MAGICIAN
AUTONOMOUS DEFECTS DETECTION AND REPAIR IN MANUFACTURING

DELIVERABLE
D1.3

Second coordination report

Work Package	**WP1 - Project Management**
Associated Task	**Task 1.1 Management and coordination of the project**
Deliverable Lead Partner	**UNITN**
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EXECUTIVE SUMMARY

This document summarizes the coordination efforts and progress of the MAGICIAN project. It describes the work undertaken in the second year, broken down by work package, and details the project exploitation activities. Additionally, it reports on the partners' estimated resource usage (where publicly permissible) and the project approach to open science management. The first coordination report was the D1.2 (M12), while future updates to this document are planned for D1.5 (M36), and the final D1.6 (M48).

DEVIATIONS

While no deviations have been observed in the report content, we have observed a delay in the submission of this deliverable with respect what was planned at the beginning, since in the second year of the project a lot of materials and components has been purchased and all the work packages started, thus the collection of all the financial and administrative data was more complicated.

In the second year, four additional deliverables have been slightly delayed, albeit the delay was communicated and accepted upfront by the PO. These deliverables are D3.2 and D4.2 and the delay of two weeks was due to the review meeting, held in mid-May, and the second integration week, held in Trento in mid-June. D1.4 was delivered a week after the end of M24, mainly due to internal discussions about the DAC and the data management. Finally, D5.1, concerning the demonstrator set-up in the ALT premises was delayed mainly due to logistics problems in sending the material in Turkey.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVATIONS

ACRONYM	DESCRIPTION
CA	Consortium Agreement
D	Deliverable
DMP	Data Management Plan
DoA	Description of Action
EC	European Commission
GA	Grant Agreement
KPI	Key Performance Indicator
QP	Quality Plan
ROL	Results Owner List
CR	Cleaning Robot
SR	Sensing Robot

WP	Work Package
T	Work Task
DAC	Data Access Committee

1 INTRODUCTION

This comprehensive deliverable serves as the coordination report for the MAGICIAN project, providing an exhaustive overview of the activities undertaken during the initial two-years period of the project's execution. It details the advancements achieved in relation to the overarching objectives delineated within the Description of Action (DoA), and furthermore, presents a granular breakdown of responsibilities and contributions, allocated on a per-partner and per-Work Package (WP) basis in for the first half of the project. An integral component of this report is the transparent disclosure of the estimated resource utilization incurred by the participants throughout this foundational phase. At the end, the document will engage in an analytical discussion regarding the preliminary indicators of project impacts and the strategic refinement of the exploitation plan.

From a managerial perspective, it is correct to note that all project activities have been executed in adherence to the DoA and the collaborative activities established amongst the consortium partners. This cooperative effort has been consistently fostered through a structured list of regular coordination meetings involving the WP Leaders, planned monthly. Additionally, dedicated WP-specific meetings have been conceived either on a recurring monthly schedule or on demand as need be by the technical developments. It is important to underscore that the orchestration of the technical work has been and will be pursued with an augmented degree of integration, thus requesting a tighter synchronism among the project partners. This heightened coordination is strategically designed to expedite the seamless integration of all the current and updated version of the MAGICIAN components into the foreseen robotic solutions, which are slated for rigorous testing within the designated operational environment along the lines, modalities and tests delineated in D5.1.

Finally, it is noteworthy to highlight that all the WPs are now active and implementing their operational phases, thus the project is now running at full speed.

2 EXPLANATION OF THE WORK CARRIED OUT AND OVERVIEW OF THE PROGRESS

In this second reporting period, the work followed the scheduled activities depicted in the project Gannt chart reported in the MAGICIAN DoA. At M13, WP6 started the activities towards the Open Calls definitions, the call for applicants, the evaluation process and the starting of the activities at M24. It has to be noted that the OC calls have been wisely anticipated of 3 months, thus we were able to manage the administrative issues and delays related to the agreements signatures from the granted third parties. At M16, WP5

on integration started as well, thus leading to the demonstrator set-up and the robot integration. As previously mentioned, this activity has been slightly delayed due to unforeseen and unusual problems related to the Turkey customs once the partners sent the components and the material.

In what follows, an overview of the project results towards the objectives of the action, including a summary of the deliverables and milestones, is reported. Besides the technical developments, special effort has been put on the further integration of the social sciences and user involvements of WP2, through to the point workshops and meeting. As a final remark, the project partners started to collaborate also on scientific publications and public dissemination activities, as detailed in D7.2. These efforts will be even strengthened in the second part of the project.

2.1 OBJECTIVES

The MAGICIAN objectives and their descriptions are briefly listed below in Table 1, with a concise report of their progress in the first two years of the project towards their achievements.

Table 1 - Objectives of the project

N°	DESCRIPTION	LEVEL OF ACHIEVEMENT
O1	A robotic perception module integrating visual and tactile sensors. The module will be embedded in a robotic sensor module (the SR, hereafter) and will be used for defects analysis and classification. The SR will replicate the skills of human workers through a learning scheme.	**KPI-SR1: Smallest size of defect that can be sensed/detected by the perception module (Target: ≤ 0.3mm).** *Status:* The tests carried out with the visual perception system have shown very good results comparable with the desired target defect dimensions. Also, the SR showed good performance results in terms of computation times and effectiveness, aligned with this KPI. Tactile data have been acquired and analysed with a dedicated Artificial Neural Networks (ANN) in isolation and together with the images, showing promising performance to meet the KPI. **KPI-SR2: Detection success rate vs humans: false positives (Target: ≤ 120%), skipped defects: (Target: ≤ 110%).**

Status: The detection success rate is tied to the input modality chosen to accommodate the previous KPI, **KPI-SR1**, thus depending on vision or tactile information or both. For this KPI, we are waiting for the integrated robots in the demonstration area in ALT to compute sufficiently long testing phases and thus acquire knowledge. As a preliminary analysis, the two components show already robustness to false positives.

KPI-SR3: Car-body scan time compared vs humans on a benchmark set (Target: ≤ 110%).

Status: Similarly to the previous KPI, the choice of visual or tactile perception affects this scan time. It is estimated that the chosen frame acquisition frequency and the new led illumination may reach the target KPI if at least two SRs, one per side of the vehicle, is adopted. However, precise quantification of this KPI is about to come with the demonstrator set-up.

KPI-LRN-SR1: Misclassification rate w.r.t. human (Target: ≤ 10%).

Status: Similarly to **KPI-SR2**, this rate depends on the chosen input modalities and the training of an ANN system. The work on classification has been halted due to the integration activities, and in the third-year clear results will be collected.

KPI-LRN-SR2: Time to convergence (Target: observation time ≤ 15h to achieve KPI-LRN-SR1).

Status: Information on this KPI will become available in the third year of the

		project.
O2	A robotic cleaning module attached to a robotic platform (the CR hereafter) equipped with a specialised end-effector to rework defects. The system will learn the necessary skills by observing humans.	**KPI-CR-1: Percentage of defects removed w.r.t. humans (Target: ≥ 98%).** *Status:* In the assessment made in the second year, the selected grinding tool proved to be affective in defect removal, thus the KPI should be met. Clearer figures will be available after the testing in the ALT premises. **KPI-CR-2: Time to remove the defect (Target: ≤ 110% of the time required by the human).** *Status:* As for **KPI-CR-1**, the collection of those figures needs further investigation in the demo-area. However, the end-effector demonstrated comparable results to human defect removal on different surfaces. **KPI-CR-3: Residual level of vibration (for grinding it is about 8.5m/s^2; Target: ≤ 1 m/s^2).** *Status:* As for **KPI-CR-1**, the collection of those figures needs further investigation in the demo-area. However, a dumping component has been designed and fabricated on purpose. **KPI-LRN-CR1: Reduction of measurement uncertainty (Target: RMSE ≤ 5%).** *Status:* As for **KPI-CR-1**, the collection of those figures needs further investigation in the demo-area. **KPI-LRN-CR2: Time synchronisation error among data coming from different sources (Target: ≤ 0.1 ms).**

		Status: As for **KPI-CR-1**, the collection of those figures needs further investigation in the demo-area. Despite this fact, the communication means, and the integrated software has been designed to meet this requirement. **KPI-LRN-CR3: Number of samples to converge to a satisfactory policy. (Target: ≤ 10h of observations).** *Status:* As for **KPI-CR-1**, the collection of those figures needs further investigation in the demo-area. Nevertheless, the control strategies and the underlying learning algorithms for the planning and execution of the tasks has been implemented and preliminary tests showed promising results in this direction. **KPI-LRN-CR4: Similarity measures between the learnt and the human policies. (Target: position error ≤ 1mm, orientation error ≤1°, force error ≤ 5N, moment error ≤ 2Nm).** *Status:* As for **KPI-LRN-CR3**, the control strategies and the underlying learning algorithms for the human motion models has been defined and under tests.
O3	A software robotic platform including: a) the basic services needed to implement the SR (O1) and the CR (O2), b) a modular infrastructure to integrate external services and components, c) a toolset to support quick system deployment and configuration.	**KPI-TP-1: Time needed to scan the whole surface of the vehicle w.r.t human operators. (Target: ≤ 80%).** *Status:* As for **KPI-TP-1**, empirical results on this KPI will become available in the third year. The planning and scheduling algorithms have been designed, implemented and tested, showing remarkable results in terms of time efficiency, going beyond the state of the

art.

KPI-TP-2: Probability of missing major defects during the scanning phase. (Target: ≤5%).

Status: As for **KPI-TP-1**, information on this KPI will become available in the third year. The work mainly focused on strategies that stochastically establish the scanning time per region and type of defect, while the algorithm is conceived to closely match the characteristics of the perception system of the SR.

KPI-MP-1: Probability to have an accident, evaluated in simulation. (Target: less ≤ 10^{-6}).

Status: As for **KPI-TP-1**, information on this KPI will become available in the third year of the project. A working algorithm for robot motion planning and control guaranteeing execution times compatible with the requirements and considering the human motion predictions has been designed and tested in the lab with toy example tasks.

KPI-MP-2: Average time to execute a sensing or defect reworking task w.r.t. humans. (Target: ≤60%).

Status: I As for **KPI-TP-1**, information on this KPI will become available in the third year of the project.

KPI-MP-3: With respect to the KPI for O1, active sensing error reduction. (Target: ≥10% reduction).

Status: As for **KPI-TP-1**, information on this KPI will become available in the third year of the project. The active sensing

algorithms, which will be based on classic and ergodic control laws, have been identified, designed and preliminary tested. Two different versions, one for the tactile and one for the vision system, are now ready but not yet integrated.

KPI-PP-1: Reduce the learning time to adapt to new use cases of the 20% using knowledge transfer.

Status: Information on this KPI will become available at later stages of the project, when clear data analysis on the testing area will be available.

KPI-PP-2: Successful integration of at least 3 third party COTS found through the FSTP.

Status: Five third-party projects have been selected, whose development just started. The numbers of the effective integration related to this KPI will be available at the end of the third year.

KPI-PP-3: Successful application of the approach to at least three new use-cases found through the FSTP.

Status: Information on this KPI will become available at later stages of the project.

O4	A closed-loop defect detection and avoidance system for robot and welding processes.	**KPI-CL-1: Probability of faulty classification of a defect. (Target: ≤8%).** *Status:* Data collection has been carried out for this KPI. The work on the closed loop classification just started, but no concrete results have been identified yet. The information on this KPI will be

		available in the third year of the project. **KPI-CL-2: Time needed for inline defect identification and classification. (Target: < process cycle time).** *Status:* As for **KPI-CL-1**, information on this KPI will become available in the third year of the project. **KPI-CL-3: Success rate of closed-loop process optimization. (Target: ≥ 90%).** *Status:* As for **KPI-CL-1**, information on this KPI will become available in the third year of the project.
O5	Two TRL 7 integrated prototypes: one for defect analysis and one for defect reworking.	**KPI-INTEGRATED-1: The two prototypes will be deployed in two distinct workstations and will successfully carry out defect analysis and reworking in sequence.** *Status:* The Doosan robotic platforms have been acquired. One robot each is in **UNITN** and **IIT** for algorithms development and testing. Two robots are in **ALT** for cooperative defect detection and reworking in the demonstration area. The end-effectors for the SR and CR have been designed and manufactured. Test will begin in this month on the lines designed in D5.1.
O6	A human-centred approach to human-robot collaboration.	**KPI-SSH-1: Number of Stakeholder Workshops (Target: > 8 by the end of the project)** *Status:* Stakeholder workshops, as defined by the project criteria, are scheduled for autumn 2025 and throughout 2026 to meet the target of eight workshops by the project's conclusion.

		KPI-SSH-2: Number of Testing (Feasibility/Demo) Activities (Target: > 8 by the end of the project) *Status:* Evaluation and testing activities will be carried out during the implementation of demonstrators in the latter part of the project. **KPI-SSH-3: Number of Stakeholders Involved (Target: > 40 by the end of the project)** *Status:* To date, 70 stakeholders have been directly engaged in the project, reflecting strong progress in stakeholder involvement. **KPI-SSH-4: Number of Presentations at Non-Academic Conferences (Target: > 6 by the end of the project)** *Status:* To date, the project has been presented at three non-academic conferences.
O7	To demonstrate the two prototypes (see O5) in an operational scenario.	**KPI-DEMO-1: Realism: the demonstrator will satisfy the production constraints.** *Status:* The demonstrator area has been set up to replicate the real production area. **KPI-DEMO-2: Accessibility. (Target: 2 months of physical accessibility and 4 months for remote accessibility).** *Status:* Information on this KPI will become available at later stages of the project.

		KPI-DEMO-3: Number of business-oriented visits. (Target: at least 100 business-oriented visits). *Status:* Information on this KPI will become available at later stages of the project.
O8	To expand scope and applicability of MAGICIAN via Financial Support to Third Parties (FSTP).	**KPI-DEMO-4: min 40 application proposals received within the 2 OCs.** *Status:* We received more than 70 applications in the first OC, so the KPI has been already met. **KPI-DEMO-5: min 12-month implementation period per selected experiment/application.** *Status:* The agreements for the first OC1 foresee a 12-month implementation per selected third-party. The KPI satisfaction is then proceeding as planned. **KPI-DEMO-6: 2 Mln/EUR distributed via FSTP.** *Status:* The first payments have been distributed and the overall cost for OC1 is well aligned with this KPI. **KPI-DEMO-7: >3 possible exploitation opportunities identified based on the selected applications/experiments.** *Status:* The third-party projects have promising exploitation opportunities. Hence, the achievement of this KPI is underway.

2.2 EXPLANATION OF THE WORK CARRIED OUT PER WP

2.2.1 WP1 – PROJECT MANAGEMENT (UNITN, M1-M48)

The primary role of WP1 is to ensure the correct alignment of the project with respect to the expected results, established timelines, and allocated budget, while simultaneously guaranteeing the proper management and preservation of all research data produced. During the first year, the focus was entirely dedicated to establishing a solid and procedural governance structure, which is essential for multi-partner cooperation and quality control. These activities, detailed in D1.1 and refined in D1.4, included:

- Institutional Definition: Formalization of the project management structure, establishment of governing bodies (e.g., Steering Committee, General Assembly), and clarification of the responsibilities of each project partner (CA/GA provisions).
- Planning and Quality Assurance (QA): Drafting and approval of the Quality Plan (QP) and the Data Management Plan (DMP), which are key elements for standardizing the research output and data preservation.
- Operational Infrastructure: Definition of templates, schedules, and QA procedures for all deliverables and intermediate reports. Rules for the internal storing of documents and internal communication protocols were also established.

The transition from the first to the second year involved the full implementation of the defined procedures. The Coordinator ensured smooth and efficient cooperation among all partners, based on the guidelines set out in D1.1 and D1.4. In particular, WP1 activated a monthly monitoring system to control the progress of project activities, ensuring that activities maintain the desired trajectory, and the CAD. On the financial front, the distribution of the pre-financing occurred regularly, in strict compliance with the provisions of the GA and the CA. The management and coordination activities described herein provide the framework for the successful execution of the research and development operations detailed in the subsequent sections of the report (Tasks of the following WPs).

Submitted deliverables:

D1.1 Data and Quality Management Plan (M6)

D1.2 First coordination report (M12)

D1.3 Second coordination report (M24)

D1.4 Refined data and quality management plan (M24)

Milestones

Ms1 Project start-up: deliverables, DMP (M6)

Details of the activities by Task and by Beneficiary

Task 1.1: Management and coordination of the project (M1-M48; Lead: UNITN; Part: All)

The work carried out in this task was project coordination, management of the consortium, meetings set-up and monitoring, and consortium-level issues handling.

The organisation and the coordination of the General Assembly is also under the responsibility of T1.1. The first General Assembly was called virtually at M6. A decision reached during this session was the adoption of a rotating model for the organization of subsequent in-person meetings, with hosting duties delegated among the project partners whenever possible. Hence, the second General Assembly has been organised in person in Crete in the FORTH premises at M13, while the third has been carried out in Genova at IIT, co-hosted with the first integration week, at M19. The next GA meeting will be held at M26 in Turkey at ALT, where the finalisation of the first prototype integration will be also carried out.

Web meetings for the different WPs and for the WP Leaders has been organised every 2-6 weeks to keep the project activities well aligned.

Partner contributions to Task T1.1

UNITN	Planning of activities and meetings, regular meetings organisation and reporting, update of communication and sharing tools and procedures, preparation of the reporting activities, support to partners, coordination of the deliverables writing, organisation of the third and fourth GA meeting.
IIT	Participation to the project GA and WP meetings and teleconferences.
LU	Taking part in internal management and planning activities, including regular online work-package meetings and attending face-to-face meetings. Reporting activities.
FORTH	Participation to the project coordination activities, including the scheduled WP-leader meetings and task-level syncs. Inputs to planning discussions, periodic progress consolidation, and partner contributions of coordination reports.
CRF	Participation to the GA meeting hosted by IIT (3rd and 4th of April 2025). Internal management and planning of activities, participation to the regular telcos and the on-line WP Leaders meetings.
TOFAS	Participation in the regular telcos and meetings. Internal

	coordination of the project in TOFAŞ. Contribution of reporting activities.
ALT	Taking part in internal management, planning and reporting activities; Internal coordination for Magician within ALT; Online and physical meeting presence; participating Integration Days physically.
SIG	Participation and contribution to the internal management and planning of activities, especially regarding the constitution and implementation of the Data Access Committee, reporting activities including data management updates. Close exchange with the coordination team in the frame of collaboration with the EU ADR community (e.g. related EU projects, ADRA/ADRA-e, AI4Europe). Participation to GA meeting hosted by IIT in April 2025.
ZAB	Hosting WP meetings and online WP leader meetings; participating in internal management, planning, and reporting activities; and attending in person the General Assembly meeting hosted by IIT on April 3–4, 2025.
PIP	Taking part in internal management, planning and reporting activities; Internal coordination for Magician within PIP; Online and physical meeting presence.
HWH	Participating in the General Assembly Meetings and other meetings related to project management, both virtually and physically. Contributions to project management reporting. Internal coordination activities.

Task 1.2: Data Management (M1-M48; Lead: UNITN; Part: All)

In this task, the data handling was outlined in the Data Management Plan, while the consortium data was stored via a shared platform that mad available by ZAB. Data from scientific publications adhered to open access rules and was stored in publicly accessible repositories, as outlined in the DMP. Additional components, such as the software for integration or the software organisation, are shared in Github on a private location. Also, all the publications go through the DAC check, as set-up in T1.3.

All the partners contributed to D1.1 - "Data and Quality Management Plan" and participated to the updated plan reported in D1.4 – "Refined data and quality management plan". The Consortium duly respected the rules set-up in the DMP and by the enforcement brought by the DAC.

Partner contributions to Task T1.2

UNITN	Contribution to the data management plan, internal discussions, collaboration with SIG for the definition of the Data Access Committee (DAC), working and supporting activities inside the DAC
IIT	No contribution on this.
LU	Input to the DMP through definition of data and metadata for human-centred design, field studies, and interviews; plus, integration of relevant data into D1.1.
FORTH	Inputs to the project data management workflows (structure of datasets, metadata fields relevant to perception/robotics experiments, and open-science posture for public artefacts) and coordinated with the lead on updates to the living DMP and through the DAC.
CRF	Application of the data management prescriptions and add-ons (alignment) of the different datasets present in the CRF MAGICIAN MS SharePoint repository (full details in the D1.1 and in D1.4).
TOFAS	Contribution to the data management plan activities and attending the related telcos.
ALT	Taking part in internal management, planning and reporting activities; participating online meetings regarding the Data Management Plan.
SIG	Contribution to the updated DMP (D1.4) in collaboration with UNITN. Constitution and implementation of the Data access Committee.
ZAB	Contribution to the data management plan, internal discussions, collaboration with SIG for the definition of the data access committee (DAC), working activities inside the DAC and its integration within subgrant agreement with selected third parties of OC1.
PIP	Input in the DMP; Assessing data requests and issues through the Data Access Committee (DAC) as technical data manager.

HWH	Data definitions and continuous monitoring of changes in data. Input in the DMP.

Task 1.3: Risk and quality management (M1-M48; Lead: SIG; Part: All)

Part of the work of this task was the definition of the quality management rules. Hence, the task contributed to the reports and deliverables writings coordination and quality assessment.

Many of the regular activities associated with T1.3 relate to the operation of the newly constituted Data Access Committee (DAC). The DAC in MAGICIAN ensures that all data-related activities comply with legal, ethical, and intellectual property standards while fostering secure collaboration and innovation. Its main objective is to regulate data sharing, access, and publication within the consortium and with external actors such as FSTP beneficiaries. The DAC oversees requests involving access to project datasets, AI models, or software; third-party licensing; dissemination approval; and potential security or ethical issues. Initially configured with five roles — Chairperson, Legal Counsellor, Ethics Officer, Technical Data Manager, and Project Coordinator — the DAC combines technical, legal, and ethical expertise to enable rapid yet rigorous decision-making. Three roles are permanent (Legal Counsellor, Ethics Officer, Project Coordinator), while the Chairperson and Technical Data Manager rotate among partners every six months and the new roles are decided at every General Assembly meeting.

The DAC operates through structured protocols covering data access, sharing, licensing, dissemination, and incident management. Each request is reviewed for GDPR compliance, IP ownership, and ethical integrity before being approved by the Project Coordinator. Since its establishment, the DAC has been activated three times, resolving two cases within ten working days and one after a procedural clarification — demonstrating its efficiency and balanced governance between protection, transparency, and research progress. However, since more data and scientific or white papers will be distributed to the public, the work of the DAC will intensify in the second part of the project.

Partner contributions to Task T1.3

UNITN	Quality plan with procedure and processes of quality assurance update, quality check of deliverables from M19 to M24. DAC procedures oversee and final decision acceptance.
IIT	Participation to discussions about technical risks and challenges.
LU	Contributed to risk and quality management activities, participated in the SIG-coordinated workshop and engaged in discussions and related actions concerning MAGICIAN's risk and

	quality management.
FORTH	Participated in risk and quality management activities during the period. Specifically, flagging technical and integration risks such as sensing head integration constraints, and data/throughput dependencies.
CRF	Contributions to the risk and quality management activities coordinated by SIG.
TOFAS	Contributions to the risk and quality management activities.
ALT	Participation in activities and workshops related to risk and quality management, internal risk & quality assessment.
SIG	Update of the integrated DMP and Quality Control Report (D1.4) in collaboration with UNITN. Support to coordination in the frame of data management including DAC implementation, and related communication, and dissemination activities.
ZAB	Participating and supporting activities and workshops related to risk and quality management, internal risk & quality assessment.
PIP	Participation in activities and workshops related to risk and quality management, internal risk & quality assessment.
HWH	Various contributions to the risk and quality management activities.

2.2.2 WP2 - USE CASE DEFINITION AND PLATFORM DESIGN (LU, M1-M48)

WP2 advances MAGICIAN by embedding human-centred design and SSH to align with real industrial constraints and enable meaningful, safe and inclusive work. During M19 to M24, as part of the iterative human-centred design process, we have analysed data from interviews, observations and field studies, and developed materials for workshops to be conducted in Italy and Turkey. LU, CRF, ALT and TOFAŞ have together recruited participants for the workshops, and the dates and times have been scheduled.

Submitted deliverables:

D2.1 Use case definition (M6)

D2.2 Initial user requirements report (M18)

D2.3 Robotic platform design (M18)

Milestones

Ms1 Project start-up: deliverable (M6)

Ms3 User-centred requirements and platform design: deliverable (M12)

Ms5 First complete working prototype: deliverable (M24)

Details of the activities by Task and by Beneficiary

Task 2.1: Use case definition (M1-M39; Lead: CRF; Part: All, except SIG)

The activities of Task T2.1 are scheduled from M1 to M39 in two distinct phases. The first phase, running from M1 to M6, focused on defining the initial MAGICIAN Use Cases at the very beginning of the project, while the second phase, running from M34 to M39, address additional Use Cases that may emerge following the launch of the project's Open Call. The full results of the first phase are documented in Deliverable D2.1. In the current reporting period (M19-M24) the task is inactive, carrying out general contributions and support to the active project tasks.

Task 2.2: User-centred design (M1-M48; Lead: LU; Part: UNITN, IIT, CRF, TOFAS, ALT, HWH)

The activities in this task are carried out primarily by LU, with the support of TOFAŞ, Altinay (ALT) and all WP2 partners. LU conducted extensive desktop research that resulted in a literature review, which subsequently informed a manuscript now submitted to a peer-reviewed journal. In parallel, the team applied for and obtained ethical approval for user-related studies in both Sweden and Turkey. Following approval, empirical work was conducted in the form of interviews with 12 production line workers, 9 managers, and 10 developers, alongside three days of observational fieldwork at TOFAŞ in Turkey, as part of the baseline study. Complementary work was carried out in Sweden, where 15 interviews with production line workers and 9 with managers were conducted at Volvo Cars, in addition to a field visit to the Volvo Cars factory in Torslanda. We have now analysed data from the interviews, observations and field studies and produced workshop materials as part of the iterative human-centred design process. The workshops will be held in Italy and Turkey. We have confirmed participants, recruited by LU, CRF, ALT and TOFAŞ. The workshop dates and times are scheduled for late autumn 2025 and early spring 2026.

Partner contributions to Task T2.2

UNITN	Actively participated in all WP2 meetings. Contributed to discussions on user-centred design. Worked on requirements definition to ensure alignment with the robot technical

	capabilities.
IIT	Participated in WP2 discussions on user-centred design. Ensured user requirements were met in the design of human-robot interfaces.
LU	Led and coordinated the overall task activities. Prepare material workshops with production line workers, developers and managers as well as a user requirement workshop with technical partners.
CRF	Supported LU in organising workshops at CRF. Assisted in recruiting participants for workshops.
TOFAS	TOFAS worked with LU about workshop organization.
ALT	Supported LU in organising workshops at ALT. Assisted in recruiting developers for workshops.
HWH	Completed required templates and tables to describe the Use Case scenario for user-centred design. Contributed to the discussion and formalisation of requirements together with partners.

Task 2.3: Interface definition and robotic platform design (M1-M42; Lead: UNITN; Part: IIT, LU, FORTH, CRF, TOFAS, ALT, PIP, HWH)

The path towards the design of the CR and the SR went firstly to the selection of the robotic platform. The preliminary technical analysis has been successfully executed, utilizing requirements derived from T2.1 and T2.2, together with the evaluation of cost-efficiency, maximum payload capacity, versatility (to ensure robust adaptation across various manufacturing tasks), and Degrees of Freedom (DoFs) of candidate collaborative robotic (cobot) arms. In the second year, the SR has been equipped with advanced sensor technology necessary for high-resolution scanning and identification of defects on the chassis (T3.1 and T4.1). Concurrently, the system has been developed to perform real-time scene reconstruction, providing a high-fidelity digital map of the workspace and the workpiece. For the CR, a specifically designed compliant hardware interface to a commercial grinder (T4.2) has been made available. The primary function of this interface is to ensure consistent and high-quality reworking operations. The software structure has been defined in this task and shared among the technical partners and during the integration weeks (at M19 in IIT, at M21 in Trento and at M23 in IIT), together with the hardware interfaces. Also, this task preliminary defines the user interfaces towards the platform combining the robot features and the available car CAD models.

Finally, ALT, in coordination with TOFAS and CRF, are actively engaged in the design phase. This direct involvement is being facilitated through the monthly meetings and the in-presence discussions in the integration weeks.

Partner contributions to Task T2.3

UNITN	Refinement of the robotic platform requirements, and update of the software modules and of the SW architecture towards the platform integration. Preliminary study of the simple GUI for the tablet to be primarily used in ALT for testing.
IIT	IIT successfully integrated the current-stage tactile perception module into the robotic platform, ensuring that its configuration is fully aligned with the platform's setup while remaining compatible with the human interfaces. As the interface design evolves to meet new system requirements, further detailed contributions will be provided.
LU	LU mainly acts as a bridge between Tasks T2.2 and T2.3, embedding some of the requirements defined in T2.2 into the robot design. LU also contributed to D2.3 by writing parts of the section on Human-machine interface design.
FORTH	FORTH contributed the perception-side interface definitions and data pathways for the sensing robot, aligning the vision/tactile acquisition stack with ROS-based platform services. In particular, the MAGICIAN Grabber architecture (zero-copy Linux shared memory) and its ROS topics/services used to expose synchronized camera, ToF distance, force/accel and light-state streams to the robot, directly serve T2.3's interface specification needs.
CRF	Participation to the general task activities and specific contributions to the interface definition and robotic platform design on the aspects related to the perception system (lighting module of the MAGICIAN camera).
TOFAS	TOFAS participated to the task activities and meetings for the platform design.
ALT	ALT organised the planning and implementation activities of the demonstrator cell where all the system will be demonstrated, and several project meetings and hands-on work are performed at

	this cell together with IIT, UNITN, TOFAS and CRF partners.
PIP	PIP contributed by gathering data and input from different components for the configuration optimization, supporting the development of an integrated and modular interface.
HWH	Further definition and refinement of the interface between the inline defect detection of welding processes and the related other modules within the MAGICIAN architecture.

2.2.3 WP3 - DATA ACQUISITION AND SKILLS LEARNING (FORTH, M4-M45)

The goal of WP3 is the development of perception systems and learning techniques for defect detection and reworking skills, emphasizing visual and tactile solutions to address both extended and small defects. During the second year, work focused on integrating and validating the perception modules developed earlier into a unified visual–tactile system. The upgraded setup supports synchronized data acquisition and processing, enabling robust defect detection and real-time operation on the robotic platform. In parallel, classification and skill-learning techniques were refined, linking perception with human demonstrations. Overall, WP3 progressed from prototype sensing components to a functional, data-driven perception and learning framework for defect analysis and reworking.

Submitted deliverables:
D3.1 First delivery of perception systems (M12)
D3.2 Second delivery of perception systems (M21)

Milestones:
Ms2 First Release of the robot components: deliverable, software components (M12)
Ms3User-centred requirements and platform design: deliverable, software and hardware components (M18)
Ms4 First software integration: deliverable, integrated software components (M21)
Details of the activities by Task and by Beneficiary
Task 3.1: Perception system, data acquisition and processing (M4-M45; Lead: FORTH; Part: UNITN, IIT, LU, CRF, TOFAS, ALT, PIP, HWH)
This task focused on refining and integrating the visual and tactile subsystems into a unified perception framework. The visual head and illumination system were redesigned for synchronized capture, while the tactile sensing setup was aligned to support multi-

modal data collection. A shared acquisition layer now enables simultaneous streaming and fusion of visual and tactile data at camera rate. The system was tested on real samples, demonstrating consistent defect detection under industrial lighting and surface conditions. These developments established the foundation for a robust perception pipeline supporting downstream learning and robotic integration.

Partner contributions to Task T3.1

UNITN	Support to the definition of the data acquisition system, study of an efficient human motion model to be integrated in the robot planning algorithms. Analysis of the mode of operation of the vision system to be integrated with the ergodic control of the robotic arm. Moreover, UNITN contributed to the redesign of LED illumination system.
IIT	IIT, in collaboration with FORTH, contributed to the software and hardware integration of the combined acquisition system by developing a unified data grabber capable of simultaneously collecting and processing tactile data and visual data from the vision system in real time. A joint data collection campaign, combining both sensing modalities, was carried out and the resulting dataset was sent to PIP for an initial comparative analysis of the two modalities. In addition, IIT assist in the revision and realization of final visual sensing device redesigning the structure of the first prototype and incorporating additional features such as the tilting option for the LEDs.
LU	LU synthesized findings from field studies, interviews, and on-site observations at TOFAŞ, interpreted through a social sciences and humanities lens, and provided guidance on aligning the design with users' needs. In project meetings, LU put forward user-centred requirement inputs and advocated a human-centred requirements process so that the developed systems accommodate human capabilities, preferences, and working conditions.
FORTH	FORTH advanced the visual perception subsystem and the shared acquisition layer: (i) Vision head redesign with 6 programmable polarized LED illuminators, 16 mm lens (from 12 mm) and 3× ToF range sensors; (ii) electronics optimization (Arduino MEGA→NANO) and reproducible housing (KiCad/OpenSCAD); (iii) software synchronization of lighting with the camera's 23 Hz frame cycle inside the Grabber; and (iv)

	deployment of the zero-copy Grabber with a ROS facade to prevent ROS congestion while keeping modules interoperable. These changes enabled real-time operation on the sensing robot; the module performed positive/negative dent detection on unseen samples and sustained inference at 23 Hz (camera-rate).
CRF	Deep contributions to the T3.1 activities, and collaboration with FORTH regarding the perception system, data acquisition and processing. Development of a dedicated HW solution for the camera lighting system, achieving high instantaneous powering of the COB LEDs and synchronization with the Sony XCG-CP510 camera unit.
TOFAS	Participated to periodic telcos. Supported the technical partners.
ALT	ALT attended the integration weeks and all relevant online project meetings to follow the progress and started planning activities to demonstrate these activities in the demonstrator.
PIP	PIP was involved in developing the tactile perception classification model in cooperation with IIT. Besides the assessment of the tactile model, efforts were made by PIP to create a fusion model combining the strengths of both tactile and vision data streams to create more accurate predictions.
HWH	Further development of a data acquisition system for welding signals. This data serves as an input for the weld defect analysis system.

Task 3.2: Learning defect classification skills from humans (M4-M45; Lead: FORTH; Part: UNITN, IIT, LU, CRF, TOFAS, ALT, PIP, HWH)

Efforts centred on advancing automatic defect classification based on the enhanced multi-modal data. Updated models trained on synchronized visual–tactile inputs achieved accuracy above 90 % on internal validation sets. The learning pipeline was containerized for portability and integrated with the live data-acquisition framework, enabling continuous updates from new samples. Semi-supervised and fusion-based methods were explored to improve generalization and adapt the classifier to evolving production scenarios. Overall, the task delivered a mature defect-classification framework that bridges perception, learning, and robotic decision-making.

Partner contributions to Task T3.2

UNITN	Study of the classification skills of humans and implications on the robot sensing system for the ergodic control, update of the stochastic strategy for visual and touch sensing integration with ergodic control.
IIT	IIT developed a robotic arm setup dedicated to performing automated data acquisition. This setup will be used to collect data through the robot by replicating the key parameters gathered from the human data acquisition phase, such as forces applied and velocities used during scanning movements, in order to implement a learning-by-demonstration approach.
LU	LU attended partners' meetings to deepen our understanding of the integration phase.
FORTH	Building on the upgraded optics/illumination and synchronized capture, FORTH trained and evaluated visual classifiers that achieve > 90% accuracy/precision/recall on the internal validation sets derived from the shipped metal samples; the stack is containerized for portability and integrated in the live pipeline. The Grabber provides synchronized multi-modal streams and ROS outputs to support data collection and downstream training workflows.
CRF	Contributions to the T3.2 activities, and coordination with FORTH regarding the learning defect classification, in strict collaboration with TOFAS, to implement the best practices currently pursued for the detection of defects in the automotive industry production sites.
TOFAS	Participated to periodic telcos. Supported the technical partners.
ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities, to demonstrate these activities in the demonstrator.
PIP	In line with the developments for the tactile classification for T3.1, efforts were made to align model characteristics and implementation with human behaviour. Attendance in monthly meetings. Defining parameters and requirements for classification modules for configuration optimization tool.

HWH	Further development of a control algorithm to detect weld spatters from sensor signals and predict their severity. Development of a classification scheme for weld spatter intensity.

Task 3.3: Learning defect working skills from humans (M4-M45; Lead: IIT; Part: UNITN, FORTH, CRF, TOFAS, ALT)

Work in this task advanced the transfer of human reworking skills to robots through Learning-from-Demonstration. Human and robotic motion data were captured under comparable conditions, enabling analysis of tactile, visual, and force cues associated with defect correction. Human-pose estimation and trajectory reconstruction modules were validated in realistic environments, providing the data required for imitation learning. The resulting framework establishes the basis for reproducing skilled human actions in robotic reworking, marking a transition from isolated demonstrations to integrated, data-driven learning.

Partner contributions to Task T3.3

UNITN	Data acquisition for the learning from demonstration approach in the MAGICIAN domain, extension of the DMPs to meshes to accurately model the learned strategy of curved surfaces.
IIT	IIT implemented the acquisition systems for both human and robotic arm data collection, creating a complete learning-by-demonstration setup for transferring human tactile skills to the robot. This setup supports defect detection tasks and will also serve as a basis for future analyses of reworking skills.
FORTH	FORTH: Within WP3's human-perception layer, the human pose estimation module was validated on TOFAS security-camera video and during the IIT integration, emitting ROS messages and TF2 frames for system use—thus supplying trajectories for learning-from-demonstration workflows. D3.2 reports the LfD pipeline for reworking skills: human trajectories are captured from video, and MocapNET can assist pose/action annotation.
CRF	Contributions to the T3.3 activities, and coordination with IIT regarding the working skills, in strict collaboration with TOFAS, to implement the best practices currently pursued for the repairing of defects in the automotive industry production sites.
TOFAS	Contribution to the task activities, attended to project meetings.

ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities to demonstrate these activities in the demonstrator.

2.2.4 WP4 - ROBOTIC PLATFORM AND INTERFACES (IIT, M4-M45)

WP4 has made substantial progress across all its tasks during the past project period. In T4.1, a tactile perception module was developed, designed as a wearable or robotic plug-in device with modular architecture and compatibility across multiple end effectors, supporting both human and robotic defect detection. T4.2 achieved full automation and customization of the grinding tool, including integration of relay-controlled ON/OFF systems and vibration isolation platforms. Two isolator prototypes, a folded beam and a novel Stewart–Gough platform were designed, optimized, and produced, accompanied by updates to robotic impedance and force control. In T4.3, the Orienteering Problem Solver Node was implemented, combining Graphformer-based routing, service time optimization, and a suite of optimization and heuristic algorithms. The framework dynamically selects Branch-and-Bound or Profit Ratio Search depending on the defect count, ensuring efficient route planning. T4.5 established a strong foundation for welding process understanding, defining four use cases. A visualization tool for welding data was developed, focusing on spatter analysis, route prioritization, parameter optimization, and root-cause analysis. Predictive modelling and long-term data monitoring are planned next. In T4.7 a Configuration Optimization Tool is under development with progress made in the detailed visualization and process mapping of module dependencies, literature review, and concept development. Documentation templates for consistent information collection across MAGICIAN modules have been completed. Overall, WP4 demonstrates strong integration of sensing, control, and optimization technologies, providing a robust technical base for intelligent robotic operations in industrial environments.

Submitted deliverables:

D4.1 Human-Robot interfaces and intelligence (M12)

D4.2 Grinding robot solution (M21)

Milestones

Ms2 First Release of the robot components: software components (M12)

Ms3 User-centred requirements and platform design: deliverable, software and hardware components (M18)

Ms4 First software integration: deliverable, integrated software and hardware components (M21)

Details of the activities by Task and by Beneficiary

Task 4.1: Human-Robot Interfaces (M4-M45; Lead: IIT; Part: UNITN, LU, CRF, TOFAS, ALT)

During this period, significant progress has been made toward achieving the main objectives of T4.1, which focuses on developing a robotic perception module based on tactile sensing technology. The design phase has been completed, resulting in a wearable and hand-held device that can also be easily integrated into robotic systems. This dual functionality allows expert users to operate the module directly while enabling its deployment on robots for human skill replication. The tactile perception module has been engineered with a strong emphasis on modularity, ensuring compatibility with various robotic interfaces defined within the MAGICIAN project. Its core architecture supports seamless integration across different end effector sensing pad, allowing the same tactile sensing capabilities to be utilized in multiple configurations. This modular approach ensures high adaptability and makes the system suitable for a wide range of defect detection tasks based on tactile perception, both in manual and automated operation modes. Overall, the development of the T4.1 module has established a solid foundation for subsequent work and perception-driven automation within the project. Prototypes of the device have been produced and preliminary testing and integration with devices with the robotic system have been performed.

Partner contributions to Task T4.1

UNITN	Simple GUI study of the MAGICIAN prototype. Analysis of the mode of operation of the tactile system to be integrated with the ergodic control of the robotic arm.
IIT	IIT leveraged the developed tactile perception module to integrate it into two distinct interfaces: one aimed at providing a dedicated tactile end-effector for the robotic system
LU	LU provided an SSH perspective and insights from field studies, interviews and TOFAŞ observations, together with additional contributions to support MAGICIAN partners. LU attended teleconferences, providing the required support and information for HR-interface design and development.
CRF	Collaboration to the T4.1 activities, and support to IIT in the activities related to the multimodal perception interfaces.
TOFAS	Collaboration to the task activities, and support to technical partners and attended to periodic project meetings.
ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities to integrate these

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	activities in the demonstrator.

Task 4.2: End-effector design and interaction control co-design (M4-M45; Lead: IIT; Part: UNITN, LU, FORTH, CRF, TOFAS, ALT)

Task T4.2 has advanced substantially during this project period focusing on the customization and automation of the DeWALT grinder tool for robotic integration. The device's ON/OFF functionality has been successfully automated through an integrated relay switch, allowing its state to be controlled directly via the Doosan robot's internal digital interface. This enables synchronized coordination between the tool's operation and the robot's motion or task execution.

Extensive work has also been carried out on vibration measurement and isolation, essential for stable and precise robotic grinding operations. Two distinct vibration isolation platforms were designed and prototyped:

- A Distributed Integrated Folded Beam Isolator Platform – a simple, easily refinable design that effectively damps vibrations along all three linear axes, though it provides limited isolation of rotational moments.

- A Novel 3–3 Stewart–Gough Isolator Platform – an innovative structure combining the rigidity of a traditional Stewart–Gough platform with a folded beam configuration, achieving effective vibration damping across all six degrees of freedom.

Comprehensive modal analyses were performed for both designs to evaluate their vibrational performance. In addition, optimization studies investigated the effect of the beam angle on the platforms' modal and static characteristics. By varying the angle between the folded beam and the base plate, three design configurations were analysed, revealing significant correlations between geometry and overall system performance.

Furthermore, a second grinder tool was fully customized, automated, and delivered to the ALT partner, along with dedicated mounting interfaces to ensure seamless integration with the robotic system. Both vibration isolator prototypes have been manufactured and tested, and updates to the robot control system—including impedance and force control refinements—have been implemented to enhance tool performance and safety during operation. In overall, T4.2 has achieved key milestones in tool automation, vibration isolation design, and robotic integration, setting a strong technical foundation for the next phases of the MAGICIAN project.

Partner contributions to Task T4.2

UNITN	Study of the end-effector co-design and analysis of the technical

	properties of the grinder to be integrated in the orienteering solution for task and motion planning of the CR.
IIT	The vibration isolator devices were fabricated and realized. Initial testing of the devices demonstrated its ability to supress the vibrations generated by the grinding tool. The control components of the grinding robot were further tuned to improve performance in terms of contact interaction and force tracking.
LU	LU provided an SSH perspective and insights from field studies, interviews and TOFAŞ observations, together with additional contributions to support MAGICIAN partners. LU attended teleconferences, providing the required support and information for HR-interface design and development.
FORTH	FORTH supplied hardware constraints and integration feedback from the sensing head used on the robot. Observed vibrations at higher robot speeds due to 3D-printed structures, and the need for smaller sensor size/higher standoff. These inputs inform co-design choices for mounting, rigidity, and collision-free reach.
CRF	Collaboration in the T4.2 activities, and support to IIT for the End-effector design and interaction control co-design.
TOFAS	Collaboration to the task activities, and support to technical partners and attended to periodic project meetings.
ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities in order to integrate these activities in the demonstrator.

Task 4.3: Planning and scheduling (M4-M45; Lead: UNITN; Part: CRF, TOFAS, ALT)

Task T4.3 has made progress in the generation and optimization of robotic routing and service time planning. The work focused on developing an advanced Orienteering Problem Solver Node capable of efficiently planning inspection or servicing routes in complex environments. A Graphformer-based architecture has been implemented to leverage graph-structured information, enabling the system to make more informed and adaptive routing decisions. In parallel, a service time decoder was introduced to improve the quality and accuracy of trajectory generation, ensuring that both travel and operation times are optimized. The service time optimization algorithm guarantees efficient and optimal route construction, balancing time, distance, and other potential operational constraints. Within the Orienteering Problem Solver Node, a variety of

algorithms have been tested and integrated, including:

- Exact Optimization Techniques: Gurobi Optimization and Branch-and-Bound methods for precise solution computation.

- Heuristic Algorithms: Ant Colony Optimization, Genetic Algorithms, and Profit Ratio Search (Nearest Neighbor + 2-OPT). The latter employs a profit-per-time-unit metric, optimizing route selection based on both travel and service times.

Performance assessments on the current use case established an adaptive algorithmic selection strategy described as follows: for up to seven detected defects, the Branch-and-Bound algorithm provides the best performance; for more than seven defects, the Profit Ratio Search heuristic proves more efficient and scalable. These thresholds are defined for the present configuration and can be reevaluated as new datasets or operational scenarios are introduced.

Another component developed in T4.3 is the motion planner that, considering the human motion model developed in T3.1, ensures a safe and efficient path synthesis using a PRM-based approach. The conceived solution, comprising human motion prediction and path synthesis, proved to be computationally efficient in order to be executed in real-time on the actual deployment foreseen by MAGICIAN.

Overall, T4.3 has delivered a routing optimization framework to enable efficient task scheduling, together with a first version of the human-aware path and motion planning within the MAGICIAN project.

Partner contributions to Task T4.3

UNITN	Definition and implementation of the orienteering solution for robot motion planning. Definition of a computationally efficient human-aware motion planning and real-time implementation.
CRF	General contributions to the task activities and support to UNITN for the HRC safety implications and impact on the robot motion planning.
TOFAS	Collaboration to the task activities, and support to technical partners and attended to periodic project meetings.
ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities in order to integrate these activities in the demonstrator.

Task 4.4: Motion control and active sensing (M4-M45; Lead: UNITN; Part: IIT, FORTH, CRF, ALT, HWH)

The main development of the task in this second year is mainly algorithmic. Two different approaches have been developed for the active sensing solutions based on the ergodic control. The first considers the perception system and its characteristics defined in T3.1 to be used as the acquisition system for an ergodic control-based approach that leverages the exploration of new uncovered areas with the exploitation of the prior probabilistically known locations of defect to optimise the search time using visual information. In a similar fashion, we specified the ergodic control approach to the tactile system as described in T4.1, again leveraging exploration and exploitation for a full reconstruction of the defect tactile data, which is useful for defect classification.

Both the solution will be published in the third year in top robotic and/or metrological journals.

Partner contributions to Task T4.4

UNITN	Ergodic control for vision-based defect detection, ergodic control for tactile-based defect detection and estimation.
IIT	No contribution to this task in the second year.
FORTH	FORTH delivered sensing-side enablers for active sensing and motion control: software-timed LED-to-camera synchronization for predictable polarization patterns; ToF-based standoff reporting; and ROS topics for distance, force/acceleration, and light state—providing control-relevant signals to motion planners/controllers.
CRF	Coordination with UNITN on the motion control and active sensing topics of the T4.4.
ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities to demonstrate these activities in the demonstrator.
HWH	HWH participated in the technical integration meeting and contributed to the discussions related to motion control and active sensing. Furthermore, HWH participated in the regular online meetings.

Task 4.5: Closed-loop defect analysis (M4-M45; Lead: HWH; Part: UNITN)

For T4.5, the priority was to build a solid understanding of the welding process and the associated data. HWH hosted a workshop week in Hamburg to facilitate this, with UNITN and PIP attending. After a deep dive into the matter and challenges, four use cases were defined.

PIP contributed to a couple of ways. Firstly, a visualization tool was developed that enables efficient exploration of welding curves and straightforward data analytics. This tool has already proven valuable and is developed further for use of non-technical people in the welding industry. The tool forms the foundation for the different use cases in this work package. A key focus so far has been the analysis of weld spatters, since spatter data is central to the use cases. We identified and categorized the types of spatters present in some collected testing data, which allowed us to make a start connecting spatter patterns to specific areas of interest. For Use Case 1 (Rework and route prioritization), we began analysing spatter information to determine how the sensing robot can prioritize its inspection path. For Use Case 2 (Spatter reduction / parameter optimization), we outlined the modelling approach in which historical welding data will be leveraged to derive and adjust reference curves. This would enable faster parameter determination, reduce reliance on destructive testing, and lower spatter occurrence. For Use Case 3 (Root cause analysis), we defined the strategy to analyse spatter trends over time to detect potential hardware degradation at an early stage and ignore anomalies. The next steps will focus on deepening the spatter analysis, implementing predictive models for parameter optimization, and setting up the data structures required for long-term monitoring.

Partner contributions to Task T4.5

UNITN	Collection of data samples with welding defects and study of the welding process model
HWH	Preparation and hosting of a workshop for performing welding tests, welding data gathering and welding quality control. Post-preparation of the workshop and review of first analysis results provided by PIP.

Task 4.6: Configuration optimisation tool (M4-M45; Lead: PIP; Part: UNITN, IIT, FORTH, ALT, HWH)

In the development of the Configuration Optimization Tool (COT) by PIP, progress has been made in several key areas:

1. **Visualization of Module Requirements**: The inputs and outputs of the Orienteering Solver Module (OP module) have been thoroughly analysed to determine the necessary modules, processes and information for its operation.

This visualization helps clarify the specific dependencies required to make the Orienteering Solver Module functional.

2. **Optimization of Module Processes**: Possibility of changes and optimization processes for the OP module have been visualized comprehensively. This visualization maps out all the processes within the module, detailing the methods by which optimization is possible. This approach provides a clear framework for identifying and implementing improvements in the module's functionality based on new use cases.

3. **Literature Review:** A comprehensive literature review has been conducted to gather insights and best practices relevant to the development of the COT.

4. **COT Concept Development**: A draft concept for the COT has been developed, laying the groundwork for its implementation.

5. **Document Setup for Module Information**: A detailed template has been created to gather essential information for each module in the MAGICIAN project. This structured approach ensures consistent collection of data across all modules and aids in mapping out the integration and optimization processes that will be incorporated into the COT framework.

6. **Information Collection**: Progress is ongoing in collecting the necessary information from all the modules within the MAGICIAN project for the COT.

7. **Documentation**: Detailed documentation for the COT is currently being developed. This documentation will support future development and integration efforts for new use-cases.

Partner contributions to Task T4.4

UNITN	Support to the definition of the strategy for configuration optimization given the architectural status of the MAGICIAN SW.
IIT	Participated to discussion about the configuration optimization tool.
FORTH	FORTH provided module-level I/O contracts and operating constraints (such as frame rate, synchronized lighting, sensor weight/size, ToF hovering distance, ROS topic schema) that can serve as inputs to the COT's module templates and solver assumptions.
ALT	ALT attended all relevant online project meetings to follow the progress and started planning activities in order to demonstrate these activities in the demonstrator.

PIP	PIP worked on the COT conceptual and architectural design, requested and processed input from other partners.
HWH	HWH followed the discussions and specifications related to the Configuration optimisation tool.

2.2.5 WP5 - INTEGRATION AND PERFORMANCE ANALYSIS (ALT, M16-M48)

To demonstrate the capabilities of the developed prototypes, the first demonstrator setup was implemented within a realistic operational scenario at the premises of ALT. A dedicated demonstrator has been established to closely emulate an actual work environment, incorporating the same production constraints encountered under real-world conditions.

This demonstrator serves both as a testbed for collecting performance metrics and as a platform for disseminating the project results to stakeholders and potential adopters. The technologies integrated into the demonstrator have been selected to ensure ease of replication in other industrial sites, thereby supporting broader scalability.

This first integrated demonstrator represents an important milestone of the MAGICIAN project. Its significance lies in the integration of outcomes from different research groups and work packages of the project.

Submitted deliverables:
D5.1 MAGICIAN First demonstrator (M24)

Milestones
Ms5 First complete working prototype: deliverable and robotic platform (M24)

Details of the activities by Task and by Beneficiary
Task 5.1: Platform integration (M16-M45; Lead: ALT; Part: UNITN, IIT, FORTH, CRF, TOFAS, PIP, HWH)

The demonstrator platform & setup, its components, functional modes, and the testing procedures carried out to evaluate system performance are defined and documented as follows:

A) Structure of the demonstrator setup, detailing its layout, key equipment, and electrical infrastructure together with subsections addressing specific components such as the slider, conveyors, cobots, and the control cabinet, including their functionalities and integration.

B) Tool integration, describing the various sensing and end-effector tools

implemented, including visual and tactile sensors as well as the grinding tool.

C) The system modes, covering the different operational states of the system from startup and learning to full automation, as well as special-purpose modes like manual, maintenance, and emergency operation.

D) System test scenarios, documenting all test phases, including pre-testing, functionality verification of defect detection tools, and stress testing in various configurations, including human presence scenarios.

Contribution of Partners on this task 5.1:

UNITN	Support to the platform integration, mainly for the defined and implemented algorithms, HW and SW integration of the first version of the MAGICIAN robot. Organization of the integration work and to the delivery of goods and material among the partners; organization of the schedule and delivery of the HW and SW components.
IIT	Development of the overall system software architecture. Integration of new software modules. Software written and implemented on platform PCs. 3D data of visual perception tool, the physical cleaning tool components are supplied physically. Integration of the grinding tool ON/OFF control. Integration of motion trajectory generation modules. Hosting of two integration weeks in IIT.
FORTH	FORTH contributed to the integration of the perception prototype on the MAGICIAN sensing robot, enabling real-time scanning and classification within the full stack; multi-modal acquisition and ROS messaging were exercised end-to-end. As D3.2 outlines, additional recording campaigns and shipments were coordinated around the integration schedule.
CRF	Participation to the integration week from 16 to 19 June 2025 in Trento (UNITN premises). Active contribution and support to the integration of the perception prototype on the MAGICIAN sensing robot, especially for the parts related to the lighting system of the MAGICIAN camera, in tight collaboration with ALT and FORTH.
TOFAS	3 conveyors, 1 skid, 1 car body and door prototypes are supplied to ALT.

ALT	The complete demonstrator documentation has been finalized. It covers the physical architecture and the integration of cobots, slider, and conveyors, along with details of the operational tools (visual/tactile sensors and the grinding tool). All system modes have been defined, ranging from the learning phase to full automation, with rigorous stress tests documented for scenarios involving human presence. ALT attended all relevant online and physical project meetings to follow the progress and started implementing activities in order to demonstrate the work performed in different WPs all together in the demonstrator platform.
PIP	Participation in meetings and following progress. Performance analysis internal evaluation and considerations for involved modules.
HWH	Internal manufacturing and configuration of a tailored welding control unit. Welding Control Units to be used for defect simulations supplied to ALT.

Task 5.2: Demonstrator set-up (M16-M45; Lead: ALT; Part: UNITN, CRF, TOFAS, PIP, HWH)

Coordination meetings are performed with TOFAS regarding the material, i.e. 3 conveyors, 1 skid, and 1 car body and door prototypes supplied by TOFAS. Missing sensors and brackets are supplied, maintenance of conveyors made, conveyors are painted and installed in Altinay facilities. Currently design work is in progress regarding the design of sliders, fences and stoppers and their locations. Until the slider design was completed, the robots are positioned according to the layout and directly fixed at a height of 1 meter above the ground to allow for software and other testing. Work on the panel, sensors, and cables began.

Then, validation tests of three conveyors are conducted. No problems are detected with the belts or motors. Defective sensors received have been identified and will be replaced. Currently, once the conveyor testing is complete, the vehicle body, along with the skid, will be placed on the conveyor and tested with a stationary robot. Once the slider design is complete, the stationary robot base will be removed, and robot and control unit will be assembled on the slider.

Contribution of Partners on this task 5.2:

UNITN	Coordination of the activities among the partner towards the demonstrator set-up.

CRF	Collaboration with ALT and UNITN on the demonstrator set up activities, with specific focus on the lighting system of the perception module, in tight collaboration with FORTH.
TOFAS	3 conveyors, 1 skid and 1 car body and door prototypes are supplied TO ALT.
ALT	The physical demonstrator has been set-up using the available material from TOFAS and the two acquired Doosan robots. Two out of three end-effectors have been integrated in the system.
PIP	Operationalizing and evaluating ML models for demonstrator setup.
HWH	Internal manufacturing and configuration of a tailored welding control unit. Welding Control Units to be used for defect simulations supplied to ALT.

Task 5.3: Performance analysis (M16-M48; Lead: TOFAS; Part: UNITN, IIT, LU, CRF, ALT, PIP, HWH)

This task focuses on evaluating the overall system performance across all project modules using standardized testing procedures. Partners will provide quantitative and qualitative data from their respective components, which will be integrated to assess compliance with project KPIs. The analysis will include statistical evaluation, scenario-based testing and performance report summarizing results.

System test scenarios, including all test phases and pre-testing, functionality verification of defect detection tools, and stress testing in various configurations, including human presence scenarios are defined together with participation of all project partners, thanks to coordination of UNITN.

Contribution of Partners on this task 5.3:

UNITN	Definition, with ALT, of the testing modalities and operational modes of the prototype for the integration and the evaluation of the demonstrator.
IIT	Collection of data and troubleshooting analysis of the integrated components and robot control modules.
LU	LU attended all relevant online meetings and contributed with the SSH perspective.

CRF	Proficient collaboration in the T5.3 activities and support to TOFAS for the planning and conduction of the performance analysis.
TOFAS	TOFAS started to work with ALT and other technical partners to get prepared about the final demonstration and performance analysis. Since the system will operate initially at ALT premises, the system will be observed in there and will be installed and operated according to the lessons learned from there.
ALT	Defined and implemented the setup of platform and demonstrator, now still implementing the system operational modes and preparing the test setup.
PIP	Quantitative analysis of ML models performance.
HWH	General monitoring of the activities within this task. No relevant results so far.

2.2.6 WP6 - CASCADED FUNDING MANAGEMENT (ZAB, M13-M48)

The goal of WP6 is to launch and manage two Open Calls (OC) for proposals aimed respectively at a) deepening and expanding the functionalities implemented in the project core pilots (OC1), b) extending the applications of the intelligences embedded in the systems (AI) towards new use cases (OC2). During the period in object, WP leader (ZAB) organized a detailed plan for the implementation of the activities of the WP and submitted to the attention of the coordinator and WP leaders the possibility to anticipate the public launch of OC1, to optimize the timing of the FSTP projects implementation and guarantee time buffer for the OC2 selected projects implementation. After approval by the partners, the option was presented to the PO for final approval and validation before proceeding to WP6 implementation.

Submitted deliverables:

D6.1 Report on OCs launch and selection of beneficiaries (M24)

Milestones

MS3 User-centred requirements and platform design: launch of the open calls (M18)

MS5 First complete working prototype: signed contracts for OC1 (M24)

Details of the activities by Task and by Beneficiary

Task 6.1: Open Calls launch, management and selection process (M13-M36; Lead: ZAB; Part: All)

After these preliminary steps (documented in the previous reporting), ZAB proceed in the elaboration of relevant documentation for the launch and promotion of OC1, leveraging on the collaboration with the technical partners in order to define the targeted developments to be addressed by the applicants. In detail, the macro functionalities defined covered the following areas: F1. *Perception* and F2. *Human-Robot Collaboration Solutions*; besides technical scope, partners were solicited also to agree upon other specific aspects such as the possibility for applicants to work in small consortia (i.e. Twin AS) and cross-border collaboration requirement (eventually withdrawn). The decision taken were reported in the following documents: 1. Open call short text, 2. Guide for applicants, 3) Flyer, 4) Template for applications. These documents were published and the call was officially launched on February 3rd 2025 (deadline May 2nd), via the project website and Funding&Tender portal: a dedicated communication campaign was launched to promote the open call, encompassing standardized mails to be sent by the partners to relevant organizations (e.g. Accelerators, RTOs, associations), presentation of the call via a dedicated webinar hold in M17 and dissemination through the project social media (in collaboration with WP7). Finally, during the call opening period (M17-M20), ZAB hold weekly online open helpdesk sessions via Teams, every Wednesday from 17h00 to 18h00 for applicants to propose and have solved their questions in a live session. Every generally relevant question proposed during the helpdesk was reported on the open call FAQ and in case of technical question, support was requested to technical partners and detailed answers reported via mail to the potential applicant. Finally, during the open call period, ZAB and UNITN perfectionated the standardized AS Agreement, to facilitate subsequent contracting procedures, and conducted the selection of final reviewers based on suggestions of the partners.

As of May 2nd, >80 proposals were received, among which 72 proposals were eligible for evaluation: ZAB coordinated the evaluation process, having all proposals allocated to one external evaluator plus one internal evaluator (selected among project partners) for review according to the indications specified in the corresponding guide for reviewers. Scores were assigned on Excellence, Impact (including a dedicated Business case evaluation conducted by a ZAB internal expert) and Implementation, on a scale from 1 to 5 for each criterion (equally ranked). The minimum total threshold for selection assigned was 9 out of 15: at evaluation committee meeting (involving exclusively internal evaluators) it was decided that proposals scoring >12 points would have undergone a third round of evaluation by internal technical partners to validate the final selection. Eventually 5 projects were selected 4 for F1 and 1 for F2, ensuring the combination of best performance and diversification of the proposal selected.

This evaluation process was supported by UNITN, IIT, Forth and PIP by providing their expert analyses as internal reviewers and assessing the proposals.

After completion of the evaluation process, detailed evaluation summary reports were

sent to each applicant, both selected, reserve list and rejected ones, and selected beneficiaries invited to proceed to contracting phase, based on the published template of agreement.

Partner contributions to Task T6.1

UNITN	Supervision of the OC launch, participation to the selection process, support to the grant definition and sign.
IIT	Participation to the OC launch preparation and screening of the received project applications.
LU	LU attended all relevant online meetings and provided support to the Open Calls launch by contributing with the SSH perspective.
FORTH	Support to the Open Calls launch, management, and selection process of the first MAGICIAN Open Call. FORTH participated in the internal technical evaluation of proposals, contributing expert reviews focused on the feasibility and alignment of submitted projects with the MAGICIAN perception and AI-related objectives.
CRF	Support to the Open Calls launch, management and selection process of the first MAGICIAN Open Call.
TOFAS	Support the Open calls management. The selected proposals were evaluated by TOFAS experts.
ALT	Support to the Open Calls launch, management and selection process of the first MAGICIAN Open Call, participating monitoring of one of the selected 3rd party projects.
SIG	Support to Open Calls promotion and website updates, especially with regard to News and additional FAQs following helpdesk sessions.
ZAB	Management of launch and closure of OC1 (M20); coordinating the evaluation process of OC1, including eligibility external, business, and internal evaluations; coordinating the second round of internal evaluation; and hosting and leading the consensus meeting for the final selection. Sending out feedback notification to applicants by sending ESRs (M21) organizing KoM

	to launch activities with the selected 5 ASs (M22). Coordinating the refinement and signature process of the subgrant agreements with the selected third parties, in collaboration with UNITN (M24). Starting to adapt documentation in preparation of the launch of OC2 in M27.
PIP	Support to the OC launch, participation to the review and selection process, support to the grant definition. Open call promotion activities.
HWH	General support of the Open Calls launch activities.

Task 6.2: OC implementation and monitoring (M25 – M36; Lead: ZAB; Part: UNITN, IIT, TOFAS, ALT)

This task is not yet started. Preparatory work to inform the monitoring partners of their duties, including preparation of monitoring templates, has been performed. General introductory meeting with all selected beneficiaries has been realized as well as assignment of monitoring partners to selected FSTP beneficiaries. Official launch of FSTP projects is expected on September 2025 (M24) with minor anticipation respect to timing expected by GA.

Partner contributions to Task T6.2

UNITN	Definition of the monitoring duties, Initialisation and start-up of the monitoring.
IIT	Following one of the selected projects from OC.
TOFAS	Supporting the OC third party partners
ALT	Monitoring one of the selected projects from OC. The presentation made by the selected party has been studied and their previous relevant projects are investigated.
ZAB	Creation of private Teams channels for each AS to enable the exchange of confidential documentation (i.e. MAGICIAN results); Coordination of the assignment process of monitoring partners to each of the 5 selected ASs. Definition of the monitoring partners' roles.

Task 6.3: Innovation management, impact assessment and lesson learned (M19-M48; Lead: ZAB; Part: UNITN, IIT, CRF, TOFAS, ALT, PIP, HWH)

Innovation management programme preliminary structure preparation conducted: most of the activities are expected to be launched as of September 2025 (M24), in coordination with the launch of the FSTP projects.

Partner contributions to Task T6.3

UNITN	Discussion on the innovation management related to the OC1.
IIT	Participation to discussion about potential innovations produced in the project.
CRF	General contributions and support to ZAB to the task activities.
TOFAS	Contribution to task activities.
ALT	General contributions and support to ZAB to the task activities.
ZAB	Leveraging the survey insights and lessons learned from OC1 to apply in OC2
PIP	General contributions and support to ZAB to the task activities.
HWH	General support of the initial activities.

2.2.7 WP7 - DISSEMINATION AND EXPLOITATION (SIG, M1-M48)

The primary goals of WP7 are to establish communication channels with potential MAGICIAN stakeholders, including industries, scientific communities, consumer associations, solution providers, regulatory bodies, and the general public. The established communication channels support project visibility and build stakeholder engagement which in turn feed into an effective dissemination of project results. The following section details the activities carried out until M24, including the updated exploitation pathways and strategies as well as the management of intellectual assets.

Submitted deliverables:

D7.1 D&C and exploitation plan (M6)

D7.2 Second D&C and exploitation plan (M24)

Milestones

MS1 Project start-up: deliverable, D&C and Exploitation plans (M6)

Details of the activities by Task and by Beneficiary

Task 7.1: Dissemination and Communication (M4-M45; Lead: SIG; Part: All)

Regarding project communication, SIG has successfully established channels and promotional materials to lay the foundation and over time extend awareness on MAGICIAN across pre-identified target groups. This progress is visible from the webpage visitor and the social media Follower numbers. Until M24, the webpage has reached 2,908 website visitors and 8,781 page visits, while the follower numbers for LinkedIn have risen to 244 followers.

Both, the website and the LinkedIn account have continuously been filled with updates on project activities and outputs including partner meetings, updates on the development of robotic solutions, event updates, scientific publications as well as public deliverables, and project collaborations. These updates have been summarized for stakeholders in an easy and attractive way in two newsletters (M11, M23) published via LinkedIn to make use of the stakeholder outreach built via this platform.

Project dissemination of MAGICIAN focused on partners' event participations, and publications – both deliverables and scientific publications – the promotion of the 1st Open Call, and the progress in the development of robotic solutions. In addition, project collaborations with INVERSE have been continued (e.g. joint publications, planned joined workshop), and a new project exchange initiated with the related EU project ENFIELD. Apart from these collaborations, MAGICIAN has followed event invitations by related projects (Online Event on SSH and industry) and has actively participated and contributed to events by the wider EU AI, Data, and Robotics community, e.g. the ADRF 2025, as well as EU events (e.g. DG Connect workshop).

For project updates, SIG was supported by all MAGICIAN partners, providing input on focus points such as event participations, robotic solutions development, and publications as well as maximizing outreach by spreading project news published via the website and Social Media channels through own channels.

A cornerstone of both communication and dissemination activities was the promotion of the 1st Open Call through LinkedIn (Social Media campaign before and after launch), YouTube (OC Webinar video), the Website (News and Open Calls section), and partners' networks as well as event participations. The interest in the Open Call resulted in a noticeable spike of numbers in website visitors and LinkedIn followers and promotion activities therefore also aimed at triggering long-term interest and engagement with project activities.

To ensure Open access for all MAGICIAN scientific publications, MAGICIAN partners have deposited publications either in the MAGICIAN Zenodo community established by SIG or in arXiv in cases where Zenodo was not accepted as repository by conference organizers (IEEE conferences and publications).

For internal organization with partners and overview of ongoing communication and dissemination activities, the monitoring table has been continuously updated by all MAGICIAN partners and analysed by SIG. Regarding communication and exchange between SIG as WP7 lead and all other MAGICIAN partners, monthly WP leader meetings are used to communicate updates and gather feedback on upcoming and delivered events, publications, and communication activities. Individual exchanges via mail and/or Teams complement internal organization for specific activities such as participation and presentation at events or support in the publication process.

The PDEC has been updated for the first time in D7.2 (M6) and a second time in D7.2 (M24) reflecting a refined focus on communication, dissemination, and exploitation strategies.

Table 2 and Table 3 below provide an overview of the status quo of KPIs for communication and dissemination activities.

Table 2 - Communication KPIs status

COMMUNICATION MEASURE	KPI	STATUS
Website	1 Website > 10,000 page visits by M48	> Website Online (M6) > Page visits until M24 (16.09.): 8,781 > Website visitors until M24 (16.09.): 2,908
Corporate Image	1 updated logo Documents templ. PPT templ.	> 1 updated project logo > 1 Word Template > 1 PPT template > Updated General Project presentation > Social Media & Flyer Templates
Social Media Presence	> 500 overall followers (M48)	> 244 LinkedIn followers (M24) > 4 YouTube followers, 366 views of OC webinar video (M24)
Promotional Material	4 posters 1 roll-up 4 project brochures	> 1 roll-up > 1 updated poster > 3 Project Brochures (General, Joint Flyer with INVERSE, 1st OC)
Newsletters	8 newsletters	1st newsletter in M11 2nd newsletter in M23

Video	2 videos	Not started yet.

Table 3 - Dissemination KPIs status

DISSEMINATION MEASURE	KPI	STATUS
Workshops	2 demonstration workshops 2 educational workshops	>1st demo WS planned for 17th Oct. 2025 at I-RIM 3D (UNITN) > other workshops planned
Web seminars	6 web seminars • 1 focusing on human-centred approach • 2 demonstrator seminars • 1 market uptake seminar • 2 Open Calls seminars	> 1st OC web seminar in M17 > other web seminars planned
Activities with other projects/init.	Min. 1 joint activity with related projects/init.	**INVERSE**: Social Media, newsletter, joint publication. **EARASHI & INVERSE**: Joint ADRF workshop applications **AUTOASSESS:** Exchange meeting, OC & Comm. mutual support **CSA activities:** e.g. participation to EC Launch event, DG Connect Workshop AI & Robotics, ADRA events **ENFIELD:** exchange meeting
Events/Conferences participation	> 30 active participations in various events, workshops etc.	27 event participations

Scientific Publications	> 10 conferences/workshop papers (Open Access) > 5 peer-reviewed scientific publications (Open Access)	> 5 OA Conference Papers > 3 OA Journal Articles
Industry and EU publications	> 2 articles in industrial magazines or EU publications	1 article on MAGICIAN Kick-off and general project information in the industrial publication "Schweißzeit" (01_24) published by **HWH**
Contributions in policies/ standardisation	1 jointly developed policy brief	Not initiated yet, HS Booster has been considered

Partner contributions to Task T7.1

UNITN	Participation to events, fairs; preparation, submission and presentation of scientific papers on the different MAGICIAN innovation outputs.
IIT	Participation in one Industrial fair, organization of Scientific workshop.
LU	Execution of various communication activities. Among these were a presentation of MAGICIAN regarding findings from the fieldwork at WORKS 2025 in Finland, and the submission of manuscripts to, among other conferences, ICRA 2026 and HRI 2026.
FORTH	Participation in dissemination and communication activities, contributing to the promotion of MAGICIAN results and supporting the definition of exploitation directions.
CRF	Thorough involvement and participation to the activities and regular telcos of the T7.1, contributions to the D&C and exploitation activities of MAGICIAN.
TOFAS	Support to the task activities and participation to

	periodic meetings.
ALT	Participation in the D&C and exploitation activities.
SIG	1st OC promotion, Monitoring of D&C activities, Regular Website updates and LinkedIn updates, 2nd MAGICIAN newsletter published, exchange meeting with related EU project (ENFIELD), contribution to DAC operations regarding scientific publications, SyGmA updates.
ZAB	Contributions to the D&C and exploitation activities of MAGICIAN. Support in the publication and promotion of OC1 communication material. Participation in >2 Webinars dedicated to MAGICIAN OCs promotion.
PIP	Contributing to D&C and exploitation activities of Magician. Visiting Vision, Motion and Robotics event for promotion of project and open calls in the Netherlands.
HWH	Execution of various communication activities. Among other, presentation of MAGICIAN defect detection and analysis system at ETFA 2025, Porto, Portugal and at Welding&cutting fair, Essen, Germany.

Task 7.2: Ecosystem Mapping and Development (M1-M48; Lead: SIG; Part: All)

For this task, the first ecosystem mapping workshop has been implemented with all partners in M4, resulting in a refinement of target groups engagement strategies. Findings from the workshop have been summarized in an internal report and used to adjust MAGICIAN's communication and dissemination strategy as described in D7.3.

The first iteration of stakeholder mapping resulted in the identification and classification of **64 stakeholders** across **7 regional and European ecosystems**. These stakeholders were categorized using a **Power–Interest Matrix** into four engagement tiers: Actively Engage, Keep Satisfied, Keep Informed, Monitor.

The mapping focused on six main stakeholder groups: Startups / SMEs / industrial stakeholders, End-users / customers, Researchers, universities, RTOs, Policy makers, Local / European institutions, Wider society.

The matrix was operationalized by partners through structured data collection and evaluation of each stakeholder's influence and interest in MAGICIAN. This approach allowed the consortium to tailor its outreach efforts by defining differentiated engagement objectives per stakeholder tier.

Summary of the profile of stakeholders and engagement strategy

Stakeholder	Actively Engage	Keep Satisfied	Keep Informed	Monitor
Wider society	1		2	
Local / European Institutions	3		2	
Policy makers	2			
Researchers, universities, RTOs	1	2	10	
Startups / SMEs / Industrial stakeholders	1	7	6	1
Developers' Community	1			4
End-users / Customers	1	3	9	1

■ Actively Engage   ■ Keep Satisfied   ■ Keep Informed   ■ Monitor

A detailed **profile of stakeholders was produced**, summarized, and distributed across engagement categories and stakeholder types in line with the inputs of partners. For instance:

- The "*Actively Engaged*" category includes strategic actors such as the European Commission, ADRA, INVERSE project, key EDIHs, and automotive manufacturers (via partner ALT).
- The "*Keep Satisfied*" category includes major industrial automation firms such as ABB, KUKA, and Ferrobotics.
- The "*Keep Informed*" category features organizations like VDL, DAF Trucks, Bosch Service, POLIMI, TU Wien, and CVRL-ICS FORTH.

This classification provides a structured baseline for all future communication, dissemination, and exploitation actions in MAGICIAN.

To support differentiated engagement, the task specifies **the communication and dissemination instruments** that will be utilized to engage each stakeholder, specifically, Open Call webinars and workshops, Joint activities with EU projects, Co-authored policy, scientific, and industrial papers, Joint exhibitions and demonstration events.
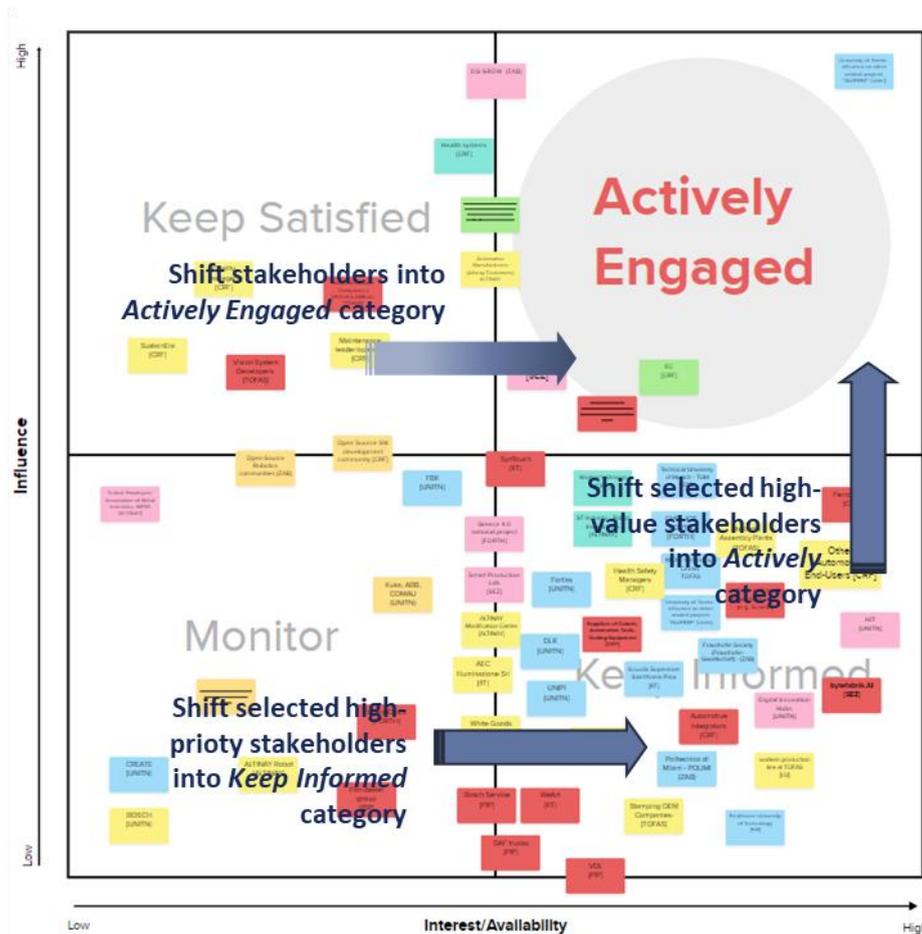
The strategic goal of the task is not only to engage stakeholders, but to actively **shift key actors into higher engagement categories** as the project progresses. For instance, stakeholders initially placed in the "Keep Satisfied" or "Keep Informed" categories are now targeted for future elevation into the "Actively Engaged" quadrant.

A roadmap for ecosystem engagement was developed, outlining concrete actions from M12 to M48 of the project. Key milestones include: Two Open Call Seminars (M18 and M30)

- Two Demonstration Workshops and two Educational Workshops
- Market Uptake Seminar
- Webinars on human-centred approaches and demonstration outcomes

These activities will be coordinated with the dissemination of project results and the implementation of the FSTP scheme (T7.1 and WP6). Additionally, each partner will refine their stakeholder lists and begin **initial engagement with 1 to 3 priority stakeholders**, based on potential mutual benefit and alignment with project objectives.

A priority of MAGICIAN's dissemination strategy is to connect with local and EU AI, Data, and Robotics ecosystems to increase the impact of project activities. In this respect, MAGICIAN has connected with the European Digital Innovation Hub (EDIH) ecosystem via strategic outreach and event attendance, notably as part of Open Call promotion.

Other strategic engagement ecosystems identified are the ADRA Partnership and Made in Europe PPP. MAGICIAN has established ties with both ecosystems through event participation (both physical and online), project presentations, and Open Call outreach.

In addition, local ecosystems have been activated by all MAGICIAN partners to engage target groups and spread updates on project activities, including the 1st Open Call.

The following steps in the mapping and engagement activities involve the **prioritization of 1 to 3 three stakeholders per partner**, followed by the development of a **value creation-based approach with each of them**, such that each partner can rationalize clearly the value that the corresponding stakeholder will obtain by engaging with MAGICIAN and vice versa. These engagement strategies will consider and align with pre-defined dissemination and communication actions.

These activities will feed into the following engagement activities until the end of the project with adaption and improvements depending on the results of the efforts

Partner contributions to Task T7.2

UNITN	Discussion on strategic research areas, industrial partners and other initiatives potentially interested in MAGICIAN, participation to events of on AI, data and robotics. Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
IIT	Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
LU	Dedicated engagement activities to be defined in late 2025,

	based on stakeholder prioritization.
FORTH	Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
CRF	Participation to the workshops and activities, in coordination with SIG, on the stakeholders, ecosystem mapping and development. Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
TOFAS	Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
ALT	Participation to the workshops and activities, in coordination with SIG, on the stakeholders, ecosystem mapping and development. Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
SIG	Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
ZAB	Participation to the workshops and activities, in coordination with SIG, on the stakeholders, ecosystem mapping and development. Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
PIP	Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.
HWH	No major results obtained so far. Dedicated engagement activities to be defined in late 2025, based on stakeholder prioritization.

Task 7.3: Path toward Exploitation (M1-M48; Lead: SIG; Part: All)

The first MAGICIAN Exploitation workshop was implemented and has been complemented by exploitation meetings with individual partners to refine Background IP, gather an overview of expected Foreground IP and coordinate exploitation activities between all partners. Findings from these meetings and the first exploitation workshop have been detailed in an internal report to establish a basis for IP management and exploitation pathways.

Refinement of BIP
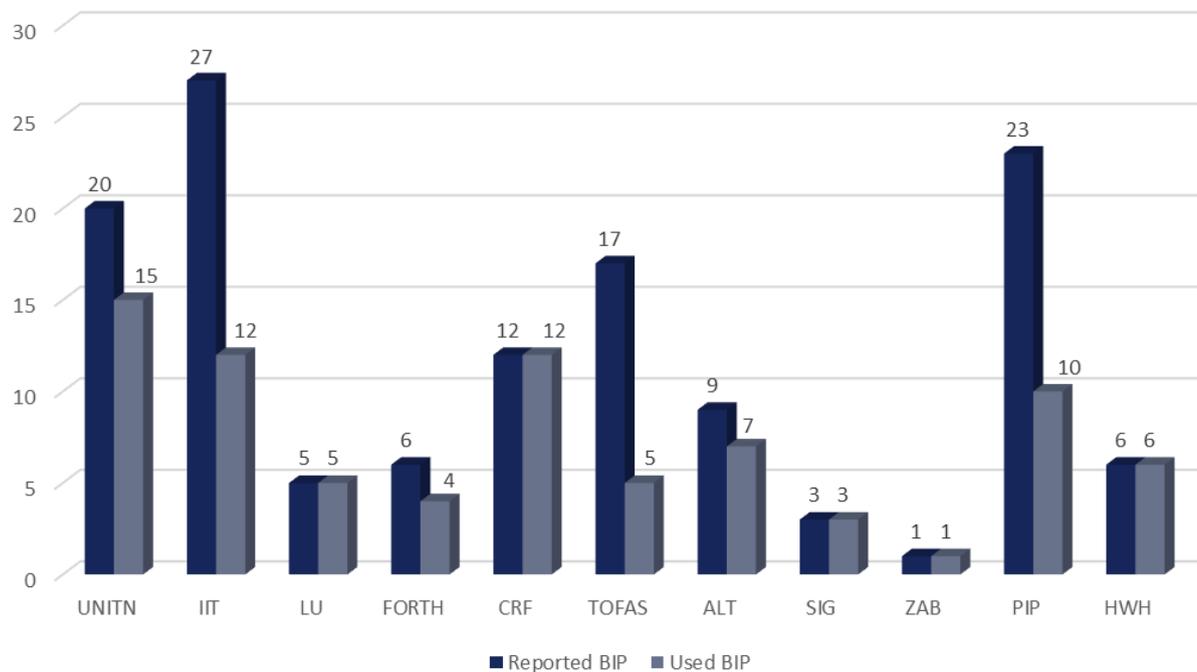
As a result of these activities, the amount of Background IP declared increased significantly from the 80 items initially reported in the Grant Agreement to a total of **129 BIP items**, marking an approximate **60% increase**. Additionally, an initial dependency mapping between Background and Foreground IP has been completed. This mapping established **358 individual contributions of BIP to FIP**, with **80 out of the 129 BIP items** contributing directly to at least one Foreground IP. These figures demonstrate the project's ability to unlock and leverage existing knowledge, which enhances the legal clarity, strategic value, and potential reuse of these assets in future developments or commercialization efforts.

New Intellectual Assets identified by partner
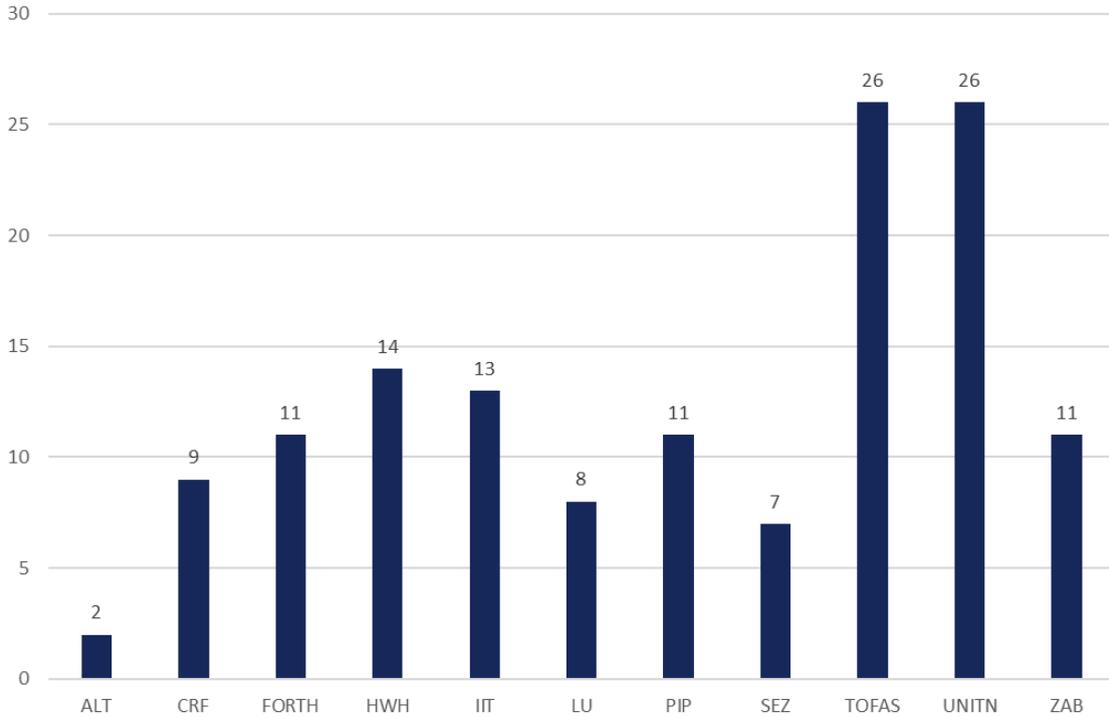
The consortium has identified **128 individual Foreground IP assets**, many of which are relevant to more than one KER. These assets have been thoroughly mapped and allocated to their corresponding KERs. The current data show strong correlations between partners and multiple KERs, including clear cross-contributions. For instance, KERs such as K3 and K4 have the highest number of associated FIP assets (24 and 20 respectively). The IP assets cover a wide spectrum including software toolkits, methodologies, experimental data, and robotic modules. The case of KER6 is specifically noteworthy, as it refers to a software toolkit for rapid reconfiguration, which includes licensing potential, design protection, and commercial agreements. These findings highlight that technological developments are being systematically translated into protectable and potentially exploitable outputs.

Co-funded by
the European Union
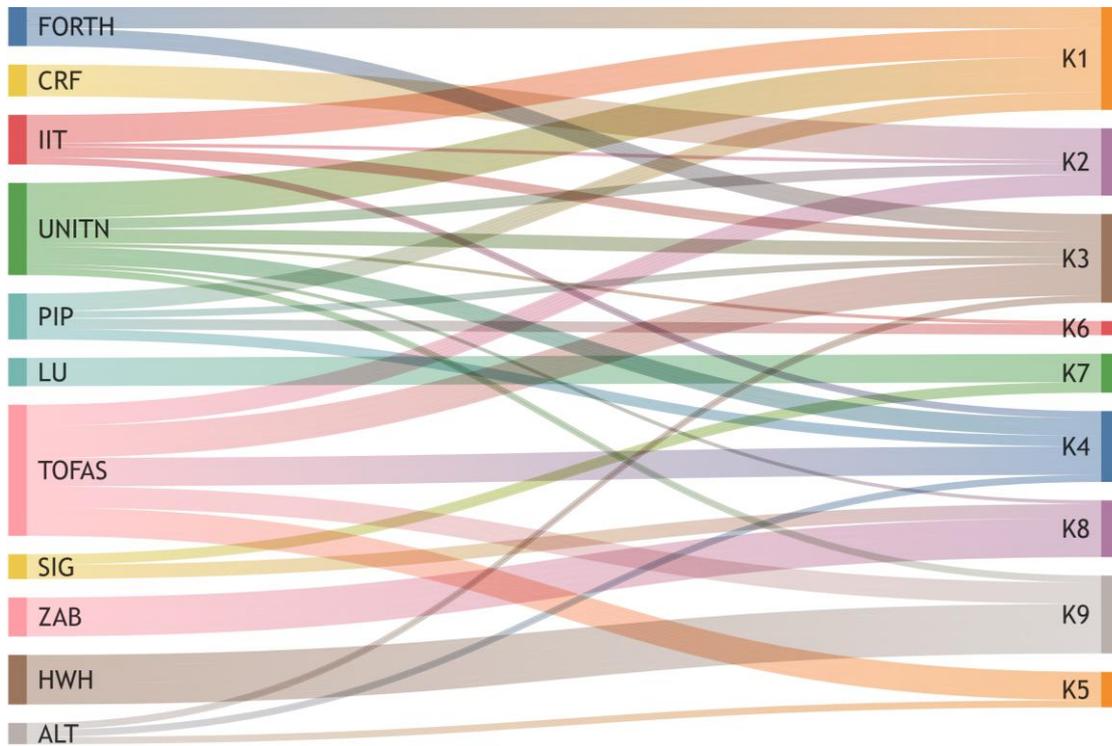
Each partner has refined their exploitation strategy for the KERs in which they are involved, considering updated IP assets and interdependencies. These strategies are being integrated into a shared Results Ownership List (ROL), which is regularly updated. The consortium has agreed to implement bi-monthly update cycles to consolidate inputs and add missing or emerging assets. Additionally, a structured internal exploitation report is currently under development and will be submitted for approval by both the consortium and the Project Coordinator. Future steps include finalisation of the exploitation pathways for each KER, identification of licensing or spin-off potential, and alignment with the business cases outlined in the project's exploitation workstream. These actions are critical to ensure the long-term impact and post-project sustainability of MAGICIAN's innovations.

Partner contributions to Task T7.3

UNITN	UNITN to finalise co-ownership with IIT/FORTH, define modular licences, validate KER1–KER4 in pilots, and align IP governance for next exploitation cycle.
IIT	Participation to discussions related to the development of exploitation plan activities. IIT to finalise joint IP governance on shared K1 FIP, advance K3–K4 patent filings, define modular licences, and prepare bundled QA–rework offer for industrial

	adopters.
LU	Participation in T7.3 telcos and coordination with SIG on the development and implementation of planned exploitation activities. LU to formalise licensing terms for HRI toolkits, align with KER2/8 validations, and develop a branded Human–Robot Well-being Toolkit for consulting and standardisation uptake.
FORTH	Participation in T7.3 telcos and coordination with SIG on the development and implementation of the planned exploitation activities. FORTH to finalise co-ownership terms with IIT/UNITN, transform K4 control research into new IP, and launch licensing-ready algorithmic assets for industrial and research exploitation.
CRF	Participation to the T7.3 telcos and coordination with SIG on the development and implementation of the planned exploitation activities. CRF to formalise service-IP portfolio, co-develop "MAGICIAN Ready" certification with IIT/ALT, and expand integration validation into KER5 pilots for industrial replication and licensing.
TOFAS	Participation to periodic meetings and support the task activities. TOFAS to formalise datasets and validation frameworks as BIP, integrate derivative-use clauses with IIT/UNITN, and launch branded validation services for robotic process certification.
ALT	Participation to online workshops and coordination with SIG on the development and implementation of the planned exploitation activities. ALT to register unrecorded integration IP as BIP, refine co-licensing with IIT/UNITN, and expand service-based exploitation via pilot validation and replication of MAGICIAN's robotic solutions.
SIG	Identifying and detailing potential products emerging from the KERs, in line with the updated individual exploitation strategies and evolving FIPs.
ZAB	Coordination with SIG on the development and implementation of the planned exploitation activities. ZAB to register BIP derivatives, formalise co-branding with SEZ/UNITN, and scaling its exploitation services across EU projects.
PIP	Participation to the T7.3 telcos and coordination with SIG on the

	development and implementation of the planned exploitation activities. PIP to formalise 10 BIPs, establish joint IP governance with IIT/FORTH/UNITN, and commercialise KER6 via modular SaaS licensing, branding it as MAGICIAN's core AI reconfiguration toolkit.
HWH	Participation to online workshops and coordination with SIG on the development and implementation of the planned exploitation activities. HWH to finalise patent filings for K9 FIPs, define BIP–FIP demarcation with RECLAIM, and develop modular IP bundles for licensing and integration with industrial partners ALT and TOFAS.

2.3 IMPACT

Impact on scientific community

MAGICIAN partners have been actively disseminating MAGICIAN at a variety of scientific conferences including IEEE conferences (e.g. ICRA, CASE), SSH and future work-related conferences, and engaged in scientific knowledge transfer in educational events such as workshops, thereby contributing to scientific exchange on MAGICIAN-related topics including ADR, but also SSH in industry, and manufacturing. MAGICIAN partners have also contributed to scientific impact by ensuring that all publications are available Open Access and thus be taken up by the scientific community. An overview of scientific events and publications can be found in D7.2.

The impact consolidation strategy regarding the KERs with the highest commercial potential will be presented in the later reports, since the refinement of business cases and Go-to-market strategy development will take place once the technical development reaches the necessary level of maturity.

2.4 UPDATE OF THE PLAN FOR EXPLOITATION AND DISSEMINATION OF RESULTS

A detailed update on the status quo of Communication, Dissemination, and Exploitation activities, the progress achieved, and the adjustments applied to the communication, dissemination, and exploitation strategy as a result of project progress, exploitation workshops, and stakeholder mapping activities has been provided in D7.3 until M24.

Additionally, continuous reporting on these activities has been provided via the EC portal, including publications and event participations.

Internally, communication and dissemination activities are monitored, coordinated, and updated through a dedicated monitoring table which is continuously filled with information by all MAGICIAN partners and managed by SIG.

3 FOLLOW-UP OF RECOMMENDATIONS AND COMMENTS FROM PREVIOUS REVIEW(S)

The first review took place in May 2025 where the project has been judged aligned with the planned developments and implementation, with some minor issues that need attention for the remaining development of the project. Those comments are detailed next, with the follow-up already put in place in the project and a description of the future actions.

3.1 OBJECTIVES AND WORKPLAN

The performed work contributed to the project overall objectives and aligned with the workplan. However, regarding the objectives the following point if attention have been raised:

- "*Accordingly with objective 6, more specific KPIs to measure the acceptance of the technology among users should be specified*". Refined and, in case, additional KPIs will be defined for O6, mainly within the work of WP2 during the third year.

- "*Critical risks related to user involvement and user acceptance are not sufficiently included. It would be appropriate to add these, as well as project management risks.*" A refined risk table has been newly defined and finalized in the next General Assembly meeting.

- "*User involvement in interviews is not well balanced (5 females out of 31 participants). To improve the balance, it could be beneficial to involve external users in interviews.*" We have already discussed in M24 how to address this issue, and the consortium, under the supervision of WP2, identified possible activities to make up for this shortcoming.

- "*Public deliverables are available on the project website and research publications are being shared, though there are some inconsistencies in the links provided to open accessible publications at the moment.*" This issue is now fixed and everything is working properly.

- "*However, as the project progresses towards real-world testing, closer collaboration between social science and technical teams will be essential to fully implement the intended human-centered approach.*" We have already discussed in M24 how to address this issue by organising WP2-lead meetings on this specific point. The issue will be fully addressed in the third year of the project.

3.2 IMPACT

Regarding the impact:

- "*No significant negative environmental impacts are expected from the project's results, although concerns about potential job reductions, which stakeholders*

fear, need to be properly addressed, especially in the next phases of the project." Under the work of WP2, these issues will be addressed with the planned focused workshops and interviews.

- "*It is suggested that a policy brief will be developed jointly with other Horizon Europe projects and topic groups at euRobotics, I-RIM and the AI4EU, Data and Robotics, although this work has not yet been initiated.*" The policy-related matter will be addressed in the fourth year of the project, when tangible results and assessment will be clearer.

3.3 OVERALL ASSESSMENT

The project overall activities have been carried out efficiently, albeit some minor issues have been identified. Besides the recommendations previously reported, these additional points should be properly handled:

- "*A minor delay concerns the vibration suppression, so most tests are still in simulation. This delay has been addressed by hiring additional staff at IIT and these results are due in the next few months.*" Experimental evidence about the vibration suppress system have been reported in D4.2. The end-effector for the CR robot is now integrated in the ALT's demonstration area.

- "*Human-robot interaction and motion capture developments are good, but their planned integration into the pilot experiments is not yet clearly described. In the next reporting period, the consortium should both clarify and demonstrate how these elements will be applied in the pilot studies, which are expected to take place during the next 18 months.*" The motion capture system has been tested properly in a laboratory environment and will be tested in the ALT's demonstration area, according to the planned activities.

4 EXPLOITATION PRIMARILY IN NON-ASSOCIATED THIRD COUNTRIES

Not applicable.

5 OPEN SCIENCE

As established from the beginning of the project, MAGICIAN continues to be committed to Open Science as put forward by the Grant Agreement and ensures that all publications are available Open Access to maximize the impact and uptake of project outputs. Open Access of MAGICIAN publications is ensured via the scientific repositories

Zenodo and arXiv with the aim of making project results easy to find, accessible, interoperable, and reusable (FAIR principles).

All publications as well as public deliverables are also available via the MAGICIAN project website as central access point to all project information and outputs. Publications are also a regular focus point in communication and dissemination activities to notify the scientific community of these project outputs and encourage their uptake.

Internally, SIG has created guidelines for Open Access and Zenodo for MAGICIAN partners to offer orientation. This document has been extended to include IEEE publishing rules, thereby integrating project progress. This guiding document is complemented by a webinar recording resulting from an initiative by UNITN to inform partners on Open Science and Data Management obligations under Horizon Europe.

6 DEVIATION FROM ANNEX 1 AND ANNEX 2

No serious deviations have been observed in the execution of all the activities in this second year of the project. However, we must notice that, due to problems in acquiring the necessary hardware components to implement all the features of the CR and SR, the physical realization of the end-effectors has been slightly delayed. Also, the logistic issues observed in the shipment of material to Turkey also forced the robots physical integration to be delayed as well. Albeit the algorithms and the underlying learning-based solutions have been developed as planned and despite the three integration weeks, the final robot integration in ALT's demonstration area is delayed of almost one month. This is not a serious concern, since the final validation of the MAGICIAN prototype as well as the integration of the solutions coming from the OC third parties is due at M36, so a sufficiently long time to absorb the delay.

6.1   TASK/OBJECTIVES

Regarding the O1 - *A robotic perception module integrating visual and tactile sensors*, the perception and the tactile end-effectors have been developed as planned. However, a study on the integration of both sensing system in the same end-effector is currently ongoing and will be available in the third year.

6.2   USE OF RESOURCES

We collected from the partner the information regarding the resources spent in the period M19-24 both in terms of effort and costs. All the partners provided estimations as this is not an official reporting, but these can be considered good estimations that allow us to monitor the progress of the project and detect potential issues.

We collected resource information from all partners for the M19-24 period, covering both effort (PMs) and costs. While this was not an official reporting milestone, the data provided are reliable estimations that allow for accurate progress tracking and the prompt identification of any budgetary or effort-related issues.

6.2.1 EFFORT

The MAGICIAN consortium claimed a total of 135,54 Person Months during the M19-24 reporting period. Details are shown in Table 4.

This figure represents 29,36% of the linearly planned effort for the overall M19-36 reporting period (calculated at 461,56 PMs, based on task duration). Although this is an estimation, it provides a clear indication that the project progress is on track and consistent with the activities performed.

Table 4 – Effort M19-M36

Duration	UNITN		IIT		LU		FORTH		CRF		TOFAS	
	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36
M1-48	12,75	3,57	0,75	0,20	0,75	0,22	1,13	0,27	1,13	0,32	0,75	0,24
M1-48	5,61	1,73	6,34	2,00	12,65	5,91	0,68	0,33	6,52	1,56	4,24	0,00
M4-45	16,71	6,65	21,00	4,05	0,86	0,16	26,14	4,45	5,14	1,63	4,29	0,00
M4-45	33,00	14,20	27,86	6,00	1,71	0,13	3,00	1,06	5,57	2,06	2,14	0,00
M16-48	16,42	5,42	6,87	1,50	1,64	0,09	4,80	1,00	6,38	2,13	17,35	4,32
M13-48	15,40	1,95	4,35	1,65	0,75	0,15	2,75	0,70	2,10	0,86	4,33	0,60
M1-48	2,25	0,88	0,75	0,30	0,75	0,66	1,13	0,40	3,75	1,27	1,50	0,16
	102,14	**34,40**	**67,92**	**15,70**	**19,11**	**7,32**	**39,62**	**8,21**	**30,59**	**9,83**	**34,59**	**5,32**

Duration	ALT		SIG		ZAB		PIP		HWH		TOTAL	
	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36	Planned PMs M19-36	Actual PMs M19-36
M1-48	0,75	0,25	2,25	0,76	3,00	0,91	1,50	0,93	0,75	0,25	25,50	7,92
M1-48	4,85	1,62		0,00	0,50	0,24	1,36	0,54	3,21	1,00	45,96	14,93
M4-45	1,29	0,43		0,00		0,00	8,14	2,00	1,71	0,50	85,29	19,87
M4-45	2,14	0,72		0,00		0,00	9,43	5,19	10,29	4,49	95,14	33,85
M16-48	29,45	9,68	0,00	0,00		0,00	4,15	0,32	13,96	4,02	101,02	28,48
M13-48	8,93	4,13	0,75	0,25	31,00	7,96	2,73	0,45	2,58	0,46	75,65	19,16
M1-48	0,00	0,50	16,88	5,95	3,00	0,00	1,13	0,22	1,88	1,00	33,00	11,34
	47,41	**17,32**	**19,88**	**6,96**	**37,50**	**9,11**	**28,42**	**9,65**	**34,37**	**11,72**	**461,56**	**135,54**

If we consider the cumulative effort M1-48, the total PMs claimed are 393,58 that corresponds to 40,28% of the total planned PMs.

Table 5 – Cumulative effort M1-48

	Duration	UNITN		IIT		LU		FORTH		CRF		TOFAS	
		Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48
WP1	M1-48	34	13,49	2	0,51	2	1,12	3	1,47	3	1,50	2	0,98
WP2	M1-48	16	8,65	16	4,85	29	22,91	2	1,42	19	9,79	13	8,00
WP3	M4-45	39	18,77	49	7,14	2	0,36	61	39,56	12	6,00	10	2,95
WP4	M4-45	77	38,78	65	8,21	4	0,43	7	3,56	13	6,86	5	0,87
WP5	M16-48	28	6,72	12	2,13	3	0,19	8	1,80	11	3,19	30	4,51
WP6	M13-48	20	3,10	6	1,66	1	0,25	4	1,20	3	0,86	6	1,03
WP7	M1-48	6	2,56	2	0,88	2	1,16	3	1,60	10	5,00	4	1,18
Total		220	92,07	152	25,38	43	26,42	88	50,61	71	33,20	70	19,52

	Duration	ALT		SIG		ZAB		PIP		HWH		TOTAL	
		Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48	Planned PMs M1-48	Actual PMs M1-48
WP1	M1-48	2	1,00	6	2,69	8,00	4,90	4,00	2,51	2,00	1,05	68,00	31,22
WP2	M1-48	12	6,47		0,00	2,00	1,22	4,00	1,24	9,00	5,29	122,00	69,84
WP3	M4-45	3	1,50		0,00		0,00	19,00	10,93	4,00	1,98	199,00	89,19
WP4	M4-45	5	2,51		0,00		0,00	22,00	12,25	24,00	13,26	222,00	86,73
WP5	M16-48	50	14,52		0,00		0,00	7,00	0,36	24,00	6,37	173,00	39,79
WP6	M13-48	12	5,01	1	0,39	40,00	14,94	4,00	0,63	4,00	0,73	101,00	29,80
WP7	M1-48	4	2,00	45	25,80	8,00	2,76	3,00	1,24	5,00	2,84	92,00	47,02
Total		88	33,00	52	28,88	58	23,82	63	29,16	72	31,52	977,00	393,58

The following Table 6 and Table 7 and relative graphs provide an overview of the effort distribution, categorized both by Work Package and by Beneficiary. This data includes

figures for the current reporting period (M19-24) and the cumulative effort to date compared to the total planned effort.

No major issue incurred, WP5 and WP6 are still under consuming but they are progressing well, and they will intensify in the coming months.

Table 6 – Effort by Work Packages

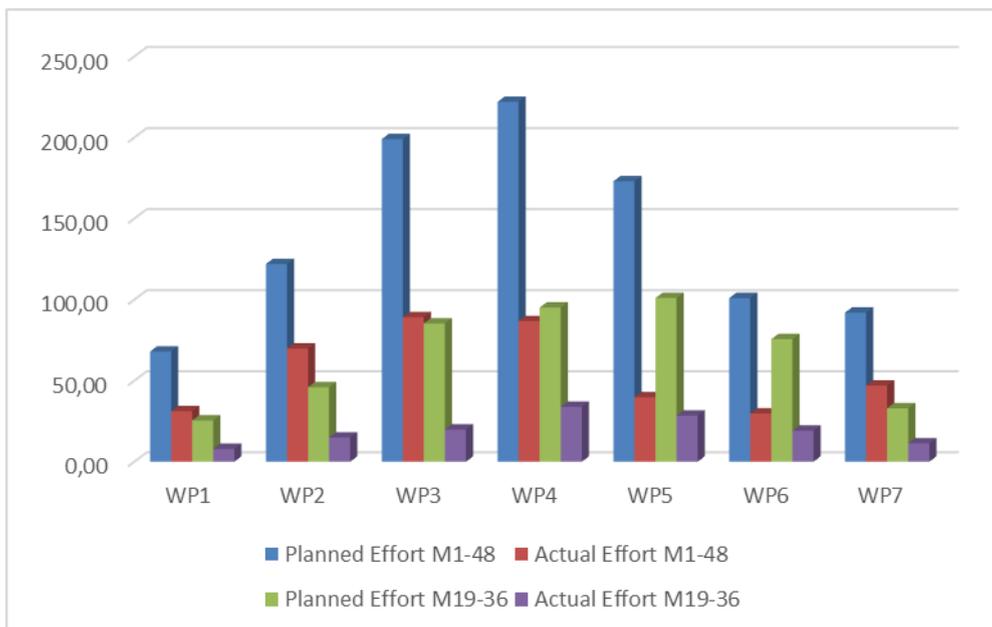| WP	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total
Planned Effort M1-48	68,00	122	199	222	173	101,00	92,00	977
Actual Effort M1-48	31,22	69,84	89,19	86,73	39,79	29,80	47,02	393,58
Planned Effort M19-36	25,50	45,96	85,29	95,14	101,02	75,65	33,00	461,56
Actual Effort M19-36	7,92	14,93	19,87	33,85	28,48	19,16	11,34	135,54
% M1-48	45,92%	57,24%	44,82%	39,07%	23,00%	29,50%	51,11%	40,28%
% M19-36	31,07%	32,48%	23,30%	35,57%	28,19%	25,32%	34,36%	29,36%

Figure 1 - Effort by Work Packages

Observed effort trends indicate that partners FORTH and TOFAS have recorded lower effort in these months; this deviation does not currently impact project critical path or raise major issues. IIT is recovering the substantial underspending in terms of Person Months incurred during the first reporting period.

Table 7– Effort by Beneficiary

Partner	UNITN	IIT	LU	FORTH	CRF	TOFAS
Planned Effort M1-48	220	152	43	88	71	70
Actual Effort M1-48	92,07	25,38	26,42	50,61	33,20	19,52
Planned effort M19-36	102,14	67,92	19,11	39,62	30,59	34,59
Actual Effort M19-36	34,40	15,70	7,32	8,21	9,83	5,32
% M1-48	41,85%	16,70%	61,44%	57,51%	46,76%	27,89%
% M19-36	33,68%	23,12%	38,31%	20,72%	32,13%	15,38%

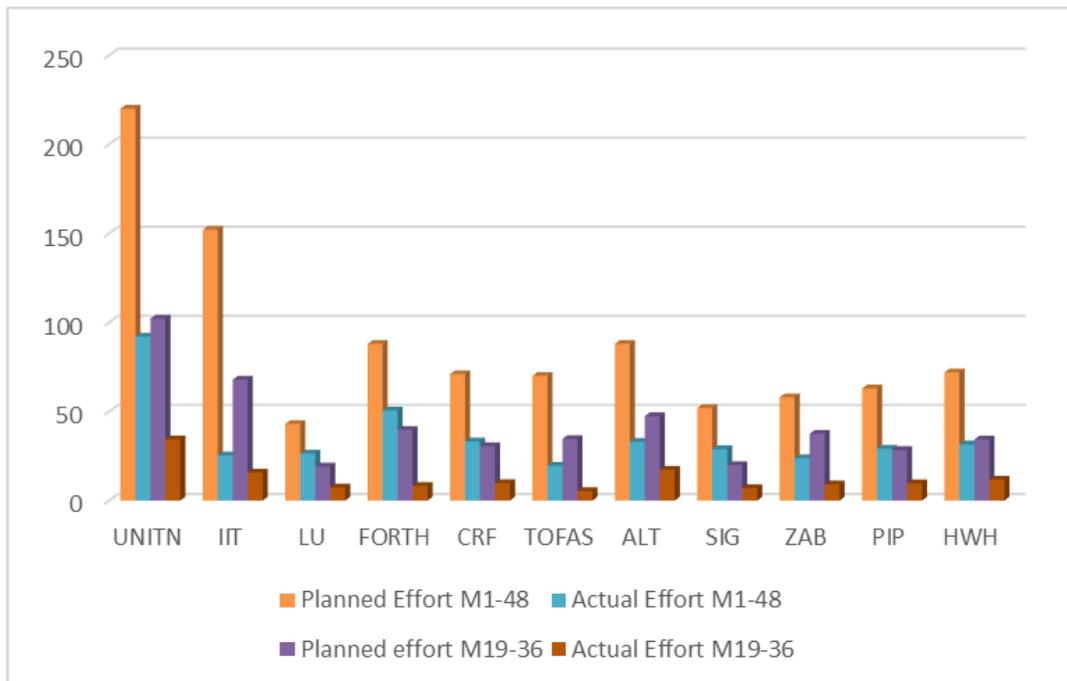| Partner	ALT	SIG	ZAB	PIP	HWH	Total
Planned Effort M1-48	88	52	58	63	72	977
Actual Effort M1-48	33,00	28,88	23,82	29,16	31,52	393,58
Planned effort M19-36	47,41	19,875	37,5	28,42	34,37	461,56
Actual Effort M19-36	17,32	6,96	9,11	9,65	11,72	135,54
% M1-48	37,50%	55,54%	41,07%	46,29%	43,78%	40,28%
% M19-36	36,52%	35,02%	24,29%	33,95%	34,10%	29,36%

Figure 2 - Effort by Beneficiaries

6.2.2 COSTS

The following table shows the claimed costs in the first reporting period and the estimated expenditure by category in M19-24 as part of RP2 (M19-36). The percentage is related to the cumulative costs M1-48.

Table 8 – Costs by Category

	PLANNED TOTAL COSTS M1-48	ACTUAL COSTS M1-18	ESTMATED COSTS M19-36	REMAINING BUDGET	% delta
Personnel	4.786.940,00	1.410.936,47	666.214,84	2.709.788,69	43,39%
Subcontract		-	-	-	
Travels	311.000,00	61.353,62	55.406,12	194.240,26	37,54%
Equipment	282.700,00	29.039,32	26.112,85	227.547,83	19,51%
Other goods and serv	350.585,00	45.623,12	39.309,34	265.652,54	24,23%
Financial support to third parties	2.000.000,00	-	-	2.000.000,00	
Internally invoiced goods and services	10.000,00	-	-	10.000,00	
Indirect costs	1.432.806,25	386.738,14	196.760,79	849.307,32	40,72%
Total	9.174.031,25	1.933.690,67	983.803,95	6.256.536,63	31,80%
Total (withouts FST	7.174.031,25	1.933.690,67	983.803,95	3.272.732,68	40,67%

The next table shows the clamed costs in the first reporting period and total costs incurred by partner in M19-24 as part of RP2 (M19-36). The percentage is related to the cumulative costs M1-48.

Table 9 – Costs by Partner

Partner	UNITN	IIT	LU	FORTH	CRF	TOFAS
Planned Total Costs M1-48	1.160.723,75	742.757,50	583.250,00	713.925,00	544.625,00	366.875,00
Actual Total Costs M1-18	366.955,71	81.767,80	184.287,45	243.271,94	180.240,98	117.813,25
Estimated Total Costs M19-36	179.304,91	96.733,99	60.372,98	62.043,59	74.590,38	38.100,31
% M1-48	47,06%	24,03%	41,95%	42,77%	46,79%	42,50%

Partner	ALT	SIG	ZAB	PIP	HWH	Total
Planned Total Costs M1-48	520.625,00	624.250,00	496.250,00	652.000,00	768.750,00	7.174.031,25
Actual Total Costs M1-18	115.718,34	204.783,91	113.907,99	122.102,20	202.841,10	1.933.690,67
Estimated Total Costs M19-36	137.502,80	69.320,00	79.901,01	63.883,40	122.050,58	983.803,95
% M1-48	48,64%	43,91%	39,05%	28,53%	42,26%	40,67%

6.2.3 UNFORESEEN SUBCONTRACTING

Not applicable.

6.2.4 UNFORESEEN USE OF IN-KIND CONTRIBUTIONS

Not applicable.