrain EU program responsible for quality data acquisition and processing

Results

- Query the PLC for process parameters leveraging OPC UA protocol
- Manual Input from operator for process parameters that can't be measured by a sensor

Progress check in line with effort

Next steps in the next Reporting Period

During the first iteration, IMECH and SCAMM will perform a preliminary requirements elicitation analysis, then PORINI will implement the IT architecture (cloud at the edge) for the data collection and data analysis. Afterwards IMECH will implement the AI model and AI support tool relying on the data coming from the IT system and the output of the INTEGRABLE system (automatic quality control implemented with the support of DIGITbrain). Finally, the system will be tested in a laboratory conditions in order to identify possible improvements to be implemented in the second iteration and achieve the final prototype to be validated in an industrially relevant environment

Industrial Pilot II: PERNOUD

Objectives for the Reporting Period

The objective of this experiment is to keep control of the time by anticipate sooner as possible.

- Retrieve the shopfloor efficiency with an optimized planning to increase the annual volume of production (+10%).
- Reduced the latency to take decisions by automatic prescriptions (planning and methods) to keep control of time

Progress during the Reporting Period

- Design of workflow to increase turnover and reduce cost and leadtime

Results

Progress Check : 66% due to staff turnover

Next steps in the next Reporting Period

- Finalize the new data base
- Work with Polytronics for Technology provider's search
- Integrate the new top management in the project

Pilot III GPALMEC

Objectives for the Reporting Period

Safety benefits that augmented driving could bring:

- unload the driver from the fatigue to be constantly focused on the driving, obstacles avoidance and on the work process
- correct a wrong manoeuvre or a manoeuvre resulting from a distraction
- avoid potentially dangerous situation by warning the driver:
 - in case the machine is crossing its operating limits (e.g. steep terrain)
 - in case the operation safety is not guaranteed (e.g. slippery terrain)
- Positive effect on the farm economy and productivity:
 - repair cost reduction lowering machine down-time

Progress during the Reporting Period

GPALMEC Srl:

- electronic equipment selection:

- §3D camera
- §control unit for driving help
- 3D camera set-up & on-field test for line of trees following and obstacle detection
- started implementation of the communication between control unit and the camera via CAN-bus

FBK research centre:

- defined material for vehicle on-field routing and positioning
- material ordered

Geier Srl – machine manufacturer:

- defined data exchange table for communication with existing vehicle control system
- started software implementation on vehicle control system and on autonomous driving control system

Results

KPI	AS-IS VALUE	TO-BE VALUE	ACTUAL VALUE	VERIFICATION METHOD
Safety improvement	Driver has to look after the driving, the work to be done, avoid obstacles and dangerous driving conditions	The augmented driving function helps the driver to detect obstacles, to keep the machine within the row of trees and to warn the driver in case of machine's operational limit crossing	15%	Practical
Repair cost and down-time reduction	Machine more subjected to accident due to driver distraction or tiredness or because the operator did not detect an obstacle	The driving helps lower the accidents by correcting wrong manoeuvres, by keeping the machine within the row of trees and by stopping in case of obstacles	15%	Practical

Next steps in the next Reporting Period

The implementation of the experiment will continue

Industrial Pilot IV: POLYCOM

Objectives for the Reporting Period

- Decrease unplanned stoppages
- Improve stability of products' quality
- Increase operational life-time of the tools/machines/equipment
- Transfer of the concept to other machines and moulding tools in the company
- First step towards company-wide approach for predictive maintenance

Progress during the Reporting Period

Progress Check = 90 % due to lower intensity of activities during summer

Results

Arrowhead platform :

- Implementation in small-scale setup (testing of Service Registry, Authenticator, Orchestrator and Event Handler services) on RPI & OrangePI HW
- Development of certificate issuing scripts in Python (added to AH wiki -> <https://github.com/eclipse-arrowhead/core-java-spring/wiki/Certificate-Creation>)

Historical data overview:

- Python environment

Next steps in the next Reporting Period

- Further explore data points related to the moulding pressure that could be informative for the monitoring
- Exploration of historical data for the special cases
- Preparation of algorithms
- Explore and test solutions for dashboarding and data storage
- First implementation and testing

Pilot V: Quescrem

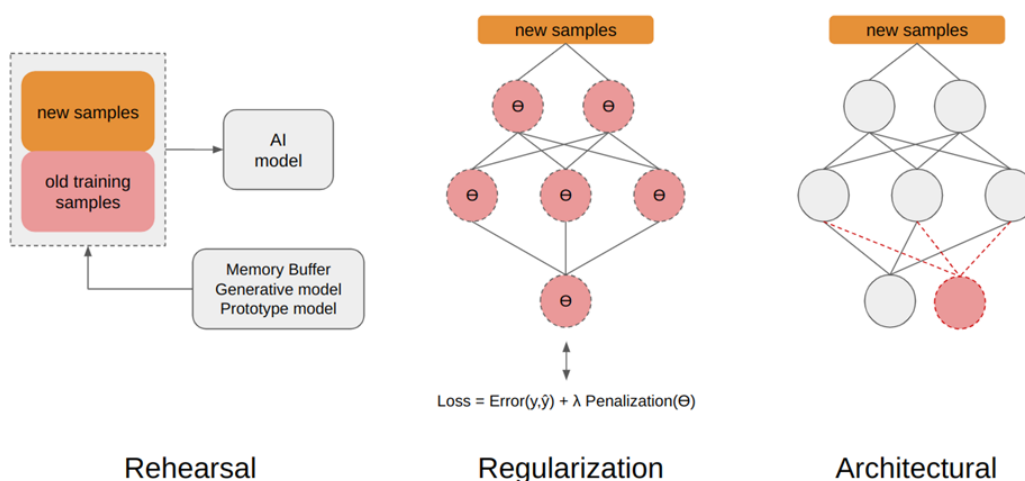
Objectives for the Reporting Period:

The objective is to improve the quality of the products and reduce waste, through the analysis of the data. The company stores parameters from the production process such as temperatures, pressures, fat, protein, etc.

Progress during the Reporting Period

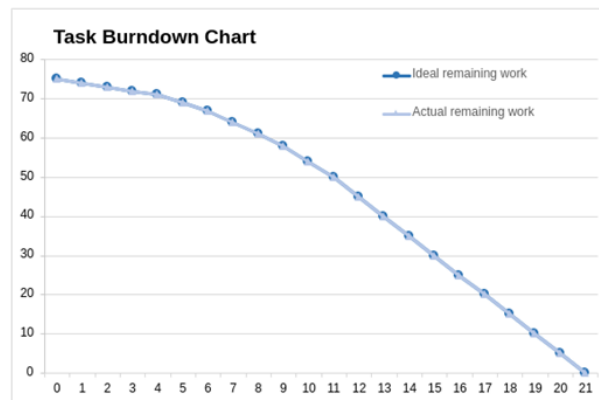
Continual Lifelong Learning: AI models can learn continuously and acquire new knowledge in real time.

Three main strategies:



Results:

KPI	AS-IS VALUE	TO-BE VALUE	ACTUAL VALUE	VERIFICATION METHOD
Waste generation decrease percentage	3,5 %	2,5 %	3,5 %	Measured by QUESCREM after the production process
Tanks released out of specification	62 %	50 %	62 %	Measured by QUESCREM during the production process



Next steps in the next Reporting Period:

The implementation of the 3 scenarios will continue

Pilot VI CAP

Objectives for the Reporting Period

- Physical and Technical Specification for the automated cell approved and initial construction of the production line completed
- Operational process defined and quality objectives identified
- Custom connectors developed for cobot and camera/projector systems

Progress during the Reporting Period

- Physical build of the automated cell has been completed ready for testing
- Proof of Concept and initial testing of production line in progress
- Custom connectors for Industweb platform completed and tested

Results

- Confirmed communication between cobot, smart tools, Vision System and Projection system

Next steps in the next Reporting Period

- Vision system tools to be developed into proposed Quality Checking process and AI model for vision system to be developed and tested

Pilot VII: Katty Fashion

Objectives for the Reporting Period:

- defining the concept of **QUAD-AI@E**
- designing a block diagram of the **automatic defect detection system**
- designing a processing flow using **AI fuzzy algorithms**
- **classification of a first category of defects**- acquisition of images with a Raspberry PI development system

Progress during the Reporting Period

Progress Check -90 % lower intensity activities during summer

Results:

- final concept realised
- block diagram designed
- processing flow using **AI fuzzy algorithms** designed
- **classification of a first category of defects** realised

Next steps in the next Reporting Period:

- development of **fuzzy AI algorithm**
- making a database of defects in clothes

- simulation of the Fuzzy AI algorithm in Matlab and its validation
- implementing the fuzzy AI algorithm in "edge AI" technology
- system testing and validation

T6.4 TERESA Experiments in TEF Network

Responsible: EAI Contributors: POLIMI, AI REGIO and AI PILOT regions

Objectives for the Reporting Period

The task started at Month 6 and will continue till the end of the project. During the first reporting Period, the objectives of the first months were to define and raise awareness among the DFs of the framework and goals of the experiments, besides starting to set the scene for their overall planning and execution in the next period.

Progress during the Reporting Period

The TEchnology and REgulatory Sandboxes (TERESA) Model was described and its twofold objective explained to the DFs which are going to host them i) a technical validation of the Human-AI interaction solutions, following the test-before-invest paradigm, and ii) a regulatory and ethical validation of such solutions, taking into account key challenges. The roadmap for the TERESA deployment was agreed and most of the DFs started to plan their experiments. More details follow hereunder.

Results

Common understanding on the TERESA Model in AI REDGIO 5.0 and initial planning of the future experimentations and testing activities within the DFs.

Next steps in the next Reporting Period

Completion of the planning, first running of the TERESA experiments according to the defined timeline and Testing Plans, involvement of the Competent Authorities and of the volunteers. Hereafter objective and progress made by Didactic factories are presented.

DFI. Industry4.0Lab

Objectives for the Reporting Period

The experiment aims at improving the efficiency of an HRI task in executing highly flexible activities. In particular, it targets a handling-oriented clustering of shapes derived by an image processing. After this clustering a data-driven (and properly trained) algorithm for the selection of the most effective combination of cobots and end effectors is supposed to be implemented.

The expected results comprise:

- Improved efficiency for electronic boards handling (decrease of crack and of drops during manipulation).
- Diminished setup time.
- Diminished variance due to specific worker's expertise.
- Increase of multidisciplinary skills trained to thesis students

Progress during the Reporting Period

Identification and involvement of the experiment team, of the motivation of the experiment and of its site. Preliminary identification of the experiment's framework from the social, economic and legal/ethical point of view. Preliminary identification of the expectations and requirements from eDIHs/Platform. Analysis of the main challenges and benefits

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

The implementation of the experiment will continue.

DFII. E2-Mech

Objectives for the Reporting Period

Specific objectives are as follows:

- To develop and propose an edge-computing platform for reliable time-consistent data gathering, elaboration and interfacing with cloud-computing systems.
- Possibly, including power units to drive motors and smart actuators.
- To develop and propose algorithms mixing AI methods, physics modelling and automatic control techniques for:
- CMP of standard servomechanisms advanced control and CMP of innovative servomechanisms, leading to more sustainable mechatronics
- To develop and propose tools and procedures to help the overall development process

Progress during the Reporting Period

Identification and involvement of the experiment team, of the motivation of the experiment and of its site. Preliminary identification of the experiment's framework from the social, economic and legal/ethical point of view. Preliminary identification of the expectations and requirements from eDIHs. Analysis of the main challenges and benefits.

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

Algorithms, tools and infrastructure development and integration [M6-M21]

- a) Continuing the previously-mentioned activities
- b) Validation of the correctness of the analytical models in fault condition with respect to real data.
- c) Local storage of data acquired through the ACTEMA Control; diagnosis platform.

First iteration testing and assessment [M19-M21]

DFIII. IJS Systems & Control Lab

Objectives for the Reporting Period

- Prepare testbed for self-evolving solutions for monitoring the production asset performance while targeting the repetitive processes such as assembly production lines
- Prepare affordable platform that could be scaled to other processes (data gathering & implementation of algorithms)
- Additional sensor implementation to the existing industrial environment
- Explore and enable development of a class of self-evolving monitoring algorithms
- Didactic exploitation of the data and platform (involvement of students in development and testing of new solutions)

Progress during the Reporting Period

- Overview of the current status and preparation of specifications
- Preparation of the initial platform for capturing the data from the local sensor and PLCs (use of NI ADCs and Industrial PC) -> prepared for implementation
- Initial work on the preparation of the algorithms
- Final platform development -> testing setup using ESP32 and OrangePI (ADC), local implementation of the Arrowhead platform

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

- Integration of additional sensors and initial platform, capturing of the first representative data
- Evaluation of the data
- Continuation of the work on the final platform (Arrowhead, ESP32, OrangePi)

- Preparation activities for the didactic workshops

DFIV. Flexible manufacturing

Objectives for the Reporting Period

The experiment is aimed at moving forward towards the following three paramount business benefits:

1. **Enhanced Product Quality**, significantly improving the accuracy of object recognition and sorting. This improvement directly translates to enhanced product quality by reducing errors in the manufacturing process, ensuring that products meet or exceed specified standards.
2. **Increased Productivity** through the implementation of synthetic data, directed to streamline the workflow by minimizing errors in the vision system. This efficiency boost is expected to lead to increased productivity, as fewer resources will be spent on correcting errors, allowing for a more seamless and efficient production process.
3. **Cost Reduction**, linked to reduced errors and increased productivity. The experiment anticipates a decrease in costs related to material waste, labor associated with error correction, and potential rework. This financial benefit contributes to the overall cost-effectiveness of the manufacturing process.

Furthermore, benefits are expected on process effectiveness, optimized production, improved company image, strategic competitiveness in the long run, employee empowerment and data-driven decision making.

Progress during the Reporting Period

Identification and involvement of the experiment team, of the motivation of the experiment and of its site. Preliminary identification of the experiment's framework from the social, economic and legal/ethical point of view. Analysis of the main challenges and benefits

Results

Setting the scene for the experiment's operation

Next steps in the next Reporting Period

Moving ahead with the implementation of the experiment.

DFV. AMC - Smart Box IIoT

Objectives for the Reporting Period

The main objectives of this experiment is to help SMEs to implement IIoT architecture and relevant AI applications with the low-cost, easy expand, flexible customization and low-effort deployment. The architecture and tools components presented in this experiment are designed to address the obstacles and challenges mentioned above for implement digitalization in SMEs.

The benefits: Improvement of the product quality and productivity for the applying the real-time monitor and predictable smart maintenance will also help to reduce the scrap rate and waste of production. Those application and smart production plan application can also improve OEE and reduce the energy consumption.

Progress during the Reporting Period

- HW:
 - Single-Board computers (eg. Raspberry PI) , Sensors, Cloud Server
- SW:
 - open source IoT platform. Ubuntu, python etc.
- Communication channel/s:
 - Ethernet, Bluetooth, etc.
- Standard used:
 - OPC UA, MQTT, HTTPS

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

The implementation of the experiment will continue.

DFVI. 4.0iLab

Objectives for the Reporting Period

Optimized Edge AI IIoT systems enables new types of applications:

- **Predictive Maintenance:** proactive equipment maintenance, reducing downtime and costs, and providing data-driven insights for optimized schedules.
- **Parts Traceability:** Real-time tracking, quality assurance, efficient recall management, and counterfeit detection, enhancing supply chain visibility and customer trust.
- **Quality Control:** Automatic defect detection, optimizes processes, and enables continuous monitoring, leading to improved product quality and manufacturing efficiency

Progress during the Reporting Period

Design and setup a testing environment for the generation of multiple and diverse deployment scenarios for edge-distributed applications:

- testing execution and collection
- performance metrics, data analysis

Evaluation and selection of different technologies

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

- IoT/Edge Hardware evaluation and selection
- Existing tools evaluation and selection

DFVII. PM50

Objectives for the Reporting Period

Predictive maintenance, where machine assets are continuously and algorithmically monitored using sensors

Progress during the Reporting Period

- Software: Existing code and models are being combined into modular toolboxes for efficient deployment and easier scaling.
- Hardware: A BOM for suitable hardware is being collected, hardware will be ordered soon

Results

- Setting the scene for the experiment's operation.
- AI needs identification.
- Focus on Human-machine collaboration aspects

Next steps in the next Reporting Period

The implementation of the experiment will continue.

DFVIII. Digital Manufacturing Innovation Hub

Objectives for the Reporting Period

The purpose of this experiment is to take a typical production scenario, demonstrated using the Mini 'Didactic' Factory at the DMIW facility, and use the data to create a stream of information which the IWOK system can use to suggest a solution for a problem to the Operator. The Operator can use their 'human' sensors to verify the solution and confirm/decline the solution to 'teach' the machine how to fix

the problem itself the next time the problem occurs. This experiment is motivated by the need to provide a higher degree of accuracy in automated problem solving and speed up a resolution using an AI-driven solution matrix

Progress during the Reporting Period

Identification and involvement of the experiment team, of the motivation of the experiment and of its site. Preliminary identification of the experiment's framework from the social, economic and legal/ethical point of view. Preliminary identification of the expectations and requirements from eDIHs. Analysis of the main challenges and benefits.

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

The implementation of the experiment will continue.

DFIX. MADE

Objectives for the Reporting Period

Acquire data related to operators' stress, such as work environmental data (e.g. temperature, pressure, humidity); biomechanical data (e.g. postural effort); and biometric data.

- Analyze and acknowledge operators state
- Identify specific human state by associating AI feedback to the single operators
- Adapt manufacturing task to the identified state
- Decreased of costs linked to unskilled labour
- Decreased production costs
- Increased product quality and value (i.e. decrease of defective components)
- Upskilling of operators
- Increased of operator wellbeing and satisfaction
- Increase of operators' employability
- Higher employment rate of low skilled labour
- Inclusion of frail workers category

Progress during the Reporting Period

Identification and involvement of the experiment team, of the motivation of the experiment and of its site. Preliminary identification of the experiment's framework from the social, economic and legal/ethical point of view. Preliminary identification of the expectations and requirements from eDIHs. Analysis of the main challenges and benefits.

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

The implementation of the experiment will continue.

DFX. TUIASI didactic factory

Objectives for the Reporting Period

The main objective of the experiment is to offer a technical alternative, through automation, to the manual operation of evaluating the quality of the products made by KAF

Progress during the Reporting Period

- defining the concept of QUAD-AI@E
- designing a block diagram of the automatic defect detection system
- designing a processing flow using AI fuzzy algorithms

- classification of a first category of defects- acquisition of images with a Raspberry PI development system

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

- a) development of fuzzy AI algorithm
- b) making a database of defects in clothes
- c) simulation of the Fuzzy AI algorithm in Matlab and its validation
- d) implementing the fuzzy AI algorithm in "edge AI" technology
- e) system testing and validation

DFXI. Testbed for Industry 4.0

Objectives for the Reporting Period

The main objective of the experiment is to detect a problem in the assembly process as quickly as possible from the cheap force and torque sensors. This can improve quality of the assembled parts and final product and reduce scrap rate of the assembly operation. This implies a reduction of the costs of nonconformance, but simultaneously the faster production will lead to a higher productivity

Progress during the Reporting Period

Identification and involvement of the experiment team, of the motivation of the experiment and of its site. Preliminary identification of the experiment's framework from the social, economic and legal/ethical point of view. Preliminary identification of the expectations and requirements from eDIHs. Analysis of the main challenges and benefits.

Results

Setting the scene for the experiment's operation.

Next steps in the next Reporting Period

The implementation of the experiment will continue.

DFXII. AAU Smart Lab

Objectives for the Reporting Period

- Improve operational efficiency: By collecting and analyzing data from sensors, SMEs can identify inefficiencies in their production/operations and take steps to optimize them.
- Enhance product quality: IoT data can help SMEs to monitor the quality of their products in real-time, identify defects, and take corrective action.
- Reduce costs: IoT data can help SMEs to identify areas where costs can be reduced, such as maintenance, and waste reduction.
- Enhance company image: By demonstrating a commitment to innovation and technology, SMEs can enhance their reputation and attract new customers

Progress during the Reporting Period

- Experiment Description
 - Preliminary experiments are conducted in AAU Smart Lab together with VELUX.
 - Main focus is to design and validation the ML methods for IoT box to detect irregularities and mistakes in the screwdriving process, to ensure better quality control of the products and improve efficiency of the manufacturing process.
- Experiment Set up

Results

Experiment description and set up.

Next steps in the next Reporting Period

Identify the scenario with selected SME to conduct the further experiments.

DFXIII. am Lab

Objectives for the Reporting Period

- to demonstrate the connection between different levels and locations of the manufacturing value chain
- to elaborate methodology for efficient connection among multiple layers
- production level-focused data harmonization
- to develop dedicated architecture
- to ensure an open-source, cross-learning and information sharing environment
- to encourage and educate regional SMEs by giving them overarching insight into the rationalization of machine data utilization beyond shop floor level

Progress during the Reporting Period

- Objective Definition
- Collaboration with INESC-TEC from Portugal:
- Architecture Design

Results

Experiment description and set up

Next steps in the next Reporting Period

- Deployment Across Partners: Implementing the Solution at Each Partner's Site
- Data Organization: Structuring and Managing Partner Data Effectively
- Issue Resolution: Debugging and Fine-Tuning for Smooth Operation
- Enhancing Monitoring and Visualization: Revamping the System for Improved Tracking and Insight
- Showcasing Success: Demonstrating the Solution in Action for Effective Results

DFXIV. Industrial Logistics Lab

Objectives for the Reporting Period

- To create a testbed in Galicia for novel Edge & AI technologies applied to manufacturing with an I5.0 approach
 - To serve as a valuable learning opportunity for gaining hands-on experience with cutting-edge technologies
- To boost collaboration among relevant actors in Galicia and create a joint approach for I5.0
 - To promote economic growth in the region
 - To sync efforts between European projects

Progress during the Reporting Period

- Continual Lifelong Learning: AI models can learn continuously and acquire new knowledge in real time
- Three main strategies: rehearsal, regularization, architectural

Results

Experiment description and set up

Next steps in the next Reporting Period

- Final DF facility identification
- Design of DF features
- Deployment of HW and services
- Test and validation

Meetings

WP2-WP6 Meeting: Industrial cases	22/02/2023	The objectives of the meeting were: • Present the Requirements Engineering Methodology including the objectives and the phases of the methodology, together with the synergies between WPs, the application for the AI REDGIO 5.0 experiments, (E)DIHs and Platforms and Data Spaces of the methodology and the next steps in relationship to the definition and application of the Requirements Engineering Methodology. • Presentation of the WP6 AI REDGIO 5.0 Application Experiments including an overview of Task 6.1. • Presentation of the AI REDGIO 5.0 Industrial Cases in which each experiment provided an overview including the general description, objectives, the social, economic and legal framework, the as-is and to-be scenarios and the foreseen implementation plan.
WP2 Task Leaders meeting	16/03/2023	The objective of the meeting was to analyse the activities performed during the first months of activity in relationship to Work Package 2. The WP leader presented an overview of the WP. Afterwards each task leader presented the status of each task and the next steps were discussed.
WP2-WP6 Meeting: Industrial cases	18/04/2023	The objectives of the meeting were: • Present the Requirements Engineering Methodology including the objectives and the phases of the methodology, together with the synergies between WPs, the application for the AI REDGIO 5.0 experiments, (E)DIHs and Platforms and Data Spaces of the methodology and the next steps in relationship to the definition and application of the Requirements Engineering Methodology. • Present the Technology REGULATORY Sandboxes (TERESAs) and its application in AI REDGIO 5.0 Didactic Factory experiments. • Presentation of the WP6 AI REDGIO 5.0 Application Experiments including an overview of Task 6.1. • Presentation of the AI REDGIO 5.0 Didactic Factories Test before Invest Experiments (1st round), in which each experiment provided an overview including the general description, objectives, the social, economic and legal framework, the as-is and to-be scenarios and the foreseen implementation plan.
WP2-WP6 Meeting: Industrial cases	04/05/2023	The objectives of the meeting were: • Present the Requirements Engineering Methodology including the objectives and the phases of the methodology, together with the synergies between WPs, the application for the AI REDGIO 5.0 experiments, (E)DIHs and Platforms and Data Spaces of the methodology and the next steps in relationship to the definition and application of the Requirements Engineering Methodology. • Present the Technology REGULATORY Sandboxes (TERESAs) and its application in AI REDGIO 5.0 Didactic Factory experiments. • Presentation of the WP6 AI REDGIO 5.0 Application Experiments including an overview of Task 6.1.

		• Presentation of the AI REDGIO 5.0 Didactic Factories Test before Invest Experiments (2nd round), in which each experiment provided an overview including the general description, objectives, the social, economic and legal framework, the as-is and to-be scenarios and the foreseen implementation plan.
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Deviations

No deviations have to be reported

3.3.7. WP7: Socio-economic Impact of AI-at-the-Edge Industry 5.

The main objectives of WP7 encompass several key aspects.

Firstly, it seeks to strategically plan and execute activities that assess and address the socio-economic impact of AI while adhering to the legal and ethical considerations outlined by the European Union. Concurrently, the WP aims to identify and fulfil the re-skilling and up-skilling requirements associated with the transition to Industry 5.0, with a particular emphasis on practical implementation within industrial contexts.

Additionally, within this WP, all necessary preliminary activities to develop a robust and effective exploitation plan will be conducted, which includes conducting comprehensive market and competition analyses, determining strategic positioning, performing SWOT assessments, formulating a comprehensive Exploitation Strategy, and establishing the requisite agreements.

Finally, in this WP the implementation of a business plan centered will be implemented tailored specifically to support the AI-at-the-edge DIH (Digital Innovation Hub) Network.

During M1-M9 period, WP7 has been focused on the analysis of relevant regulatory and ethical framework relevant for the AI REDGIO 5.0 tools and experimentations. Also an analysis of the main standards and certifications is on progress in order to identify the reference one for the AIREGIO5.0 project.

In addition, two surveys have been designed to collect information from project partners concerning their current AS-IS situation. Finally, starting from the exploitation results of AIREGIO project, a preliminary analysis of the exploitation methodology is in progress. A live asset database and an IPR database have been developed to start the identification and the description of the Key Exploitable Results.

T7.1 Legal, Regulatory and Ethical Issue

Responsible: EAI Contributors: POLIMI ENG Industrial Users

Objectives for the Reporting Period

The main objective of the task during this period was to identify and start the analysis, in conjunction with T2.4, of the legal instruments and ethical sources relevant for the project and its experiments.

Progress during the Reporting Period

The activities were mainly directed to select and starting the analysis of relevant regulatory and ethical framework relevant for the AI REDGIO 5.0 tools and experimentations, taking into account the peculiarities of the evolutions towards I5.0, AI-at-the-Edge and Digital Sovereignty and covering for instance privacy, security, data protection, safety and liability. The recent ongoing reforms, trends and initiatives were also explored, such as the AI Act and the Spanish Regulatory Sandbox for AI, the AI Liability Directive and other instruments underway.

Results

First selection and analysis of the sources relevant for the legal and ethical analysis and requirement's elicitation.

Next steps in the next Reporting Period

Further analysis of the legal and ethical documents and of their relevance for AI REDGIO 5.0 components and overall system, as well as experiments.

T7.2 Jobs, Competences and training action plan

Responsible: POLIMI Contributors: All Regions and Industrial Users

Objectives for the Reporting Period

The primary goal of the Polimi team in this endeavor is to create and implement a well-structured method for evaluating the existing levels of Data, AI, and digital proficiency within experiments (AS-IS), quantifying the desired AI and digital proficiency these experiments aim to achieve (TO-BE), and developing a specific action plan to facilitate the necessary transition to address identified gaps. This task will primarily concentrate on the People aspect, as it involves a comprehensive examination of the current job roles and professions within the project context to pinpoint potential skill deficiencies resulting from the adoption of Data, AI, and digital technologies. The approach being employed is a structured survey-based approach, aligning with AI on edge and Industry 5.0 principles, where both required and possessed skills will be analyzed and discussed, and suitable training programs will be identified to bridge these skill gaps.

Progress during the Reporting Period

To kickstart this methodology, the initial focus lies in the identification of new roles, professions, and the corresponding skills aligned with the project's scope. Thus far, 10 roles have been introduced, categorized into two distinct groups: "New Roles and Professions" and "Roles with Skills for Enterprises in the Context of Industry 5.0." These roles and their associated skills have been sourced from reputable references, including the Industry Observatory of Politecnico di Milano¹, the I4MS training website², as well as authoritative EU and academic sources.

Results

Following the introduction of these roles, two primary surveys: the "Prioritizing Survey" and the "Possessed-Needed Survey" have been designed to collect information from project partners concerning their current AS-IS situation. These surveys will be shared among the project partners to gather essential data and insights.

Next steps in the next Reporting Period

Continuing with the methodology, in the upcoming months of the project, the previously mentioned surveys will be distributed among project partners. Subsequently, the collected responses will undergo analysis. This analysis will involve extracting and evaluating the training activities needed based on the survey findings. Additionally, relevant workshops will be organized to validate and finalize the results obtained through this process.

T7.3 Standardisation & certification Action Plan

Responsible: LTU Contributors: All Technological Providers

Objectives for the Reporting Period

This task will focus on implementing the coordination and contributions of the AI-REDGIO 5.0 with the different initiatives in key bodies as ENISA, UNE/ISO, ETSI, IEEE and ITU-T; at the same time those contributions to alliances and initiatives as GAIA-X. In detail, key outcomes will be the data quality assessment contributing with a new reference document for quality of data coming from the different IoT sensors will following the IEEE P2510 standard, an ITU, UNE/ISO and GAIA-X best practices for quality

¹ <https://www.osservatori.net/it/ricerche/osservatori-attivi/transizione-industria-40>

² <https://i4ms.eu/trainings/>

of data coming from databases and external sources be assessed leveraging on the correlation and contextualization capacity from the FIWARE Context Broker, edge computing capabilities and embedded machine learning, and finally contributions to the ecosystem of Smart Data Models and Data Spaces with the results/experiences of the project.

Progress during the Reporting Period

In today's technology and standardisation landscape, significant advances have been made in a number of areas that are crucial for the development and implementation of innovative solutions. These advances are detailed below:

Contributions to Standards:

We have made contributions to two key standards that are shaping the future of technology and interoperability:

- Smart Data Models:
 - Description: Smart Data Models represent an initiative to standardise the way data is represented and shared between different systems and applications. These models seek to ensure that data can be easily understood, processed and used by different platforms without requiring complex transformations.
 - Resource: To facilitate the implementation and use of these models, a tool has been developed and is available in PyPI under the name [pysmartdatamodels](#).
- IEEE P2510:
 - Description: The IEEE P2510 standard focuses on defining metrics and methodologies for data quality and reliability, especially in contexts where data accuracy and integrity are crucial.
 - Importance: This standard is essential to ensure that data used in critical applications meets certain quality and reliability criteria.

Standardisation Events:

We have actively participated in three key events related to standardisation:

- ETSI M2M / CIM Meeting:
 - Description: This meeting focused on machine-to-machine (M2M) and common information model (CIM) communications. These topics are essential to ensure effective communication between different devices and systems in an increasingly connected world.
- IEEE P2510 Meeting:
 - Description: At this meeting, progress and proposals related to the IEEE P2510 standard were discussed. It was an opportunity to collaborate with experts in the field and contribute to the development of the standard.
- Data Spaces - GAIA-X/DSBA Meeting (SEMIC2023 interoperability):
 - Description: This event focused on data spaces and interoperability, with a special focus on GAIA-X and DSBA. The meeting addressed issues related to interoperability and how to ensure that different systems and platforms can work together effectively.
 - Importance: In a world where the amount of data generated is growing exponentially, ensuring interoperability and effective use of this data is essential.

In short, these developments and participations reflect our commitment to standardisation and the promotion of technology solutions that are interoperable, reliable and effective. We will continue to work in these areas and look for opportunities to contribute to the development of standards and innovative solutions.

Results

Standardisation is essential in the world of technology, especially when seeking to ensure interoperability between different systems and platforms. In this context, contributions in the field of standardisation are vital to move towards a more cohesive and functional technology ecosystem.

Standardisation contributions with pysmartdatamodels: The pysmartdatamodels library is a tool designed to facilitate the implementation and use of Smart Data Models. These models seek to standardise the way data is represented and shared between different systems and applications. One of the most significant contributions has been the adaptation and improvement of this library to allow the insertion of data generated directly in a context broker.

Specific contributions to the pysmartdatamodels library:

- **Integration with Context Broker:** Functionalities have been introduced that allow data generated through pysmartdatamodels to be inserted directly into a context broker. This facilitates the management and distribution of data in real time between different applications and systems.
- **Data Transformation:** Tools have been added to transform data according to the standards required by the context broker, ensuring that data is compatible and easily interpretable.
- **Process Automation:** Process automation has been implemented so that once data is generated and transformed, it is automatically sent to the context broker without manual intervention.
- **Documentation and Tutorials:** The documentation of the library has been extended, providing tutorials and specific examples on how to use the new context broker related functionalities.
- **Feedback and Continuous Improvements:** A communication channel has been established with the community to gather feedback and make continuous improvements to the library, ensuring that it meets the needs and expectations of the users.

Contribution to Smart Data Models (<https://smartdatamodels.org/>): New data models have been contributed or existing models have been refined to address specific industry or sector needs. In addition, testing has been carried out to ensure that the proposed models are compatible with different systems and platforms, thus promoting interoperability.

Contribution to Data Spaces Business Alliance Convergence: Work has been carried out on the integration of the FIWARE Data Space Connector, ensuring its compatibility and functionality within the framework of the Data Spaces Business Alliance.

Assessment of Edge Computing Standards for IoT: Evaluation of standards such as OMA LwM2M and NGSI-LD, and their extension to Microshift (Redhat), is essential to ensure that IoT devices can communicate and operate efficiently in edge computing environments.

Extension to Microshift: Work has been done on the adaptation and extension of these standards to be compatible with Redhat's Microshift, seeking to take advantage of the advanced capabilities offered by this platform.

Next steps in the next Reporting Period

- Allignment of the AI Redgio 5.0 blueprint with the specifications and reference implementations for each of the pillars proposed by the OpenDEI framework (Data Spaces) / IDS-RAM specification.
- Guidelines for Data Quality Assessment and best practices for introducing it into AI for Industry 4.0, alignment with key standards and certifications as CEN/TS 17660 and IEEE 2510.
- Data Interoperability (Smart Data Models), best practices and automatization: py-smartdatamodels.
- Fair Data economy, AI and SITRA rulebook.
- Contributions to key standards in IEEE, ITU, ETSI, ENISA etc. from all partners.

T7.4 Market analysis, Exploitation Strategy and Action Plan

Responsible: ENG Contributors: All Technological Providers

Objectives for the Reporting Period

In the reported ENG carried out all the coordination activities of WP7 by organizing period meeting period and by reporting the status of the WP during the official monthly meeting.

Concerning Task 7.4, activities carried out during this first period concerned a preliminary identification of all AIREGIO Assets divided into Industry 5.0 Consultancy Package; Data Space / AI-at-the-edge Technological Package and Experiments / Open Calls Industrial Package.

Moreover, ENG started the design of the “Assets Database”, a live database of all results, ownership and co-ownership and license to be filled in by the KERs' owners according with specific templates ENG is going to finalize.

Progress during the Reporting Period

- Creation of the preliminary draft for the live asset database and also preliminary draft of the KERs' templates

Results

- Set up of the shared files
- Preliminary Market Analysis

Next steps in the next Reporting Period

- Creation of the ToC for the deliverable D “Market analysis, Exploitation Strategy and Action Plan

Meetings

Date	Meeting
30-03-2023	WP7 Regular Alignment
30-05-2023	WP7 Regular Alignment
30-08-2023	WP7 Regular Alignment

Deviations

No deviations emerged during the reporting period.

3.3.8. WP8: AI REDGIO 5.0 Communication, Dissemination and Liaisons

Work Package 8 (WP8) in the context of AI REDGIO 5.0 is dedicated to "Communication, Dissemination, and Liaisons." Its primary objective is to effectively communicate the project's activities, engage stakeholders, disseminate results, and establish the necessary promotional materials and communication channels to ensure visibility and accessibility to stakeholders. Additionally, WP8 seeks to cultivate a community around the project's activities, promoting interactions with other initiatives for collaboration, discussions, project development, scaling up, best-practice exchange, and experience sharing.

The key components of WP8 include a comprehensive Communication and Dissemination plan, which outlines objectives and strategies for achieving project goals. The Communication objectives are to build awareness and interest in the project among defined target groups, promote common understanding and alignment, and foster synergies with related projects and initiatives. On the other hand, the Dissemination objectives encompass ensuring effective internal communication among partners, creating public awareness, generating scientific interest by sharing acquired knowledge, methodologies, and technologies developed during the project, maximizing the impacts of project achievements, and actively involving stakeholders in bridging the gap between the project and its wider ecosystem. In conclusion, to achieve our objectives, Work Package 8 (WP8) has been divided into four specific tasks. Collectively, these tasks' divisions are playing a pivotal role in AI REDGIO 5.0's communication, dissemination, and engagement efforts. They have ensured that the project's activities and results have been effectively communicated, stakeholders have been actively engaged, and collaboration opportunities have been maximized, both within the project's boundaries and in the broader context.

T8.1 Scientific/Technological dissemination strategy and action plan

Responsible: AFIL Contributors: ALL

Objectives for the Reporting Period

During the reporting period, our primary objectives were to track and achieve specific targets for Task 8.1, which focused on our Scientific/Technological dissemination strategy and action plan. T8.1 will aim to optimize the project's influence by facilitating the dissemination of AI REDGIO 5.0's scientific and technological outcomes. This will involve the creation and execution of a Dissemination Strategy and Action Plan, which will encompass participation in exhibitions, conferences, webinars, workshops, and demonstrations related to AI.

Progress during the Reporting Period

In assessing our progress, we closely monitored four pivotal indicators throughout the reporting period: the count of Conferences and Events, the tally of Publications, the number of Articles, and the quantity of Datasets.

Results

Our strategic endeavours must now be both implemented and intensified as we aim to meet our ambitious Month 36 objectives, which call for at least 10 Conferences and Events, 6 Publications, 15 Articles, and 8 Datasets. By Month 18, we had established specific targets, which included a minimum of 2 Conferences and Events, 2 Publications, 5 Articles, and 3 Datasets. At the end of Month 9, we had achieved 2 Conferences and Events, no Publications, 4 Articles, and no Datasets.

Achieving these targets will necessitate a concerted effort and a revision of our strategies to ensure effective dissemination of our scientific and technological findings in the forthcoming months. It's worth noting that, particularly in the context of scientific publications and datasets, our initial Key Performance Indicators (KPIs) are in line with our expectations given that the project is still in its early development phase. During these initial months, we do not have the opportunity to provide precise scientific dissemination of the project's initial steps. We anticipate that the commitment from all partners will significantly increase once we achieve tangible and officially shareable results.

Next steps in the next Reporting Period

Moving forward, we are committed to redoubling our efforts to reach and surpass our established targets. We will work collaboratively to enhance our dissemination strategies and aim to produce a more substantial body of work for both scientific publications and datasets as the project advances beyond its initial development phase. We anticipate a substantial increase in partner engagement as we attain concrete and shareable results in the near future.

T8.2 Brand Management, Marketing & Communication

Responsible: AFIL Contributors: AI REGIO regions contribute

Objectives for the Reporting Period

During the reporting period, the primary focus was on accomplishing the goals established for Task 8.2, which encompasses Brand Management, Marketing, and Communication. The objective for T8.2 is to establish a robust and clearly defined strategy for enhancing communication efforts. This strategy aims to raise awareness of the AI REDGIO 5.0 project and engage stakeholders in the formation and expansion of an open and collaborative community that brings together all pertinent project actors and the broader ecosystem(s).

Progress during the Reporting Period

During the first months of the project, the Key Performance Indicators (KPIs) related to the task have been diligently tracked to gauge our progress in this task. These metrics encompassed the delivery of Templates and PowerPoint presentations, the evolution of the website and logo, website content updates, growth in social media followers, video construction (now under development), and the creation of flyers.

Results

By the end of Month 18, the objectives were to deliver one template, complete the development of one website and its corresponding logo, publish a minimum of nine updates on our website, distribute three newsletters, amass a following of at least 250 individuals across various social media platforms, produce three videos, and design one flyer. As of Month 9, we were on track for most of these indicators. Specifically, we had successfully delivered one template and completed the development of the website and logo. Additionally, we had distributed one flyer to our partners, updated the website six times, and accrued an impressive following of 248 on LinkedIn and 97 on Twitter. However, we had not yet published videos, even if the first one is under development, and the production of newsletters if expected to be released with the first one in the following weeks.

Next steps in the next Reporting Period

Looking ahead, our primary focus in the upcoming months will be dedicated to the creation and dissemination of newsletters. We have already devised release dates and content frameworks, with active participation expected from all partners in crafting articles. Furthermore, many of these newsletter updates will be strategically designed to direct readers to our project's website, thereby boosting overall website traffic.

Simultaneously, we are in the process of producing our first project presentation video, which will serve as a straightforward introduction to the project and its objectives. Following this, we have a schedule in place for additional videos, particularly those related to open calls, as well as other explanatory videos aimed at effectively disseminating project information.

T8.3 Liaison with other I4MS projects and DIHs

Responsible: POLIMI Contributors: AI REGIO regions contribute

Objectives for the Reporting Period

AI REDGIO 5.0 belongs to I4MS4.0 in HEP, following the successful SME-driven experience from I4MS in H2020 and in particular the AI REGIO Phase IV experience. The main objective of T8.3 is to establish cooperation liaisons with Made in Europe, Big Data AI and Robotics Partnerships as well as the Industry 5.0 movement in DG RTD.

Progress during the Reporting Period

In this initial period T8.3 had a twofold objective: on the one side to assure continuity with I4MS in H2020 (and in special mode with AI REGIO and KITT4SME, the two-Phase IV projects about AI adoption by SMEs) and on the other side to start collaboration with the other I4MS2.0 projects. In the former aspect, AIREGIO5.0 was actively participating to the organisation and execution of AI REGIO Final Event in Brussels on September 27th and thanks to common partners (e.g. ART-ER) we started collaboration with KITT4SME in the domain of Industry 5.0 and Human-Robot Interaction.

Results

AIREGIO5.0 was presented in the Regione Lombardia AI REGIO political event on September 25th (ESM and AI Vanguard Pilots) and in the introductory speech of Sergio Gusmeroli (POLIMI) during the AI REGIO final event. AIREGIO5.0 was also part of the Manufacturing Day organised by EFFRA (Made in Europe partnership) on September 26th.

Next steps in the next Reporting Period

The most important task after the conclusion of H2020 I4MS projects will be to give continuity of the I4MS portal and give initiation to a network of DIHs for AI in Manufacturing (ADRA association and its forum in Versailles on November 8-9 2023)

T8.4 AI DIH World and International cooperation

Responsible: POLIMI Contributors: AI REGIO regions contribute

Objectives for the Reporting Period

The main objective of the task is to keep close relationships and liaison with International Cooperation programs.

Progress during the Reporting Period

In the context of widening the network of regions and DIHs, first contacts have been sought with Vanguard Initiative (AI and ESM Pilots) and with Funding Box / TNO working in the BOWI project to implement collaboration corridors among less mature and more mature DIHs

Results

Two meetings have been held with Vanguard AI Pilot (18 september) and ESM Pilot (25 september), while intense collaboration with BOWI has started to create collaboration corridors among DIHs (EDIH summit 31 May 1 June 2023).

Next steps in the next Reporting Period

In the next period, we will intensify the International collaboration especially with the World Manufacturing Foundation in order to organise an International workshop in 2024.

Meetings

In addition to the regular WP status meetings where all WPs share their progress and updates, WP8 will enhance internal communication within the project. Monthly information related to the comprehensive goals of each WP will be collected by WP8 and then disseminated via email to all partners. Furthermore, a dedicated meeting with POLIMI, the task leader for T8.3 and 8.4, will be scheduled to discuss the next common steps. Another specific call will be organized to define communication objectives, particularly in anticipation of future open calls.

Deviations

There are currently no significant deviations from the project plan within WP8. The tasks and objectives are progressing as outlined in the initial project plan, and adjustments have been made to align with the project's evolving needs and goals. Any minor deviations have been addressed and managed effectively within the existing framework.

3.4. Use of resources

The overall evaluation of effort consumption at M9 is **245,84 PM**.

This information is based on internal reporting of AI REDGIO 5.0 partners provided on the basis of internal customized tables, managed centrally by the project coordinator.

The following Chart summarises the planned (M1-M9 and Total Planned) versus actual effort consumption allocated over Work Packages.

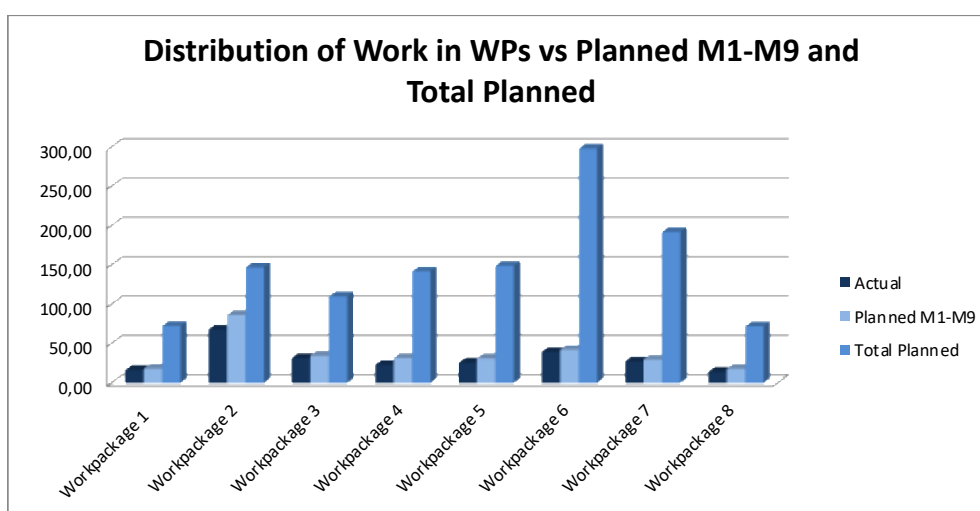


Figure 4: Distribution of Work in WPs vs Planned at M9

In the following pages you can find:

- A table with the overview of the used project resources per Work Package at M9: the resources allocated by the respective partners during the period M1-M9 are compared with the planned resources for the project for the period M1-M9 and the total planned resources for the whole duration of the project. The effort plans are based on the description of action values per partner and per Work Package/task. The actual values cover the first 9 months of the project (please consider them as provisional mostly for Sep23).
- A chart depicting the partner breakdown of planned (M1-M9 and Total Planned) versus actual effort consumption allocated over all Work Packages.
- A set of charts summarises the actual versus planned effort consumption allocated for each Work Package for each partner.

A pure linear assignment of the planned efforts according to the Gantt has been used.

Person-Months Status Table																																															
CONTRACT N°		101002009		Partner - Person-months per Workpackage																																											
ACRONYM		AFRICA																																													
PERIOD		M1-M9																																													
		TOTALS	1	2	3	3.1	4	4.1	4.2	5	6	6.1	7	8	9	9.1	10	11	12	13	14	15	15.1	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37		
			POLIM	SIG	ARTER	UNIBO	KCSIV	JSI	UL	BPI	OOOSIV	UTW	ATIL	POLY	HIT	FBK	MAKE	GAIN	MADECC	TUJASI	CVUT	MADE	AAL	PBN	ENG	SCCH	LTU	GRAD	IMECH	CARSA	MSSA	SUITE5	EAI	UNP	HOPU	POR	SCAMM	PERNO	ALMEC	POLYC	INNOL	KATTY	DMW	C2K	CAP		
Workpackage 1	Consortium Coordination, Innovation Management (POLIM)	Actual	16.41	5.00	0.20	0.17	0.26	0.36	0.00	0.00	0.75	0.00	0.39	0.97	0.47	0.24	0.00	0.65	0.25	0.25	0.24	0.00	0.25	0.00	0.33	0.39	0.20	0.13	0.10	0.14	1.39	0.20	0.22	1.16	0.22	0.00	0.10	0.10	0.14	0.17	0.13	0.13	0.13	0.25	0.13	0.13	
	Planned M1-M9	15.13	6.25	0.00	0.25	0.25	0.25	0.00	0.00	0.75	0.00	0.38	1.00	0.00	0.25	0.00	0.25	0.25	0.25	0.25	0.25	0.25	0.00	0.13	0.38	0.13	0.13	0.13	0.13	1.00	0.38	0.38	0.00	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.25	0.13	0.13		
	Total Planned	72.50	25.00	2.00	1.00	1.00	1.00	0.00	2.00	3.00	0.00	1.50	4.00	2.00	1.00	0.00	1.50	4.00	2.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Workpackage 2	Needs, requirements, evaluation for AI-driven I&O (CARSA)	Actual	66.15	2.45	0.50	1.00	0.70	0.00	0.50	1.20	1.40	0.47	0.00	1.53	1.40	0.00	0.40	1.40	0.72	1.45	3.48	0.00	1.40	2.12	0.00	0.40	1.30	0.70	1.50	6.30	0.50	0.50	1.33	1.17	0.00	2.33	4.24	2.99	1.00	6.23	5.54	4.00	1.00	1.22	2.16		
	Planned M1-M9	86.48	3.00	0.60	1.38	0.69	0.00	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38		
	Total Planned	147.00	5.00	1.00	2.00	1.00	0.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00		
Workpackage 3	EDIRIS Network for AI-at-the-edge Industry 5.0 (POLIM)	Actual	31.78	4.00	1.20	0.16	0.00	0.38	0.00	0.80	2.10	1.01	0.21	0.39	0.81	1.42	0.00	0.20	0.30	1.00	1.47	2.77	0.47	0.00	4.41	3.40	0.00	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Planned M1-M9	34.58	4.97	2.32	0.69	0.00	0.25	0.67	0.67	2.08	1.38	0.21	0.44	0.89	2.71	0.00	0.89	3.16	0.94	1.58	2.46	0.89	0.00	1.58	3.43	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	0.00
	Total Planned	110.00	15.00	6.00	2.00	0.00	1.00	2.00	2.00	7.00	4.00	1.00	1.00	3.00	8.00	0.00	3.00	10.00	3.00	5.00	7.00	2.00	0.00	5.00	14.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Workpackage 4	Industry 5.0 Data4AI Platform & Data Spaces (NBSA)	Actual	23.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Planned M1-M9	31.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	2.60	2.20	0.00	4.60	2.60	0.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	2.20	0.00		
	Total Planned	142.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Workpackage 5	Industry 5.0 EDGE AI Toolkit, On-demand Platform (SUITE5)	Actual	25.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Planned M1-M9	31.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total Planned	149.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Workpackage 6	AI REDDIO 5.0 Application Experiments (ARTER)	Actual	39.45	0.70	0.35	0.33	0.60	0.00	0.29	0.60	0.00	0.33	0.22	0.30	0.00	0.00	0.68	0.45	0.00	0.35	0.47	0.00	0.15	1.80	0.00	0.64	0.28	1.28	0.64	0.60	0.00	0.06	0.29	0.00	0.00	1.00	2.65	1.75	1.10	0.71	5.00	2.80	0.75	1.30	5.80		
	Planned M1-M9	42.18	1.32	0.57	1.04	0.57	0.00	0.29	0.29	0.57	0.00	0.43	0.25	0.29	0.00	0.88	0.43	0.43	0.29	0.43	0.43	0.00	0.43	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	0.00	0.43	
	Total Planned	298.00	9.00	4.00	5.00	0.00	0.00	2.00	2.00	4.00	0.00	3.00	2.00	2.00	0.00	3.00	3.00	2.00	3.00	3.00	2.00	0.00	3.00	3.00	4.00	2.00	2.00	4.00	4.00	8.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Workpackage 7	Socio-economic Impact of EDGE AI Industry 5.0 (ENG)	Actual	27.34	1.37	0.00	0.16	0.00	0.00	0.00	0.90	0.41	0.00	0.50	0.45	0.57	0.00	0.00	0.45	0.00	0.41	0.53	0.45	0.00	0.00	1.91	0.60	1.23	1.30	0.45	0.34	0.00	0.00	2.08	0.00	3.00	0.88	0.99	0.07	0.25	1.41	1.16	1.09	0.00	1.72	2.16		
	Planned M1-M9	29.53	1.71	0.23	0.23	0.00	0.00	0.21	0.25	0.91	0.46	0.00	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46		
	Total Planned	119.20	1.90	1.00	1.00	0.00	0.00	0.00	0.00	2.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Workpackage 8	Communication, Dissemination and external Liaisons (AFIL)	Actual	14.94	2.00	0.20	0.10	0.00	0.00	0.00	1.50	0.50	0.25	2.00	1.00	0.10	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
	Planned M1-M9	18.00	2.60	0.50	0.25	0.00	1.00	0.00	0.00	1.50	0.50	0.25	3.00	1.00	0.25	0.00	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		
	Total Planned	72.00	1.00	2.00	1.00	0.00	4.00	0.00	0.00	6.00	2.00	1.00	12.00	4.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Total Project		Actual	246.84	15.52	2.45	2.15	1.56	1.14	1.00	2.29	7.25	2.39	1.18	6.44	4.43	2.33	0.00	2.14	6.00	2.28	3.92	7.25	1.42	1.64	10.32	12.25	5.44	5.47	9.87	7.29	9.91	6.97	4.61	5.69	3.18	8.00	6.28	8.19	4.98	2.62	13.48	12.08	8.43	3.76	9.90	10.48	
	Person-month	Planned total	1182.30	76.00	16.00	12.00	7.00	6.00	8.00	9.00	28.00	11.00	6.50	25.00	16.00	13.00	0.00	13.00	20.00	9.00	15.00	17.00	7.00	8.00	14.50	32.50	22.50	25.00	37.50	29.50	35.00	47.50	45.50	38.50	42.50	48.50	44.50	36.50	29.50	36.50	61.50	54.50	41.50	16.50	31.50	38.50	

Table 11: Used Project Resources per WP and Partner at M9

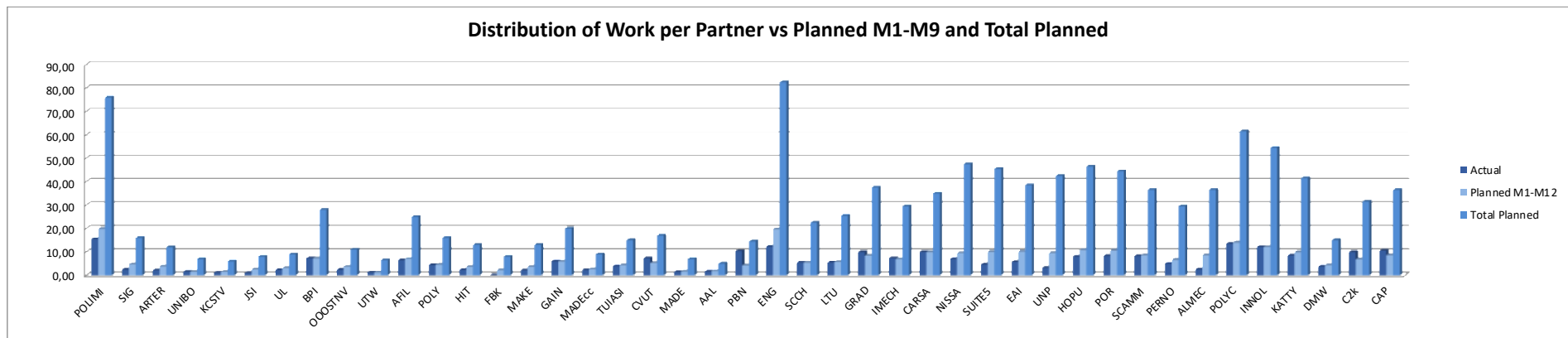


Figure 5: Distribution of Work vs Planned per Partner at M9

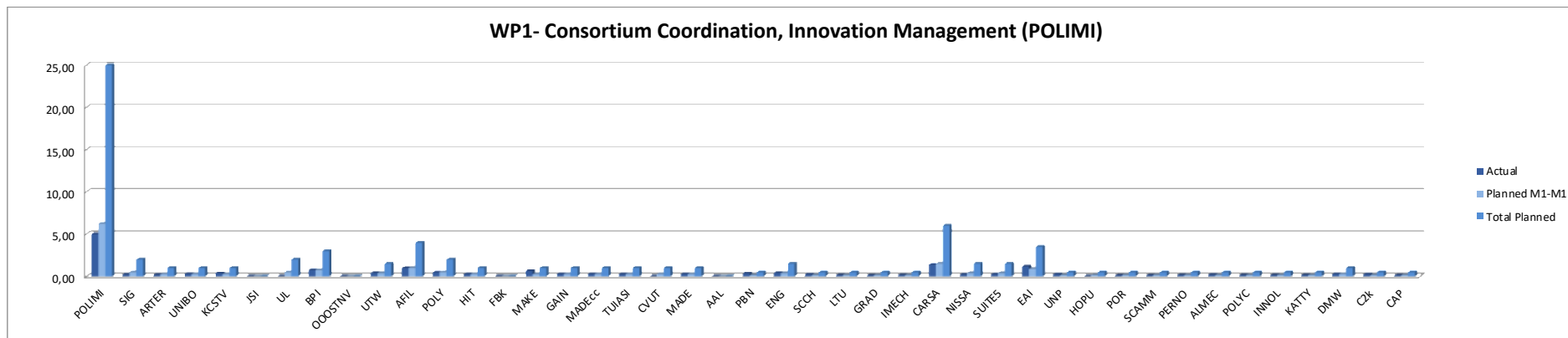


Figure 6: Distribution of Work vs Planned per Partner in WP1 at M9

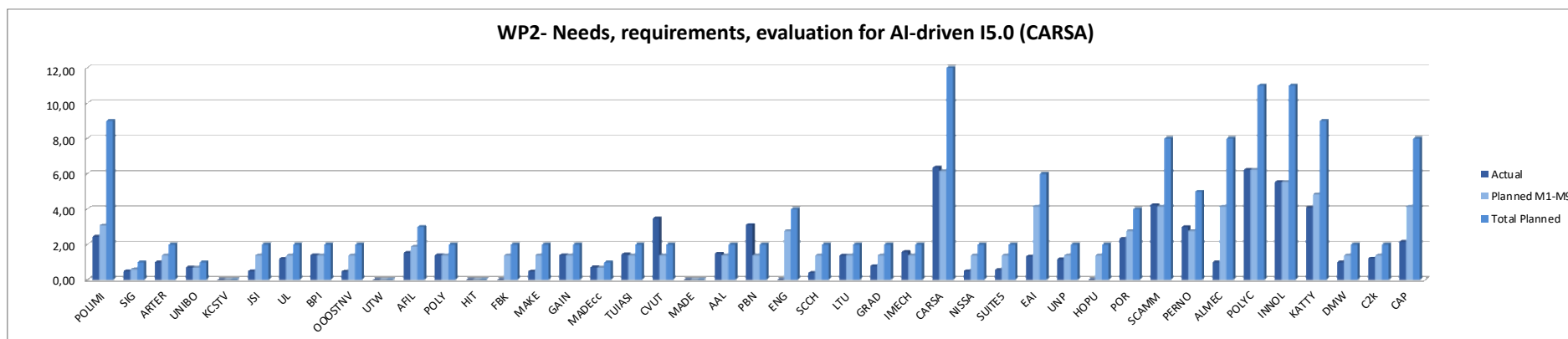


Figure 7: Distribution of Work vs Planned per Partner in WP2 at M9

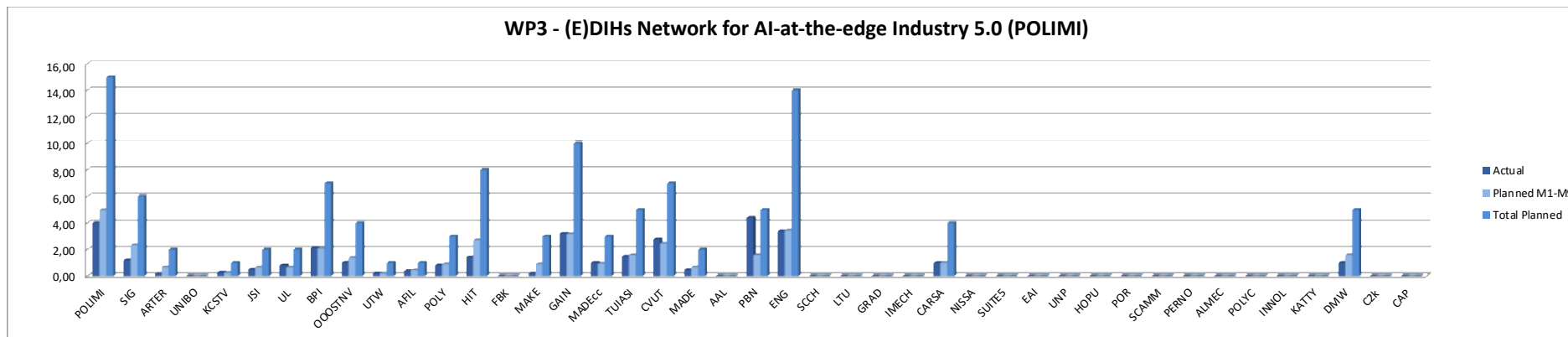


Figure 8: Distribution of Work vs Planned per Partner in WP3 at M9

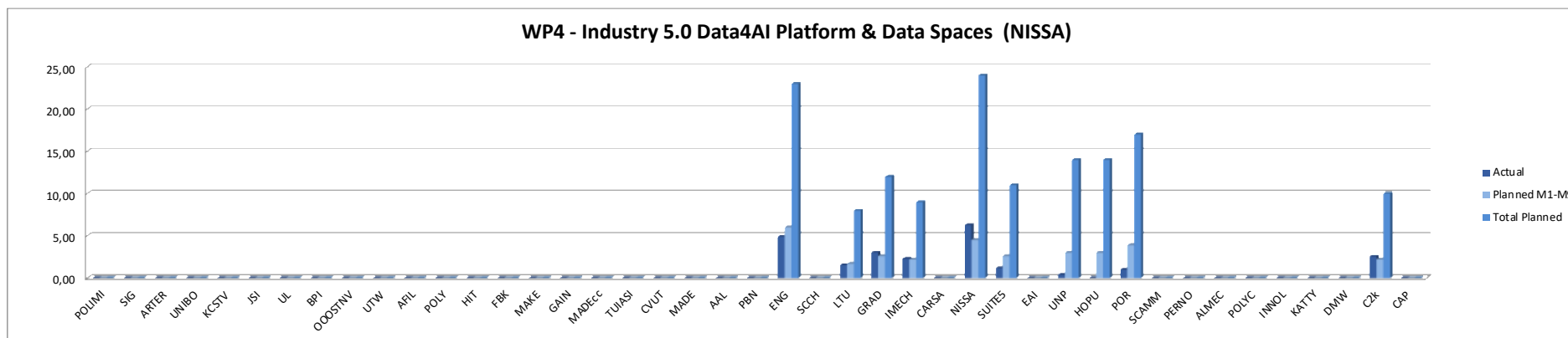


Figure 9: Distribution of Work vs Planned per Partner in WP4 at M9

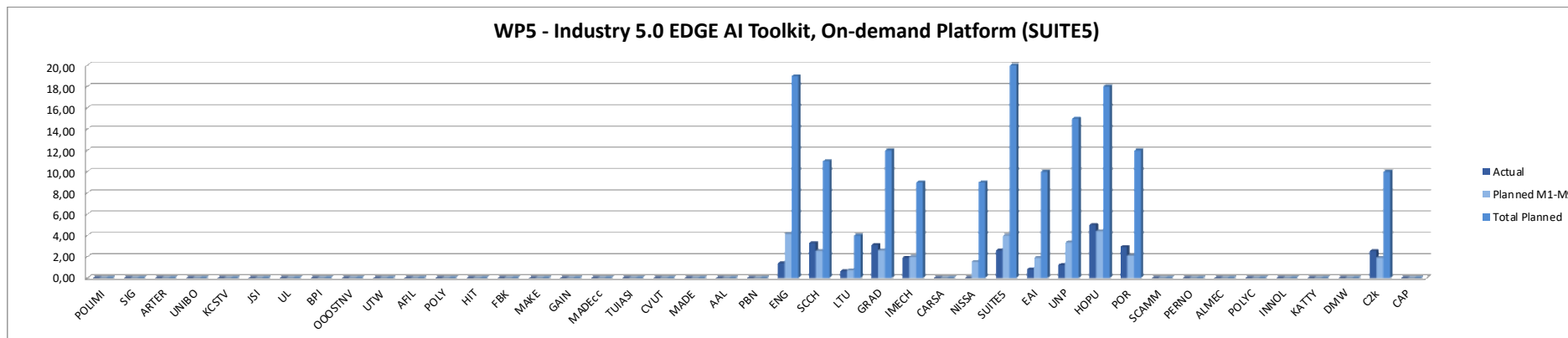


Figure 10: Distribution of Work vs Planned per Partner in WP5 at M9

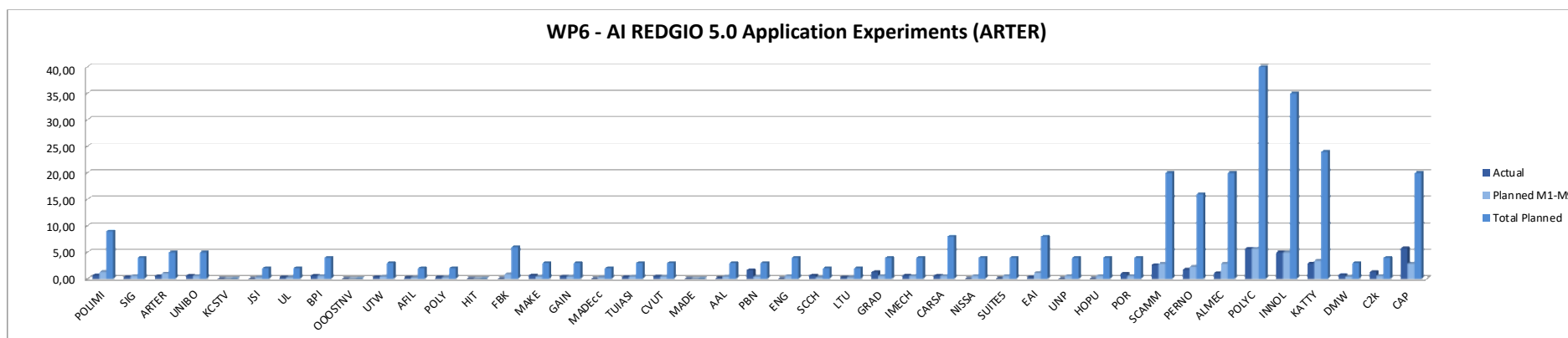


Figure 11: Distribution of Work vs Planned per Partner in WP6 at M9

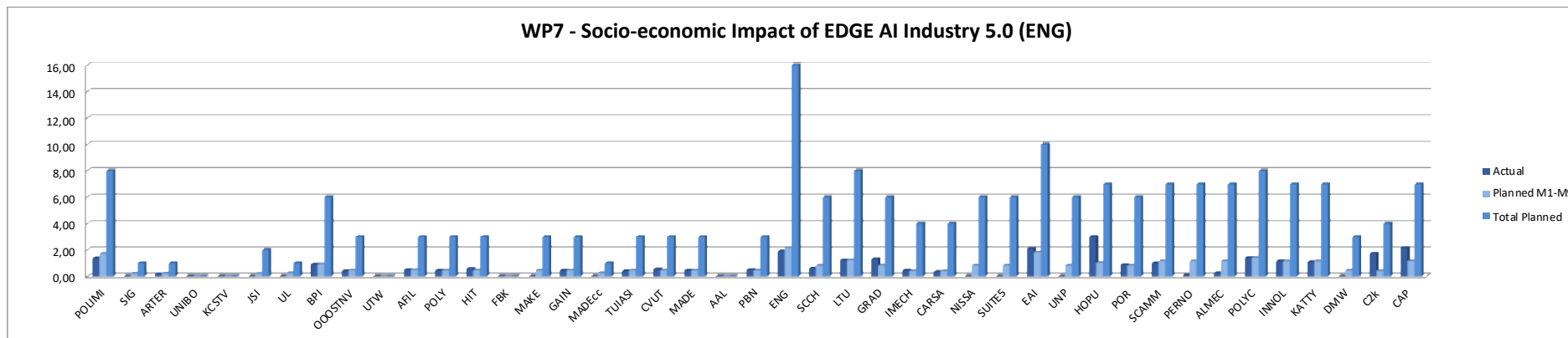


Figure 12: Distribution of Work vs Planned per Partner in WP7 at M9

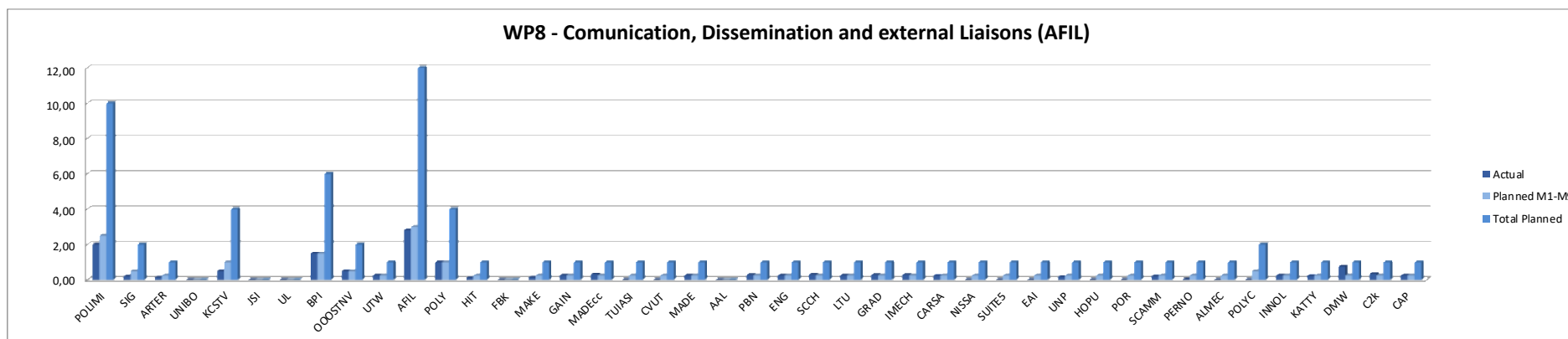


Figure 13: Distribution of Work vs Planned per Partner in WP8 at M9

4. Update of the plan for exploitation and dissemination of result

At M9 no need to update the plan described in Annex 1 (Description of the Action – DoA).

5. Update of the data management plan

At M9 no need to update the plan described in Annex 1 (Description of the Action – DoA).

6. Deviations from Annex 1/DoA

6.1. Tasks

A small delay in the WP2 (Task2.1 and Task2.2) and WP4 (Task 4.1), as D2.2, D2.3 and D4.1 have only been delivered in M10. No impact on the subsequent results of the tasks is expected since they are currently stopped and planned to restart at M21. Corrective concurrent engineering actions have been applied to mitigate any impacts to other activities associated.

The following chart provides an updated version of the work plan indicating the deviations.

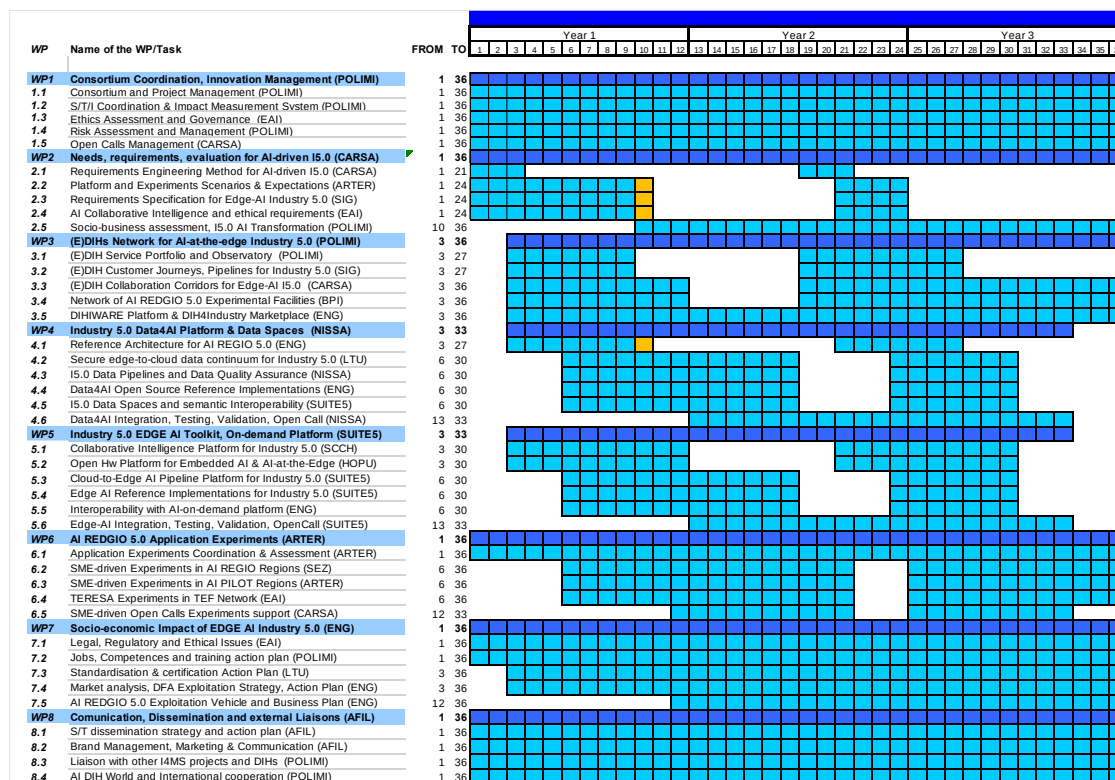


Figure 14: AI REDGIO 5.0 Updated Workplan

This will not produce any impact on the planned activities and future milestones and any change in budget and MMs reported.

6.2. Use of resources

Considering the warning threshold of $\pm 20\%$ actual vs. planned PMs and considering the effort consumption from the beginning of the project, the situation for the project is in line with the planned, being **245,84 PM** vs. planned **291,94 PM**, with a difference of **-15,79%**, below the warning threshold. In fact, all work-packages are quite in line with the plan, except WP4 which is below the plan of **-27,10%**. The current workload is lower than planned (using a linear distribution), due to few development activities have been started (causing underspending). It is to be expected that in the next period this workload will be much higher and we move to overspending in respect the pure linear approach used for effort monitoring.

The majority of partners are inline with the planned efforts (difference between -20% and +20%) and almost all the others show effort underspending, which justifies the **-15,79%**, figure. As project has just started, usage might be quite different from a pure linear assignment of the planned efforts according to the Gantt. Moreover, the hours reported in M9 are estimated and they will not be final until the end of M11, so they are subject to change. Moreover, usage might be quite different from a pure linear assignment of the planned efforts according to the Gantt.

6.3. Unforeseen subcontracting

No deviations reported at M9.

6.4. Unforeseen use of in-kind contributions from 3rd party against payment or free of charge

No deviations reported at M9.