REMODEL - Robotic tEchnologies

for the Manipulation of cOmplex

DeformablE Linear objects

Deliverable 8.9 –

INTERMEDIATE EXPLOITATION PLAN

Version 2021-10-31

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1 Executive Summary

This document describes the exploitation activities followed from M12 to M24 and updates the strategy for the promotion of exploitation to be developed in REMODEL according with the evolution of the project. The key means on exploitation include:

- Market monitoring.
- Fine-tuned ER specification by using the lean Canvas model.
- IPR seminar to REMODEL partners.

This document updates the preliminary Exploitation Plan and it will be adapted along the project lifetime until the end of the project (D8.10) and beyond it for some selected ERs. It is composed of specific exploitation actions to be implemented during and after the project.

The following objectives for the exploitation of the project results have been set:

- Following the formulated business strategy for the project, preliminary business models are presented.
- Updated plan for communication activities in the post-covid era needed to achieve proper communication channels to reach stakeholders;
- An IP management was done;
- An updated plan for the commercialization of the project results is being developed using the ownership of the ERs declaration.

2 Introduction

The exploitation part of the project focuses on the economic and technical benefits within projects consortium based on the developed technologies of REMODEL project.

REMODEL addresses issues that are critical for the implementation of robotic systems able to manipulate wires, cables, and wiring harnesses. REMODEL outcomes are applicable to several industrial manufacturing activities that nowadays are manually executed, such as switchgear wiring, wiring harness manufacturing and assembly, manipulation of hoses for medical devices and many others.

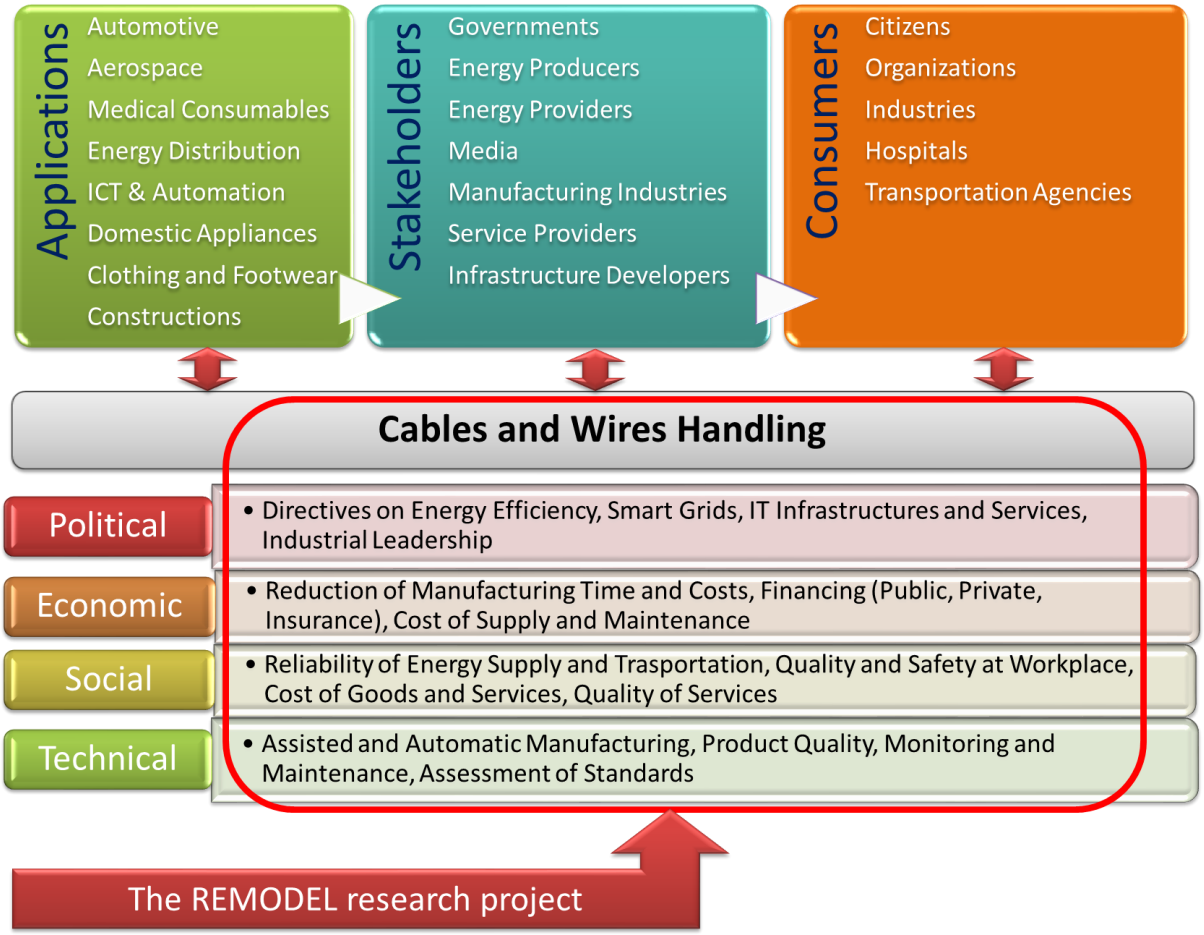


Figure 1: REMODEL expected impacts

These manufacturing activities are characterized by the execution of repetitive manipulation tasks, that cause psychophysical stress on the workers on the long term, reducing their efficiency, increasing absenteeism and lowering down the quality of the workplace. In view of the EU policy aiming at creating more safe and attractive workplaces, as well as increase the competitiveness and productivity of EU industries, REMODEL has a huge potential impact on several strategic sectors, going from automotive and aerospace industry, to civil engineering and industrial automation, to the production of medical consumables

3 REMODEL expected impacts

REMODEL works to implement technology solutions that facilitates to bring back production to Europe by reducing the time to market and increasing the traceability and standardization in former manual operations (**Impact 1 – FoF12**). By means of the automation it will be possible to increase in a 15% the job quality index and safety in ergonomically and repetitive jobs for different kind of companies (**Impact 2 – FoF12**), achieving at the same time an improvement in productivity thanks to the automation capabilities (**Impact 3 – FoF12**).

These impacts will be developed, customized and quantified in REMODEL use cases. Each of these will be used as demonstrators for dissemination and communication activities, and as individual exploitable results as robotic solutions for the automation of cables manipulation. A brief presentation of REMODEL use cases is presented:

3.1 Specific impact on UC1/ER5 – Dual arm robotic platform for switchgear wiring - switchgear market scenario

IEMA expects a reduction of the wiring time of 30% (Imp3) due the introduction of the REMODEL technology, with respect to the overall wiring time. A reduction of the wiring time of about 30% generates an additional sales volume of 5M€, with an increase with respect to the “conventional” manufacturing of about 43%. Considering the cost of 10 robotic systems to satisfy the production requests, the net income increases by about 35%.

UC1 is related with the ER5- Dual arm robotic platform for switchgear wiring.

3.2 Specific impact on UC2 with ER11 – Integrated dual arm manipulation system for interconnection systems automatic manufacturing process – ELIMCO - Wiring harnesses manufacturing for aerospace industry and ER7 - Dual arm robotic platform for Automotive Industry – ELVEZ - Wiring harnesses manufacturing for automotive industry

For ER11- Integrated dual arm manipulation system for interconnection systems automatic manufacturing process, ELIMCO calculates a reduction of the actual production time by about 31% thanks to the possibility of exploiting robots to manufacture pre-assembled products. This result can be achieved considering the robot can work also during nighttime. ELIMCO expected in this way a reduction of the time to market by 2 days can be achieved. Considering the cost of 2 robotic platforms needed to cover the ELIMCO production, the net income is expected to increase by about 24%.

For ER7 - Dual arm robotic platform for Automotive Industry, ELVEZ evaluates the REMODEL short term benefits on job quality for its workers and productivity. Pre-processing of products during nighttime will increase parts productivity from 615 to 675, reducing at the same time some of the repetitive tasks for the operators. Additionally, based on the automation, the planning of production and changes in manufacturing procedures can be predicted well in advance; stablishing at the same time a constant process monitoring, enabling faster reaction to product changes, defects and mistakes. This implies also a significant reduction of the production line stop time.

3.3 Specific impact on UC3 with ER11– Bimanual manipulation system for wiring harness manipulation - VWP

In VWP plant 750 Transporter and Caddy vehicles are produced every day – namely 630 Caddy and 120 Transporter. Each of them comes in a big number of diverse options, which increased the complexity of the process. In automation plants, saving just few seconds along the cockpit assembly line has a significant impact on the production. Moreover, it is clear that the activity carried out by the robot reduces the psychophysical stress on the workers due to execution of these repetitive activities and reduces the risks of musculoskeletal disorders

3.4 Specific impact on UC4 with ER6 – Manipulator for Quality Checks in Extrusion Processes in biomedical industry - ENKI

ENKI produces microcatheters for the medical industry. ENKI is now suffering a significant shortage of the manpower for their production in general. In order to sustain their business ENKI needs to move workers from highly repetitive, low added value tasks, like hose handling to more independent and flexible roles. Due to the nature of the material and the type of operation it has not been possible so far by using traditional robotization approaches.

The methods for reliable and efficient manipulation of flexible materials developed in REMODEL will allow to perform the manipulation with at least the same speed and allow ENKI to allocate employees to different roles. Moreover, this will increase the traceability of production, increase the quality by reducing the number of mishandled hoses and reduce contamination risk, by excluding humans from the final stage of the process. On top of that, the highly repetitive and tiresome task will be eliminated, thus contributing to increased work comfort.

By using REMODEL technologies, ENKI will be able to arise the percentage of QC (quality checks) up to 10% (assuring to ENKI's client a better control on the extruded product). We must consider also that this platform will free an operator allow him/her to perform different tasks.

4 REMODEL EXPLOITABLE RESULTS

A key activity in WP8 is to analyze and update the potential of REMODEL results. During the last months, a deep analysis about the main contributors and interested partners in each of the ERS have been performed. As a result of this, initial ERs have been modified or better declared to highlight the ownership and main exploitation channels. Later on this document, it will be presented the preliminary analysis on the ERs unique value proposition.

REMODEL aspires to narrow the gap between research and industry by transferring that latest R&D results in robotics towards various industrial sectors. Each partner will pursue different actions to maximize the benefit from the project outcomes.

The role of the REMODEL partners can be segmented into different roles according to their organization profile, that is:

- End users which represents the market needs and provide the product requirements to be satisfied by the REMODEL project.
- Research and academic partners that may carry out new research activities built upon REMODEL results. This includes research institutes, laboratories attached to schools and universities.

Because of this, the exploitation paths followed by each partner will be developed according their capabilities and convenience, as can be seen in the defined ERs.

In preliminary version of D8.8 were defined 12 Exploitation Results (ERs), but it has been decided to eliminate the ER2 since it is the same as the ER9, in addition the main exploiter and IPR partners have been reviewed. All information IS now updated in the following table:

N	Previous ER	Updated ER	Nature	Main Exploiter	IPR partners
1	CAD platform for flexible robotics programming	CATIA application for flexible robotics programming	Software (tool)	TECNALIA	TECNALIA
2	Dual arm manipulation of deformable linear objects in Aeronautical Industry	ELIMINATED		TECNALIA	TECNALIA
3	Generation of robot planning from product CAD files for switchgear wiring	Generation of robot planning from product (3D) CAD files for switchgear wiring	Software (tool)	IEMA	IEMA UNIBO
4	Manipulation tools for deformable linear objects	Multi-sensorized modular and reconfigurable manipulation tools.	HW – gripper & SW – Software	Joint Agreement (UNIBO + UCLV	UNIBO UCLV
5	Dual arm robotic platform for switchgear wiring	Dual arm robotic platform for switchgear wiring	REMODEL PILOT	IEMA	IEMA UNIBO UCLV
6	Manipulator for Quality Checks in Extrusion Processes in biomedical industry	Manipulator for Quality Checks in Extrusion Processes in biomedical industry	REMODEL PILOT	ENKI	ENKI UNIBO UCLV
7	Dual arm robotic platform for Automotive Industry	Dual arm robotic platform for Automotive Industry	REMODEL PILOT	ELVEZ	TAU UNIBO ELVEZ
8	CAD Platform Interface to provide the system planner, the layout and product inputs	CAD Platform Interface to provide the system planner, the layout and product inputs	Software (tool)	UNIBO	TAU UNIBO ELVEZ IEMA ELIMCO
9	Integrated dual arm manipulation system for interconnection systems automatic manufacturing process.	Integrated dual arm manipulation system for interconnection systems automatic manufacturing process.	REMODEL PILOT	ELIMCO	ELIMCO TECNALIA
10	Automated robot / sensor calibration toolkit	Automated robot / sensor calibration toolkit	Software (tool)	TO BE DETERMINATED	TUM IEMA ELVEZ ELIMCO VWP
11	Bimanual manipulation system for wiring harness manipulation.	Bimanual manipulation system for wiring harness manipulation.	REMODEL PILOT	VWP	VWP PUT UNIBO

					UCLV TAU
12	**Interactive perception module exploiting vision and touch**	**Interactive perception module exploiting vision and touch**	**Software (complete)**	**PUT**	**UNIBO UCLV TAU TUM PUT**

Updated description of each result can be found on **Annex1: Summary of ERs potential**.

4.1 Non-commercial exploitation - Standardization

Non-commercial routes will be pursued for the exploitation of the project results. The consortium, or at least part of it will certainly apply for new projects both at the national, EU and international level, in order to enlarge the field of application of the project outcomes and increase the knowledge and interest about the robotic manipulation of deformable objects by the scientific community.

The REMODEL results will be taken as reference in order to contribute to the definition of new standards for the industrial applications that are the objective of the project. For example, since no standardized information is provided about the components is the assembly operations targeted by REMODEL, it could be possibly to propose the representation modality developed in REMODEL as a standard way to represent component data in order to automatize the related manufacturing activities. A similar can be foreseen for the representation of the operations involved in the manufacturing and assembly of wiring harnesses and products containing cables in general.

5. CANVAS Business model and Lean Canvas

The CANVAS business model (by Alexander Osterwalder) was used in D8.8 for the exploitation results process ideation. This model has been selected and presented in D8.8 because it has been successfully applied in a wide range of contexts by private and public companies around the world and has become a common language allowing to describe and manage business models to elaborate new strategic alternatives.

Using this methodology a preliminary business model Canvas for REMODEL manipulation of flexible objects has been created and presented in D8.8

<table>
<tr>
<td rowspan="2">Key Partners

Industrial partners:
IEMA, VWP, ENKI, ELIMCO and ELVEZ will be the end users providing the use cases and to bring the solutions to the industry.

RTD partners:
UNIBO, UCLV, TECNALIA, TAU, TUM and PUT to advance robotics technologies TRL</td>
<td>Key Activities
Project period develops:
Manipulation devices and robotics platforms specialized of DLOs
3D environment reconstruction, part identification, localization and deforming tracking
Modeling, identification, prediction and tracking of DLO shape and behavior
Control algorithms based on perception data and DLO models
DLOs grasp and manipulation control by vision-tactile-proximity data fusion
Exploring interactive perception paradigm
Motion planning
Automated task planning
Teaching by desmostration and tutored learning of robot skills
After project end: Marketing, dissemination
Key Resources
Partners’ own physical resources, personnel for development, installations, testing and marketing
Financial resources</td>
<td rowspan="2">Value Propositions

Development and combination of different technologies to provide to robotic manipulators with the ability of DLO manipulation.
Reduce time to market from 10% to 27% depending on the use case
Increase customization capabilities
Introduce product documentation and traceability for better quality assessment
15% increase in OECD Job Quality Index through work environment and safety improvement
20% increase in productivity</td>
<td>Customer Relationships

Services:
Solutions validation
Support
Customized engineering
Training</td>
<td rowspan="2">Customer Segments

Potential target clients are all industrial manufacturing involving DLOs manipulation:
Switchgear wiring
Wiring harness manufacturing
Wiring harness assembly
Hose packaging</td>
</tr>
<tr>
<td>Channels
IEMA, VWP, ENKI, ELIMCO and ELVEZ internal plant technology managers
Commercial network and marketing
Exhibitions and fairs (national and international)
Project social media</td>
</tr>
<tr>
<td colspan="3">Cost Structure
Cost for engineering and industrialization
Marketing activities during and after the project
Hardware/software cost</td>
<td colspan="2">Revenue Streams
Cost saving from competitive solutions
Increase sales potencial due to innovative solutions
Revenue for services</td>
</tr>
</table>

However, individual CANVAS is needed for the ERs, where the focus on the value proposition of the ER will be better explained. Because of this, the Lean Canvas (designed by Ash Maurya) will be used from now, looking for focus on the problem to solve and the proposed solution, instead on the organization behind.

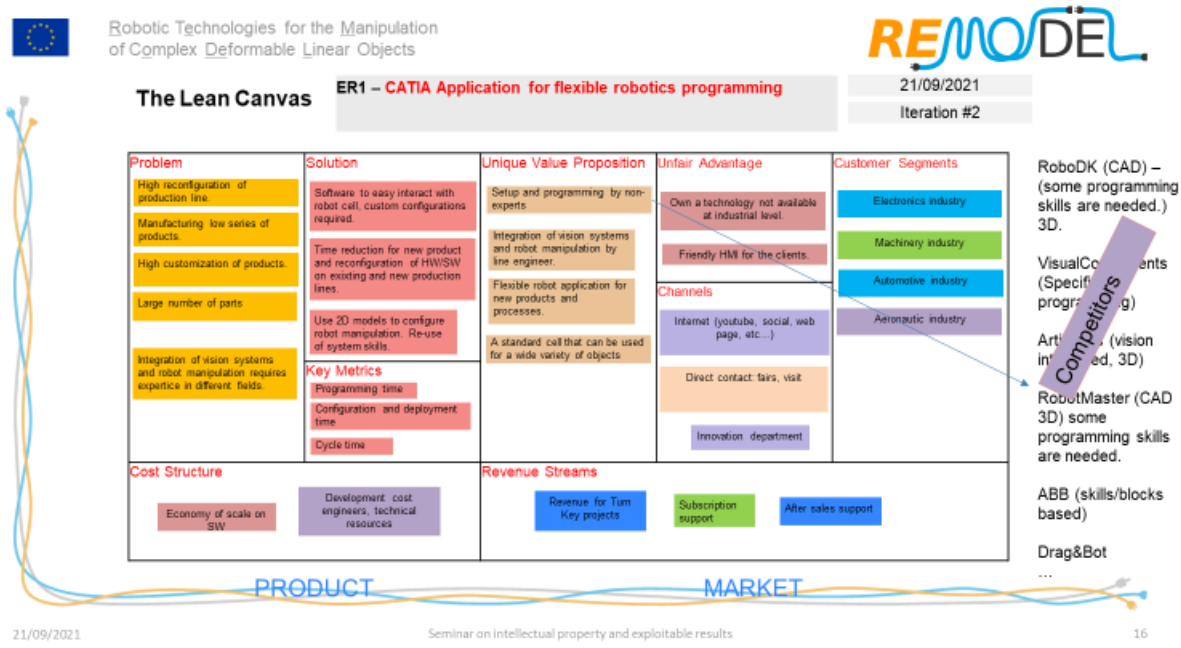
<table>
<tr><td rowspan="2">Problem</td><td>Solution</td><td rowspan="2" colspan="2">Unique Value Proposition</td><td>Unfair advantage</td><td rowspan="2">Customer segments</td></tr>
<tr><td>Key Metrics</td><td>Channels</td></tr>
<tr><td colspan="3">Cost Structure</td><td colspan="2">Revenue streams</td></tr>
</table>

Figure 2: Lean Canvas model by Ash Maurya.

Here the new aspects to define are:

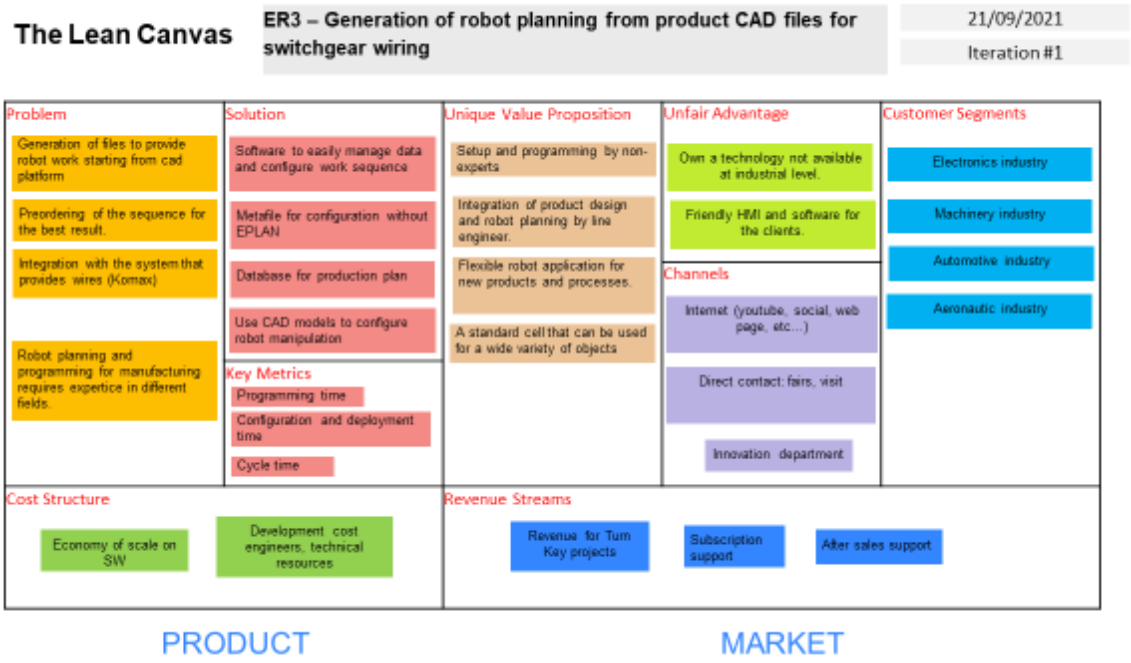
- **Problem:** what is the customer problem (what is the pain or the wish gain?) that the solution proposed by the ER address? What other alternatives in the market exist that do solve the same customer problem?
- **Solution:** How does the product or service address the customer problem?
- **Unique value proposition:** what is the value of the proposed solution in confront with the alternatives in the market? It is not about the technical differences, it is about the reliability, cost effectiveness, etc.
- **Key metrics:** which numbers indicate the business is sustainable? Which number indicates the product fit with the customer pain/gain?

5.1 ER1- CATIA application for flexible robotics programming

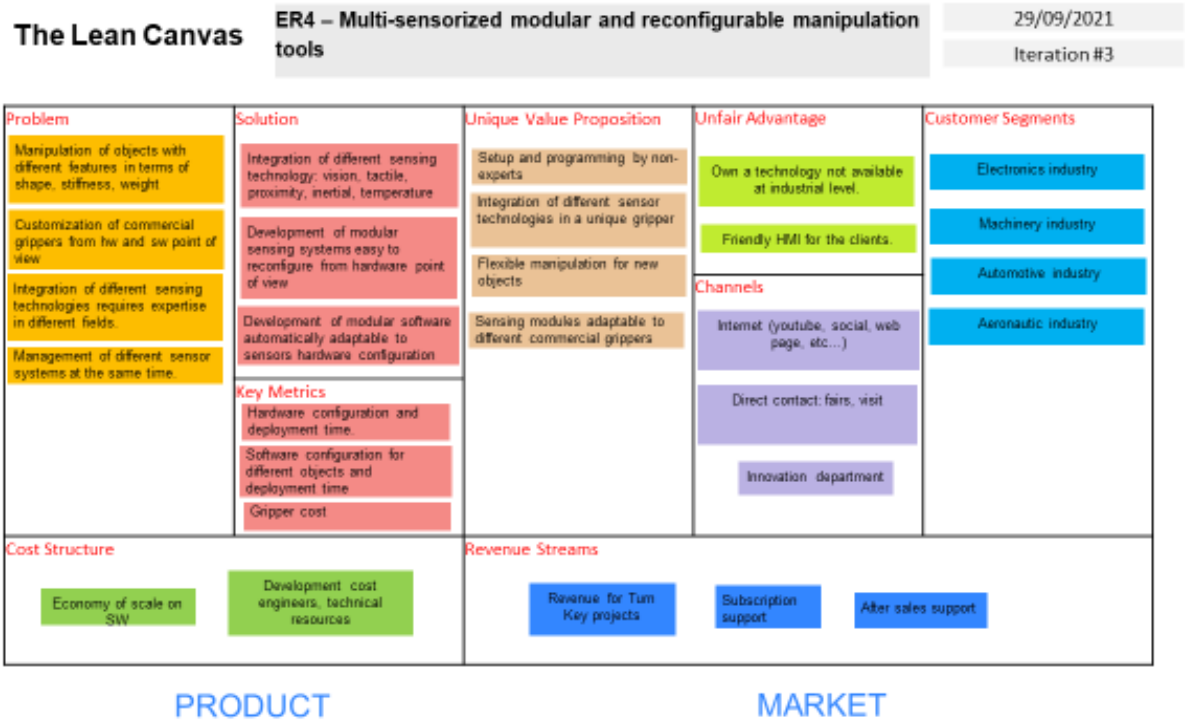


As analyzed from the beginning of REMODEL, the targeted customers are end-users that want to program new applications using existing CAD models. In this ER is used in an intuitive and graphical user interface that can be used by non-experts, based on CATIA software, which allows the robot program to be generated from CAD models.

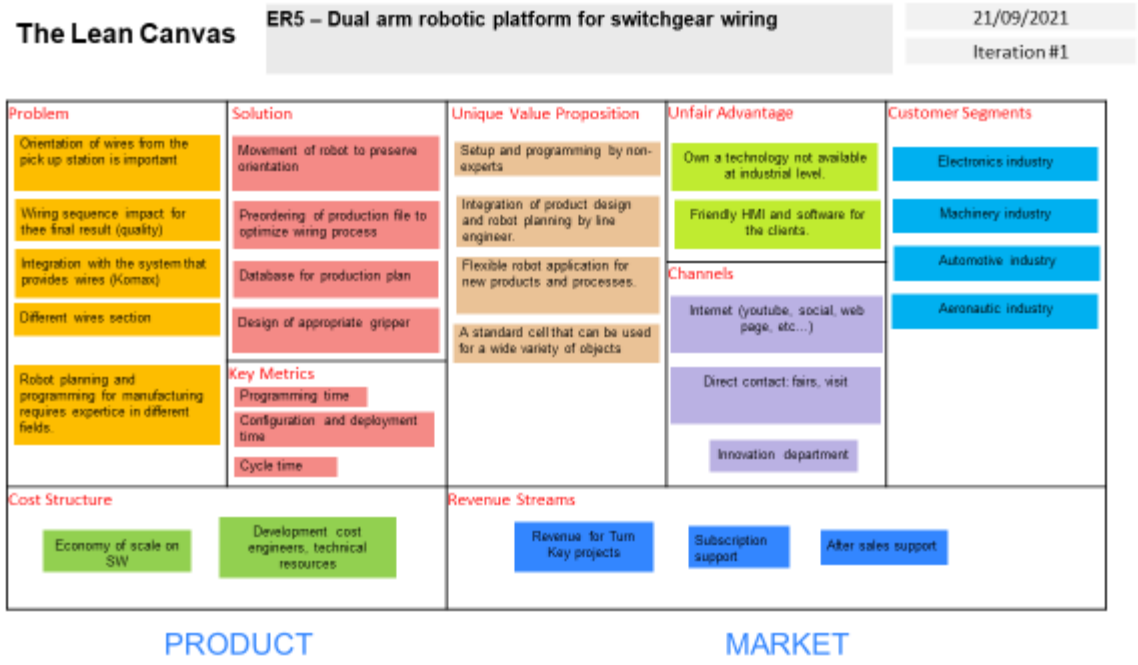
5.2 ER3- Generation of robot planning from product (3D) CAD files for switchgear wiring



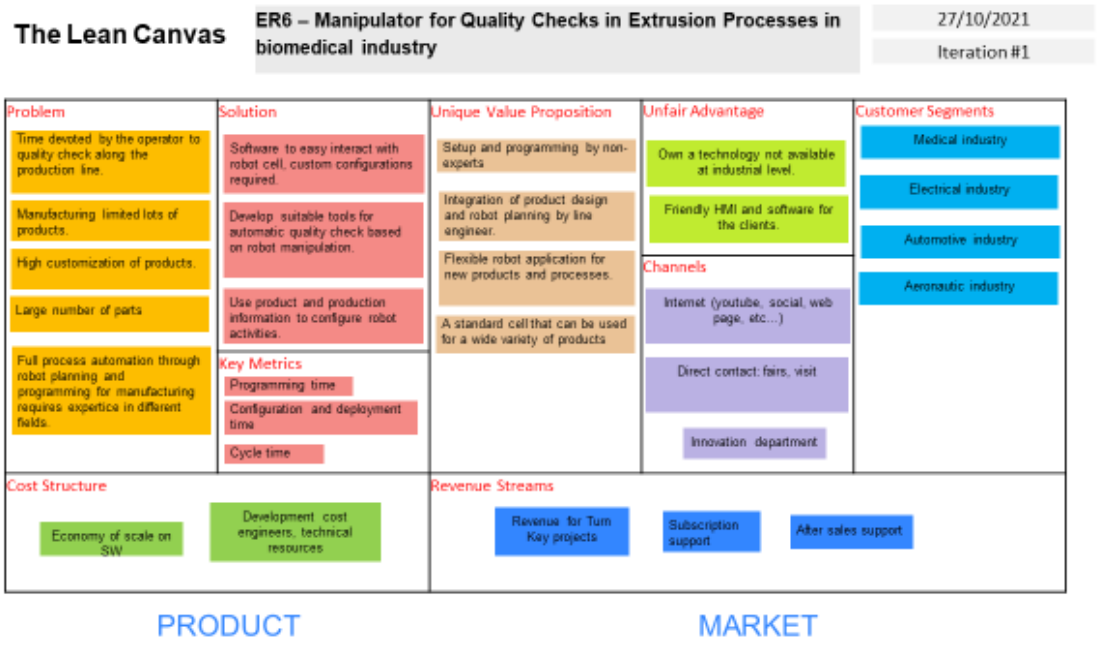
5.3 ER4- Multi-sensorized modular and reconfigurable manipulation tools



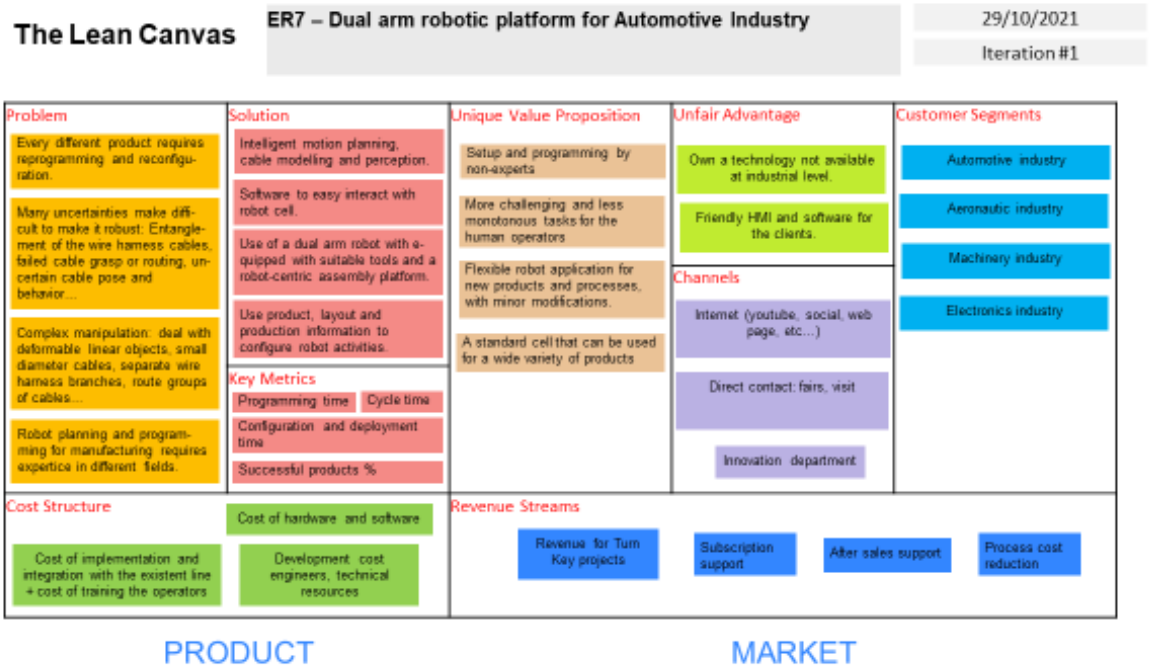
5.4 ER5- Dual arm robotic platform for switchgear wiring



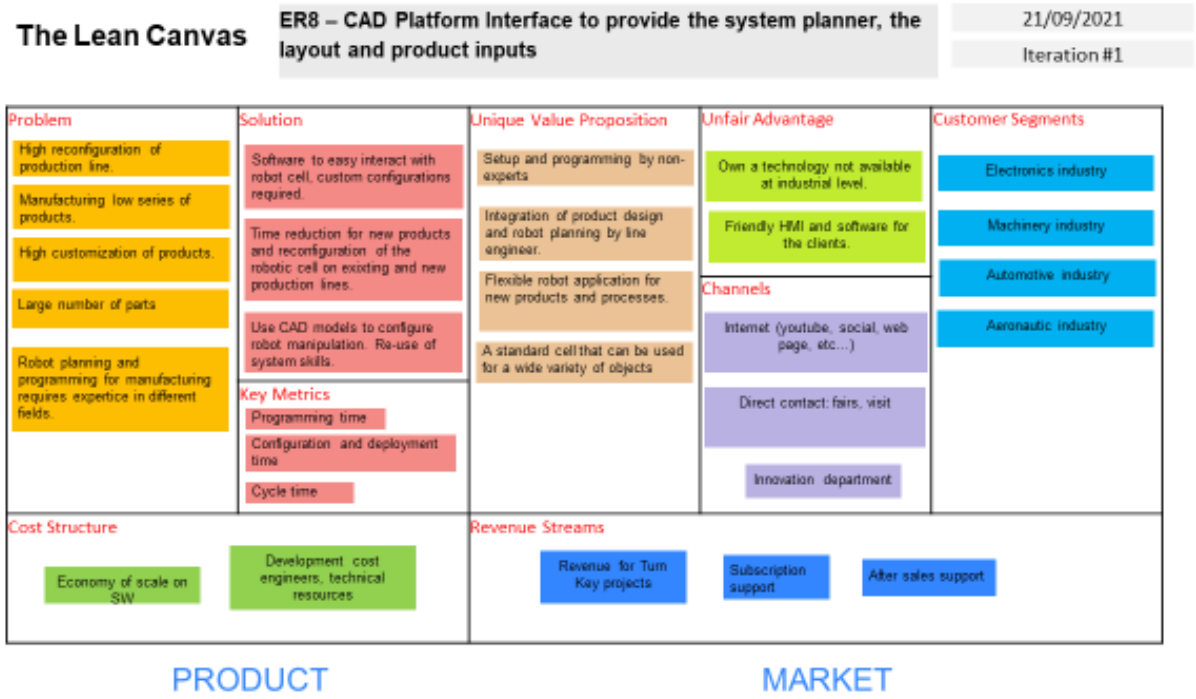
5.5 ER6- Manipulator for Quality Checks in Extrusion Processes in biomedical industry



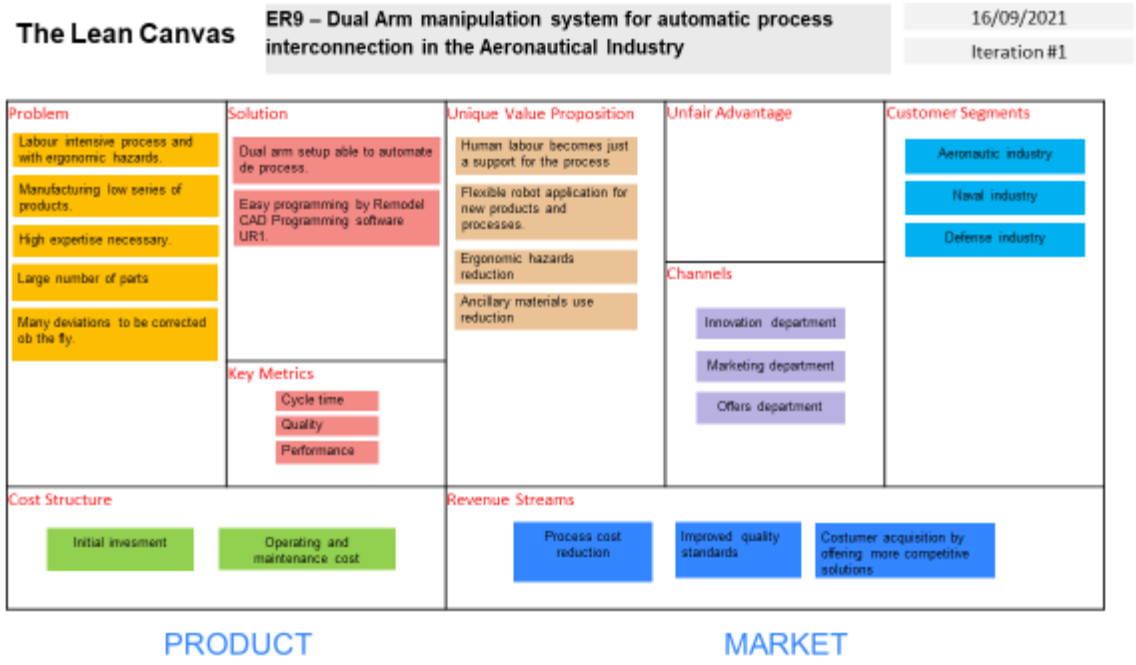
5.6 ER7- Dual arm robotic platform for Automotive Industry



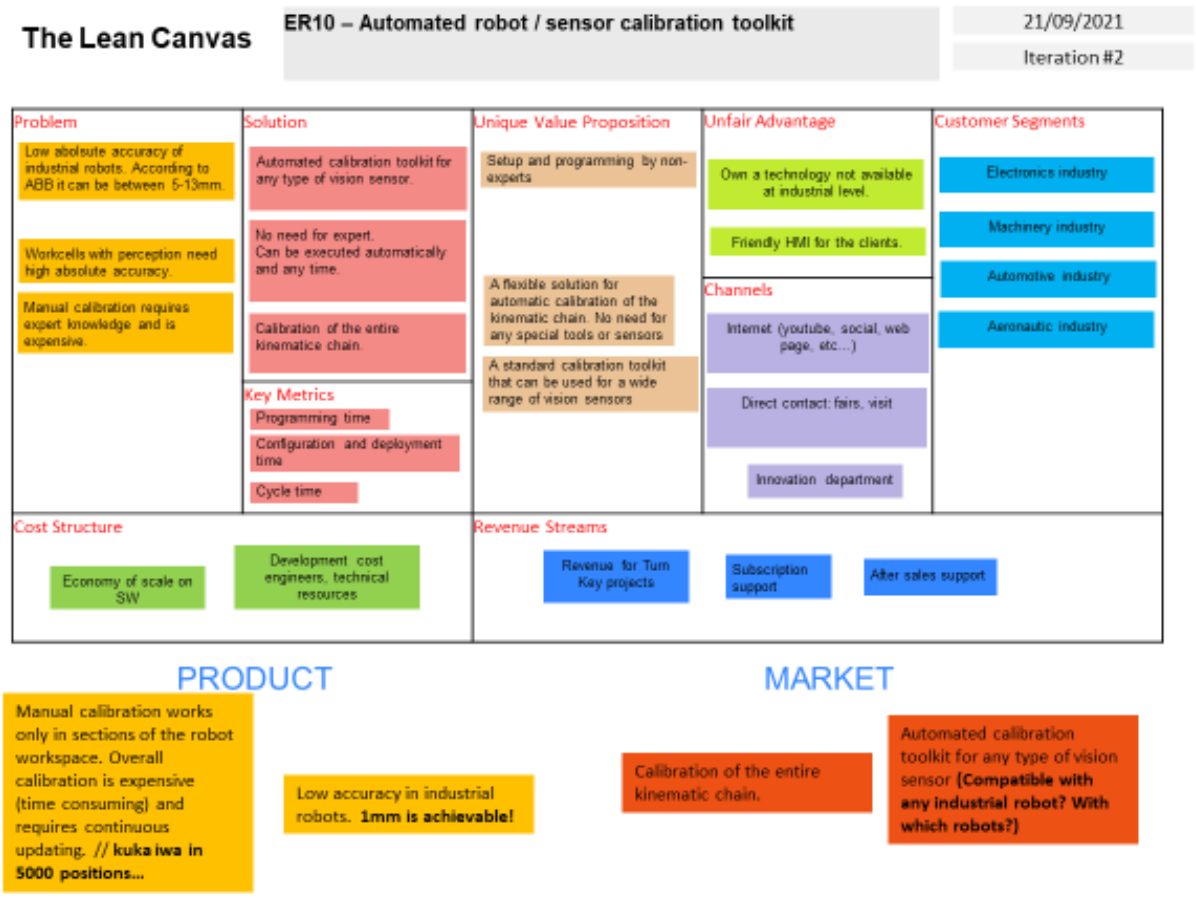
5.7 ER8- CAD Platform Interface to provide the system planner, the layout and product inputs



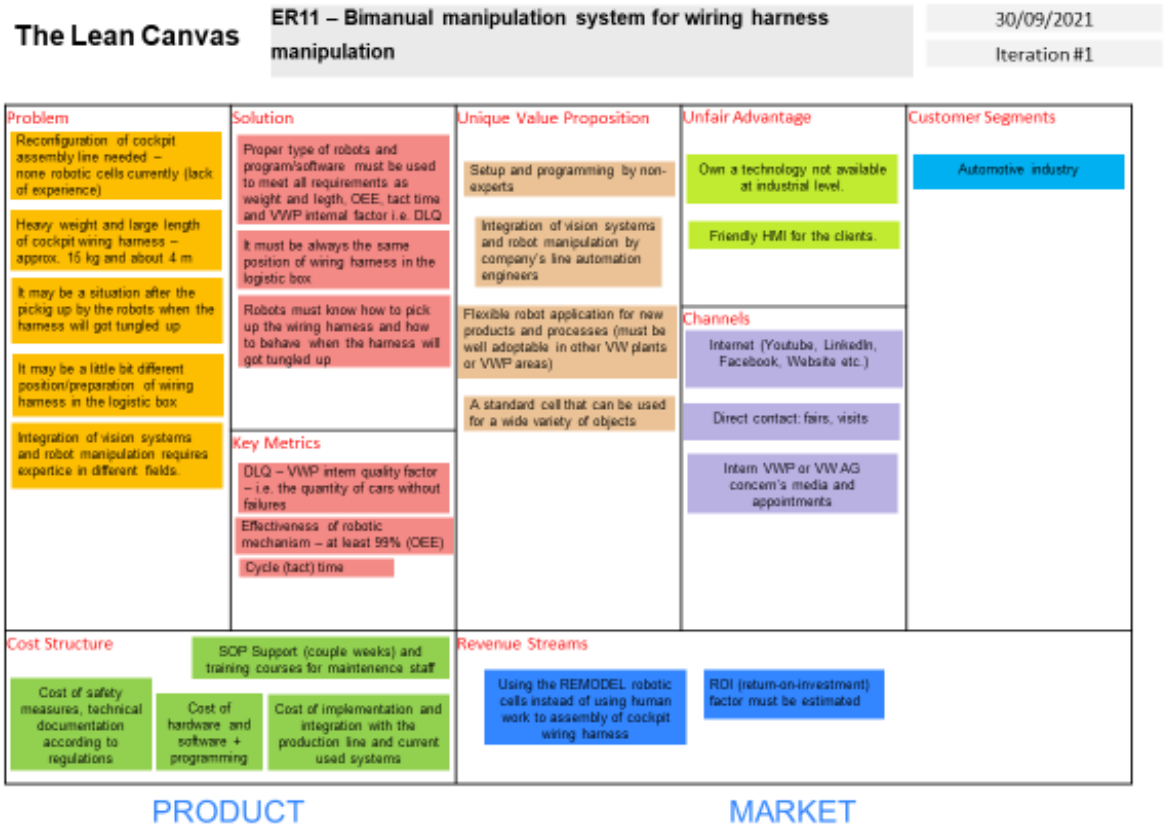
5.8 ER9- Integrated dual arm manipulation system for interconnection systems automatic manufacturing process



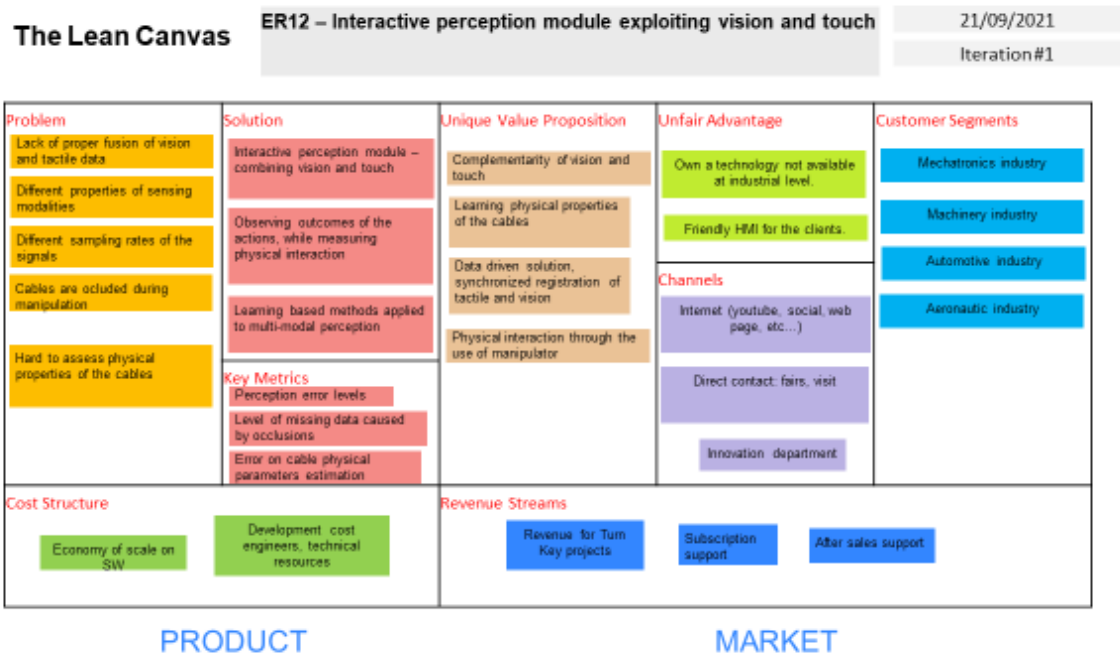
5.9 ER10- Automated robot / sensor calibration toolkit



5.10 ER11- Bimanual manipulation system for wiring harness manipulation



5.11 ER12- Interactive perception module exploiting vision and touch



6 IPR management seminar

6.1 Intellectual Property Rights (IPR)

Apart from the Guideline for IPR rules in Horizon 2020 projects (the Coordinator is in contact with the IPR Helpdesk Service organized by the EC) that will be the basis for the project IPR standards, more specific rules regulating each aspect of the property and protection needs have been defined in the Consortium Agreement (CA).

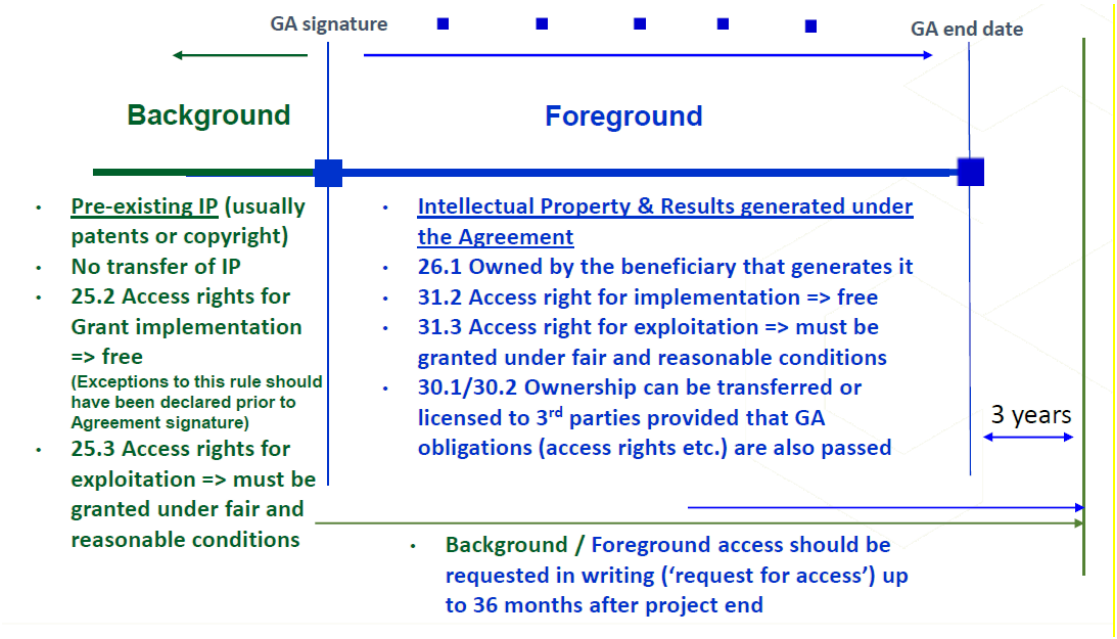
Now, focus on ERs, the partners need to formally identify

What is IP?

Intellectual Property: Intangible rights protecting the products of human intelligence and creation such as copyrightable Works, patented inventions, trademarks and trade secrets.

What are the results?

any (tangible or intangible) output of the action (data, methods, models, recommendation for standards, software codes, service, knowledge or information, etc) that is generated in the action, as well as any rights attached to it, including intellectual property rights.



6.2 Background

As a research project integrating different technologies that are available to partners, the project acknowledges the need to identify and protect the background and foreground knowledge and IPR.

Background means establish a clear picture of background intellectual property each partner is bringing to the project and to correlate the processes each partner will implement to assess and protect new intellectual property. This assessment is linked to the project's CA.

Background table to be updated by the ER main exploiter.

Background – ER1 – TECNALIA	
ID	CATIA Application for flexible robot programming
Owner(s)	TECNALIA
Nature	Software
Registration / Protection	Confidential Information
Description	A software application developed by TECNALIA during different projects to generate robotic programs using information from CAD(3D) models and a skill-based system. This application was made through an easy programming framework in which the user creates the robot program using the developed skills.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER3 – UNIBO	
ID	Generation of robot planning from product CAD files for switchgear wiring
Owner(s)	UNIBO
Nature	Software
Registration / Protection	Confidential Information
Description	A software package has been developed by UNIBO during the WIRES project to generate the robot plan for the switchgear wiring starting from the information provided by the product design. This software package have been provided to the partners for the integration in the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER3 – IEMA	
ID	Generation of robot planning from product CAD files for switchgear wiring
Owner(s)	IEMA
Nature	Software
Registration / Protection	Confidential Information
Description	During the Wires project and since the start of REMODEL IEMA provides CAD file which are used by UNIBO software for extrapolation of datas and all the information used by robot planning for the switchgear wiring.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER4 – UNIBO	
ID	Multi-sensorized modular and reconfigurable manipulation tools.
Owner(s)	UNIBO
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	A first multi-sensorized device has been developed by UNIBO during the WIRES Experiment within the ECHORD++ project. In REMODEL UNIBO is developing the actuation system for the manipulation of Deformable Linear Objects. Also the integration of a vision system is under evaluation in T6.3. Separate ROS nodes are under development for each component.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes.

Background – ER4 – UCLV	
ID	Multi-sensorized modular and reconfigurable manipulation tools.
Owner(s)	UCLV
Nature	Hardware and Software
Registration / Protection	Tactile sensor patented (n° 0001400420, 2010) / Confidential Information
Description	A first multi-sensorized device has been developed together during the WIRES Experiment within the ECHORD++ project. It exploited UCLV patented tactile sensor. In REMODEL a new version of sensorized finger is under development in T6.2 by UCLV: it includes tactile sensor (patented) and proximity sensor. Separate ROS nodes are under development for each sensor.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes.

Background – ER5 – UNIBO	
ID	Dual arm robotic platform for switchgear wiring
Owner(s)	UNIBO
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	UNIBO implemented a single arm solution for switchgear wiring during the WIRES project. The platform is provided with a software package for collision checking that can be adapted to different robot models. Collision capabilities are exploited to verify the robot plan and adjust it accordingly. The ARIADNE software developed by UNIBO during the WIRES project can be used to detect from images deformable linear objects in the scene retrieving spline models of the objects. This software is a basic component of the dual-arm robotic platform for switchgear wiring. These hardware and software will be exploited for the development of the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER5 – UCLV	
ID	Dual arm robotic platform for switchgear wiring
Owner(s)	UCLV
Nature	Hardware and Software
Registration / Protection	Tactile sensor patented (n° 0001400420, 2010) / Confidential Information
Description	Two sensorized fingers with tactile sensors developed by UCLV have been produced to be integrated into the PANDA Robot parallel gripper available in UNIBO laboratory for the REMODEL demonstrator. The fingers have been shipped to UNIBO and correctly integrated both from a mechanical and software point of view. Two ROS nodes have been provided for the acquisition of tactile map and for the reconstruction of the shape of grasped wires.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	The fingers can be used only for project activities. No available use for commercial purposes. They can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER5 – IEMA	
ID	Dual arm robotic platform for switchgear wiring
Owner(s)	IEMA
Nature	REMODEL PILOT
Registration / Protection	Confidential Information
Description	During the WIRES project, IEMA collaborated with UNIBO for the development of the project for the wiring of electrical panels by a robotic arm. IEMA formalized and introduced a series of mechanisms for the generation of a CAD that are interfaced and processed by UNIBO software packages, and produced some switchgears for test purpose.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER6 – ENKI	
ID	Manipulator for Quality Checks in Extrusion Processes in biomedical industry
Owner(s)	ENKI
Nature	Knowledge
Registration / Protection	Confidential Information
Description	ENKI has long experience in the design and production of medical hoses. ENKI knows which are the procedure for their internal quality check, including the methods, procedures, hardware and software tools to be adopted for that purpose. Specific strategies and solutions have been designed and implemented in ENKI to perform the quality check of their extruded hoses. This knowledge will be exploited for the development of the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER6 – UCLV	
ID	Manipulator for Quality Checks in Extrusion Processes in biomedical industry
Owner(s)	UCLV
Nature	Hardware and Software
Registration / Protection	Tactile sensor patented (n° 0001400420, 2010) / Confidential Information
Description	Two sensorized fingers with tactile sensors developed by UCLV have been produced to be integrated into the PANDA Robot parallel gripper available in UNIBO laboratory for the REMODEL demonstrator. The fingers have been shipped to UNIBO and correctly integrated both from a mechanical and software point of view. Two ROS nodes have been provided for the acquisition of tactile map and for the reconstruction of the shape of grasped tubes.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	The fingers can be used only for project activities. No available use for commercial purposes. They can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER6 – UNIBO	
ID	Manipulator for Quality Checks in Extrusion Processes in biomedical industry
Owner(s)	UNIBO
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	UNIBO implemented a single arm solution for switchgear wiring during the WIRES project. The platform is provided with a software package for collision checking that can be adapted to different robot models. Collision capabilities are exploited to verify the robot plan and adjust it accordingly. The ARIADNE software developed by UNIBO during the WIRES project can be used to detect from images deformable linear objects in the scene retrieving spline models of the objects. This software is a basic component for the manipulation and quality check in extrusion processes for biomedical industry. This hardware and software will be exploited for the development of the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.
Background – ER7 – UNIBO	
ID	Dual arm robotic platform for Automotive Industry
Owner(s)	UNIBO
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	UNIBO implemented a single arm solution for switchgear wiring during the WIRES project. The platform is provided with a software package for collision checking that can be adapted to different robot models. Collision capabilities are exploited to verify the robot plan and adjust it accordingly. The ARIADNE software developed by UNIBO during the WIRES project can be used to detect from images deformable linear objects in the scene retrieving spline models of the objects. This software is a basic component of the dual-arm robotic platform for Automotive Industry. This hardware and software will be exploited for the development of the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER7 – TAU	
ID	Dual arm robotic platform for Automotive Industry
Owner(s)	TAU
Nature	Hardware and Software
Registration / Protection	Copyright / Confidential Information
Description	TAU has prior experience working with dual arm robots. In particular, TAU has developed a human-robot collaborative assembly workstation using a dual arm cobot (ABB YuMi), and has introduced a dual arm industrial robot (Motoman SDA 10F) in a production line dedicated to drawing different cell phone models.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document

Background – ER8 – UNIBO	
ID	CAD Platform Interface to provide the system planner, the layout and product inputs
Owner(s)	UNIBO
Nature	Software
Registration / Protection	Confidential Information
Description	A software package has been developed by UNIBO during the WIRES project to extract the information required to generate the robot plan for the product design files provided by the EPLAN/ProPanel CAD platform. This software provides the basic interface the system planner for the robotic activities. This software package have been provided to the partners for the integration in the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER8 – IEMA	
ID	CAD Platform Interface to provide the system planner, the layout and product inputs
Owner(s)	IEMA
Nature	Software
Registration / Protection	Confidential Information
Description	IEMA helped UNIBO in building a software to extract the information of the product design files provided by the EPLAN/ProPanel CAD platform. These information will be used by the robot to generate the plan.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER8 – ELIMCO	
ID	CAD Platform Interface to provide the system planner, the layout and product inputs.
Owner(s)	ELIMCO
Nature	Software
Registration / Protection	Industrial secret / Confidential Information
Description	Elimco provided its manufacturing knowledge about the CAD/CAM process of the aeronautical wiring harnesses production.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes.

Background – ER8 – TAU	
ID	CAD Platform Interface to provide the system planner, the layout and product inputs
Owner(s)	TAU
Nature	Software
Registration / Protection	Copyright / Confidential Information
Description	TAU has prior research done both for generating CAD models based on captured data and for extracting information from CAD files. In particular, TAU has developed an application able to generate a 3D model of a building facilities from a point cloud. This CAD model was later used to extract relevant information for the building rehabilitation, such as the location of pipes and planes. Additionally, TAU has prior experience working with knowledge-based systems for multiple applications.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document

Background – ER9 – ELIMCO	
ID	Integrated Dual arm manipulation system for interconnection systems automatic manufacturing process.
Owner(s)	ELIMCO
Nature	REMODEL PILOT
Registration / Protection	Industrial secret / Confidential Information
Description	The company background within this exploitable result is related to the use case itself. Elimco has provided the manufacturing knowledge about this particular type of harnesses in order to advance towards its automation.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	Details about the manufacturing process can be used within the project framework.
Licensees for use	Can be used only for project activities. No available use for commercial purposes.

Background – ER9 – TECNALIA	
ID	Integrated Dual arm manipulation system for interconnection systems automatic manufacturing process.
Owner(s)	TECNALIA
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	TECNALIA implemented a dual-arm robotic solution manipulation during the VERSATILE project. The solution allows the easy development of new applications by non-expert users while ensuring the correct execution of the new robot trajectories. Therefore, this solution will be used as the basis for the REMODEL solution for wire-harness manufacturing. This hardware and software will be exploited and enhanced to adapt them to the requirements of the manipulation of deformable linear objects.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER10 – ELIMCO	
ID	Automated robot / sensor calibration toolkit
Owner(s)	ELIMCO
Nature	Software
Registration / Protection	Industrial secret / Confidential Information
Description	Elimco provided manufacturing knowledge that helps for the ER development. Also, an industrial perspective has been shared with the consortium.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes.

Background – ER10 – TUM	
ID	Automated robot / sensor calibration toolkit
Owner(s)	TUM
Nature	Software
Registration / Protection	Copyright / Confidential Information
Description	This software performs automated hand-eye of a robot with a 3D sensor. The development of this toolkit was started by TUM in the HORSE project (TRL 1-3). The prototype demonstrated the markerless, extrinsic calibration of an eye-in-hand LiDAR sensor (e.g. Hokuyo UTM or Sick TIM series) on a KUKA LBR iiwa. The software works with any industrial robot and LiDAR scanner supported by ROS. It is further recommended that both devices are intrinsically calibrated themselves first.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes.

Background – ER10 – VWP	
ID	Automated robot / sensor calibration toolkit
Owner(s)	TUM / VWP as Intellectual Property Rights Partner
Nature	Software (tool)
Registration / Protection	Copyright / Confidential Information
Description	This software enables an automated calibration of robots and 3D sensors. The development of this toolkit was started by TUM in the HORSE project (TRL 1-3) and further developed on the basis of each use case (know-how, experience and knowledge belonging to industrial partner). In VWP case it means UC3 – wiring harness assembly.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Access for use is enabled for whole VW AG concern regarding to Consortium Agreement, where whole concern was reported as a third parties for simplified transfer of results (see attachment 3 of the CA).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	VWP and concern VW AG are interested in using of together performed results in order to manufacture the car cockpits (commercial purposes) – free of charge or on very concessional terms.

Background – ER10 –IEMA	
ID	Automated robot / sensor calibration toolkit
Owner(s)	IEMA
Nature	Software
Registration / Protection	Copyright / Confidential Information
Description	During the WIRES project IEMA helped in the analysis and recognition of electronic component by the vision system and produced CAD model of the objects to detect.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER11 – VWP	
ID	Bimanual manipulation system for wiring harness manipulation
Owner(s)	VWP
Nature	REMODEL Pilot
Registration / Protection	Copyright / Confidential Information
Description	The REMODEL Pilot is combined of equipment and software (results) developed in others WPs. Pilot is based on know-how, experience and knowledge belonging to industrial partner. Then is further developed at VW plant by the cooperation of all involved partners in order to finish the REMODEL Pilot. In VWP case it means UC3 – wiring harness assembly. To assure the real production conditions, test station must be adjusted properly.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Access for use is enabled for whole VW AG concern regarding to Consortium Agreement, where whole concern was reported as a third parties for simplified transfer of results (see attachment 3 of the CA). Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	Licensees for use is enabled for whole VW AG concern regarding to Consortium Agreement, where whole concern was reported as a third parties for simplified transfer of results (see attachment 3 of the CA). VWP and concern VW AG are interested in using of together performed results in order to manufacture the car cockpits (commercial purposes) – free of charge or on very concessional terms. It strictly forbidden to share individually all drawings, data and other company's information (know-how, knowledge) to the third parties – both during the project and after finishing of him. These data should be authorized by VWP.

Background – ER11 – UNIBO	
ID	Bimanual manipulation system for wiring harness manipulation.
Owner(s)	UNIBO
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	UNIBO implemented a single arm solution for switchgear wiring during the WIRES project. The platform is provided with a software package for collision checking that can be adapted to different robot models. Collision capabilities are exploited to verify the robot plan and adjust it accordingly. The ARIADNE software developed by UNIBO during the WIRES project can be used to detect from images deformable linear objects in the scene retrieving spline models of the objects. This software is a basic component of the bimanual manipulation system for wiring harness manipulation. These hardware and software have been provided to the partners for the integration in the REMODEL demonstrator.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	The ARIADNE software can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER11 – UCLV	
ID	Bimanual manipulation system for wiring harness manipulation.
Owner(s)	UCLV
Nature	Hardware and Software
Registration / Protection	Tactile sensor patented (n° 0001400420, 2010) / Confidential Information
Description	Two sensorized fingers with tactile sensors developed by UCLV have been produced to be integrated into the OnRobot RG2 parallel gripper available in PUT laboratory for the REMODEL demonstrator. The fingers have been shipped to PUT and correctly integrated both from a mechanical and software point of view. A ROS node have been provided for the acquisition of tactile map.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	The fingers can be used only for project activities. No available use for commercial purposes. They can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER11 – PUT	
ID	Bimanual manipulation system for wiring harness manipulation
Owner(s)	PUT
Nature	REMODEL Pilot
Registration / Protection	Copyright / Confidential Information
Description	The REMODEL Pilot is combined of equipment and software (results) developed in other WPs. Pilot is based on know-how gathered during integration of TRL4 solution at PUT premises using own hardware and software.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	PUT is interested in using obtained results if there are opportunities to commercialize the outcomes together with involved project partners.

Background – ER11 – TAU	
ID	Bimanual manipulation system for wiring harness manipulation
Owner(s)	TAU
Nature	Hardware and Software
Registration / Protection	Copyright / Confidential Information
Description	TAU has prior research done where it was trying to characterize and implement handling of deformable linear objects using a dual arm cobot. TAU has algorithms to detect individual cables from clusters using vision, and perform pick and insertion operations using bimanual manipulation
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document

Background – ER12 – UNIBO	
ID	Interactive perception module exploiting vision and touch
Owner(s)	UNIBO
Nature	Software
Registration / Protection	Confidential Information
Description	UNIBO developed software packages to exploit vision and tactile sensors for cable grasping and manipulation during the WIRES project. This software can be used to correct the pose of cables for cable terminal connection starting from initial guess provided by the tactile sensors and using a camera to detect the cable tip orientation. Tactile feedback is also used in the control of the insertion phase to detect failures and to verify the correct connection after insertion. This software will be exploited for the development of the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER12 – UCLV	
ID	Interactive perception module exploiting vision and touch
Owner(s)	UCLV
Nature	Software
Registration / Protection	Tactile sensor patented (n° 0001400420, 2010) / Confidential Information
Description	Sensorized fingers with tactile sensors developed by UCLV have been produced to be integrated into different commercial parallel grippers available in partners' laboratories. Two ROS nodes have been provided for the acquisition of tactile map and the reconstruction of shape for grasped DLOs. These data will be combined with vision data.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	The fingers can be used only for project activities. No available use for commercial purposes. They can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document.

Background – ER12 – TAU	
ID	Interactive perception module exploiting vision and touch
Owner(s)	TAU
Nature	Hardware and Software
Registration / Protection	Copyright / Confidential Information
Description	TAU has used the Amazon Deeplens in collaborative assembly tasks involving cobot and worker to detect who is human operator and set the production parameters depending on the skill level of the person. Additionally, vision has been utilized for reinforcement learning applications involving the confident utilization of an underactuated gripper, to improve its performance. TAU has collaborated with UNIBO and UCLV at the TRL4 level to perform a characterization study of the tactile sensors utilized in REMODEL to evaluate optimum grasp distances and exhibited forces for different applications.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	Can be used only for project activities. No available use for commercial purposes. It can be used for other activities after the definition of a Non Disclosure Agreement (NDA) document

Background – ER12 – TUM	
ID	Interactive perception module exploiting vision and touch
Owner(s)	TUM
Nature	Software
Registration / Protection	Copyright / Confidential Information
Description	The development of the of REMODEL ER12 will be supported by TUM's general knowledge in object detection and perception. Moreover, TUM has developed the iiwa_stack ROS driver supporting the KUKA LBR iiwa robot and extensions for a number of grippers available in the iiwa_stack tools package. Both software components have been released as open source under BSD license: • https://github.com/exo-core/iiwa_stack • https://github.com/exo-core/iiwa_stack_tools
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential / Open Source.
Access conditions for use / Limitations	
Licensees in the project	BSD
Licensees for use	BSD

Background – ER12 – PUT	
ID	Interactive perception module exploiting vision and touch
Owner(s)	PUT
Nature	Software (complete solution)
Registration / Protection	Copyright / Confidential Information
Description	The interactive perception module is combining the previous outcomes of UNIBO, UCLV, TUM, PUT. In particular PUT has previous results of using touch and vision in materials recognition task. The outcomes are available to the consortium through publications and the code.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	PUT is interested in using obtained results if there are opportunities to commercialize the outcomes together with involved project partners.

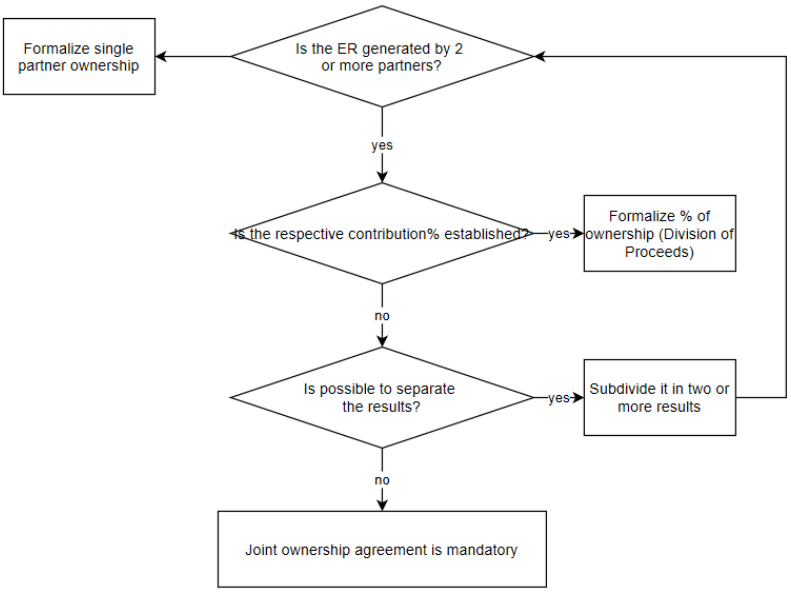
6.3 Protection of foreground

Foreground (i.e. results including IP generated during the project) shall be owned by the partner or partners who developed the results.

Each partner shall inform the project Coordinator and the project partners 4 weeks in advance of the filing of a patent application or of the dissemination of information in the public domain. Subject to the provisions of the GA and the CA any owner of any result shall be free to use such results and to commercialize it. In case of joint ownership each owner shall be free to use such results and commercialize it and to grant licenses to its affiliated entities in compliance with the provisions of the GA.

Results emerging from the project shall be made available free of charge to partners of the consortium for research purposes within the scope and duration of the project.

If a partner is not interested in filing a patent application or in maintaining a patent application for an invention achieved as result of the project, he/she shall offer his rights in the respective invention or patent application.



Foreground table to be completed by all partners in the ERs.

Foreground – ER1 – TECNALIA	
ID	CATIA Application for flexible robotics programming
Owner(s)	TECNALIA
Nature	Software
Registration / Protection	Confidential Information
Description	In this application is used in an intuitive and graphical user interface that can be used by non-experts, based on CATIA software, which allows the robot program to be generated from CAD models. The software will be developed in WP3, WP5 and WP7. Following the progress according TRL requirements, main achievements were: TRL4. Simple planning activities have been tested in laboratory setup; TRL5. A complete integrated system will be evaluated in laboratory for the production of a complete product; TRL6. A complete integrated system will be tested at least on one of the REMODEL demonstrators.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: CATIA Application for flexible robotic programming will reach TRL6 at the end of the project. TECNALIA will evaluate the possibility to license this software as a standalone package or as a plugin to CATIA. By the end of REMODEL, TECNALIA will get in contact with Dassault Systemes to investigate the possibility of establishing commercial partnerships.

Foreground – ER3 – IEMA	
ID	Generation of robot planning from product (3D) CAD files for switchgears wiring
Owner(s)	IEMA
Nature	Software (tool)
Registration / Protection	Confidential Information
Description	IEMA contributed to the drafting of the UNIBO software for the interpretation and conversion of a wrl file. Starting from a CAD file exported by EPLAN, the complete software has the task of extracting the information necessary for the planning of the robot. IEMA provides to UNIBO cabinets and CAD file for the testing of software and robot planning.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: It will be defined by the end of REMODEL.

Foreground – ER4 – UNIBO and UCLV	
ID	Multi-sensorized modular and reconfigurable manipulation tools
Owner(s)	UNIBO, UCLV (Joint Agreement)
Nature	Hardware and Software
Registration / Protection	Copyright / Confidential Information
Description	The developed multi-sensorized gripper will allow the manipulation and grasping of a huge set of objects different in terms of shape, stiffness, weight. The solution will exploit the integration of multiple sensing systems (tactile, proximity, vision) and of the corresponding modular software for their use. The hardware and software will be developed in WP6 and WP5 respectively. Following the progress according TRL requirements, main achievements were: TRL4. Single components have been tested and evaluated in LAB TRL5. A complete integrated system will be evaluated in LAB TRL6. A complete integrated system will be tested at least on one of the REMODEL demonstrators Background required to use the Foreground: UCLV tactile sensors.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: Multi-sensorized modular and reconfigurable manipulation tools will reach TRL6 at the end of the project. UNIBO and UCLV are evaluating the possibility to submit a joint utility model or a joint patent for the protection. At the end of the project they will evaluate how to exploit the prototype in order to obtain a commercial product. Two possible solution will be evaluated: transfer the exploitation of the prototype to a third company or found a joint spin-off company. A final decision on the exploitation path will be defined by the end of REMODEL.

Foreground – ER5 – IEMA	
ID	Dual arm robotic platform for switchgear wiring
Owner(s)	IEMA
Nature	REMODEL PILOT
Registration / Protection	Confidential Information
Description	IEMA has the task to create a robotic system that collects wires produced by komax machine into different warehouse trays. The system will use the same information for the production of wires and will be integrated in the production line. Design of a suitable gripper will give the right flexibility to pick up all kind of wires. These warehouse trays will be used by the dual arm robotic platform to wires switchgear in the demo area.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: It will be defined by the end of REMODEL.

Foreground – ER6 – ENKI	
ID	Manipulator for Quality Checks in Extrusion Processes in biomedical industry
Owner(s)	ENKI
Nature	Hardware and Software
Registration / Protection	Confidential Information
Description	This hardware and software will provide the information to perform quality checks along extrusion processes in biomedical industry starting from the information about the production line and product design. The hardware and software will be developed in WP5, WP6 and WP7. Following the progress according TRL requirements, main achievements were: TRL4. Simple manipulation activities have been tested in laboratory setup; TRL5. A complete integrated system will be evaluated in a laboratory setup for the quality check of medical products; TRL6. A complete integrated system will be tested considering multiple products and the production line layout. Background required to use the Foreground: ENKI, UNIBO and UCLV for "Manipulator for Quality Checks in Extrusion Processes in biomedical industry"
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: Manipulator for Quality Checks in Extrusion Processes in biomedical industry will reach TRL6 at the end of the project. ENKI will evaluate the possibility to commercialize this hardware and software solutions. By the end of REMODEL, ENKI will get in contact with other companies producing extruded products to investigate the possibility of establishing commercial partnerships

Foreground – ER7 – ELVEZ	
ID	Dual arm robotic platform for Automotive Industry
Owner(s)	ELVEZ
Nature	REMODEL PILOT
Registration / Protection	Confidential Information
Description	This ER consists of one of the REMODEL pilots, in particular the dual arm robotic platform for automotive wiring harnesses manufacturing, implemented in ELVEZ. This pilot involves picking the initial wire harnesses, separate and route their cable branches following different paths and tape them together, according to the model specifications. This requires the integration of all the other WPs developments, properly configured for the use case: CAD Platform with information about the assembly process, layout and components; UI to control and monitor the process; Teaching by Demonstration system for an easy, intuitive and fast robot programming; perception systems to track the manipulated cables; intelligent task planner and motion planning algorithms; and the new tools and hardware developed in the project. Finally, this ER includes the implementation and testing of this use case, in TAU's laboratory (TRL4) and in ELVEZ production line (TRL5 and 6).
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: This pilot case is expected to reach TRL-6 by the end of the REMODEL project. The possible path defined for its exploitation is to continue its development up to an operational environment.

Foreground – ER8 – UNIBO	
ID	CAD Platform Interface to provide the system planner, the layout and product inputs
Owner(s)	UNIBO
Nature	Software
Registration / Protection	Confidential Information
Description	This software will provides the information to plan the robotic activities starting from the information provided by the product design. The software will be developed in WP3 and WP5. Following the progress according TRL requirements, main achievements were: TRL4. Simple planning activities have been tested in laboratory setup; TRL5. A complete integrated system will be evaluated in laboratory for the production of a complete product; TRL6. A complete integrated system will be tested at least on one of the REMODEL demonstrators considering multiple products. Background required to use the Foreground: UNIBO software package for switchgear CAD interface.
Access conditions for research in the project / Limitations	Free to be used inside the project. Confidential.
Access conditions for use / Limitations	Not transferable.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	It can be used for project activities. No available use for commercial purposes. Other research activities can be evaluated after the definition of a Non Disclosure Agreement (NDA) document.

Exploitation path: CAD Platform Interface to provide the system planner, the layout and product inputs will reach TRL6 at the end of the project. UNIBO will evaluate the possibility to license this software as a standalone package or as a plugin to other software platforms, like CAD platforms for switchgears. By the end of REMODEL, UNIBO will get in contact with companies producing these software platforms to investigate the possibility of establishing commercial partnerships.

Foreground – ER9 – ELIMCO	
ID	Integrated Dual arm manipulation system for interconnection systems automatic manufacturing process.
Owner(s)	ELIMCO
Nature	REMODEL PILOT
Registration / Protection	Industrial secret / Confidential Information
Description	This ER consist of one of Remodel pilot cases, in particular the dual arm robotic platform for aeronautical wiring harnesses manufacturing. Elimco
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	To be used in Elimco factory.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	None from Elimco side.

Exploitation path: This pilot case is expected to reach TRL-6 by the end of the REMODEL project.
As selling robotic platforms does not fit Elimco's core business, the possible path defined for its exploitation is to continue its development up to an operational environment. This path will need further investment but can lead to a major advantage on the aeronautical industry.

Foreground – ER10 – TUM	
ID	Automated robot / sensor calibration toolkit (No. 10)
Owner(s)	TUM
Nature	Software
Registration / Protection	Copyright / Confidential Information
Description	This software enables an automated calibration of robots and 3D sensors. While the initial proof of concept (TRL-3) was only capable of calibrating the extrinsic pose of a LiDAR sensor, several extensions have been implemented in REMODEL WP4: 1. Support of arbitrary 3D sensor types (LiDAR, triangulation based line scanners and depth cameras) 2. Calibration of entire kinematic chains, such as the whole robot and the sensor pose. 3. Support of bundle adjustment to increase precision and/or to allow calibration of more complex kinematic chains Additional work carried out in WP3 and WP5 was used to update the toolkits UI to the new functionality and to improve the existing robot and sensor interfaces. The technology is planned to be demonstrated and evaluated in TUM's laboratory, research partner laboratories and finally on site at at least one use case provider, increasing the TRL up to 6.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	t.b.d.
Licensees in the project	To be treated confidential, by the rules of project CA.
Licensees for use	First set of licenses will be agreed under negotiation.

Exploitation path: The Automated robot / sensor calibration toolkit is under development at Technical University of Munich and is expected to reach TRL-6 by the end of the REMODEL project.
As licensing and selling software does not fit the universities core business, three possible paths have been identified:

1. Transferring the software and its IP rights to a new spin out company,
2. selling the software to an existing software distributor or
3. releasing it as open source.

A final decision on the exploitation path has not been taken yet. But, it will be better defined by the end of REMODEL.

Foreground – ER11 – VWP	
ID	Bimanual manipulation system for wiring harness manipulation
Owner(s)	VWP
Nature	REMODEL Pilot
Registration / Protection	Copyright / Confidential Information
Description	The REMODEL Pilot is combined of equipment and software (results) developed in others WPs. Pilot is based on know-how, experience and knowledge belonging to industrial partner. Then is further developed at VW plant by the cooperation of all involved partners in order to finish the REMODEL Pilot. In VWP case it means UC3 – wiring harness assembly. To assure the real production conditions, test station must be adjusted properly. Following the progress according TRL requirements, main achievements were: To TRL 4: The robotic platform developed in T6.1 will be tested in laboratory testbeds set up both at PUT and at UNIBO. Spare parts provided by VW will be used for this investigation. The manipulation abilities developed in T5.4 will be used to arrange the wiring harness according to a predefined pattern. To TRL 5: The integration of the wiring harness installation testbed in the VW production line will be considered, and suitable tests will be executed to evaluate application constraints in terms of execution time, robotic platform footprint and safety with respect to human operators. To TRL 6: A test plant for the evaluation of the wiring harness installation use case will be set up at the VW factory considering the moving cockpit assembly line. Demonstration during the wiring harness arrangement on the cockpit with synchronization with the moving line and online calibration of the robot task. Background required to use the Foreground: VWP Pilot.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Access for use is enabled for whole VW AG concern regarding to Consortium Agreement, where whole concern was reported as a third parties for simplified transfer of results (see attachment 3 of the CA). Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	Licensees for use is enabled for whole VW AG concern regarding to Consortium Agreement, where whole concern was reported as a third parties for simplified transfer of results (see attachment 3 of the CA). VWP and concern VW AG are interested in using of together performed results in order to manufacture the car cockpits (commercial purposes) – free of charge or on very concessional terms. It strictly forbidden to share individually all drawings, data and other company's information (know-how, knowledge) to the third parties – both during the project and after finishing of him. These data should be authorized by VWP.

Exploitation path: Bimanual manipulation system for wiring harness manipulation is under development by the involved partners at Volkswagen Poznan and is expected to reach TRL-6 by the end of the REMODEL project.
A final decision on the exploitation path has not been taken yet. But it will be better defined by the end of REMODEL.

Foreground – ER12 – PUT	
ID	Interactive perception module exploiting vision and touch
Owner(s)	PUT
Nature	Software (complete solution)
Registration / Protection	Copyright / Confidential Information
Description	The main goal of the interactive perception module is to provide the way of combining vision and touch data in a single framework. It will allow to overcome problems with different properties of the sensing modalities, also different sampling rates of the acquired signals. Additionally, it will help with occlusions during manipulation process and assessment of physical properties of the cables. The proposed solution will rely on observing the outcomes of the actions performed by the robot while measuring physical interactions with the cables. The proposed solution is data driven and based on synchronized registration of tactile and vision. The approach will heavily rely on learning solutions with neural networks. The final outcome is the system allowing for predicting the actions of the cables before manipulating them in order to allow physically informed robot motion planning.
Access conditions for research in the project / Limitations	Free to be used inside the project.
	Confidential.
Access conditions for use / Limitations	Free to be used only for the partners inside the project (for project purposes).
Licensees in the project	To be treated confidential, by the rules and regulations of project CA.
Licensees for use	PUT is interested in using obtained results if there are opportunities to commercialize the outcomes together with involved project partners.

Exploitation path: It will be defined by the end of REMODEL.

6.4 Access rights

As part of the CA, the rules and level of accessibility of the project have been discussed and agreed upon by universities, researchers and stakeholders or other third parties

6.5 Dissemination rules

Each disclosure of the results (publications, conferences, seminars, courses, etc.) will be coordinated by adopting precautionary IPR protection tools in order to not obstacle with preventive disclosures the possibility of protecting the achieved foreground.

6.6 Confidentiality

The CA is taken care of the beneficiaries “willing to protect the confidentiality of their and others” background as well as the information generated under the project (foreground)

7 Conclusions

The Exploitation Plan has been updated according with current state of REMODEL developments. Main exploiters were selected and a first version of the unique value proposition of the most prominent results of the project have been produced.

The IPR seminar kept started the discussion about the use of the knowledge produced in the project, as well as its future use beyond REMODEL duration.

8 Annex 1. ERs declaration – Summary of ERs potential

To clearly visualize the routes for exploitation of each result, a template has been structured to define the ER in detail and characterize it against its exploitation potential

Exploitable result No 1: CATIA Application for flexible robotics programming **Reported by: TECNALIA**	
Describe the innovation content of result	Add to TECNALIA's skill-based system the different skill-instances to use the 2D design that together with 3D-based skills can generate program robots.
Who will be the customer?	Mainly targeting end users and integrators. Potential customers: AIRBUS, CAF, IKUSI…
What benefit will it bring to the customers?	1. Program the robot is more intuitive, so it not necessary to be an expert 2. Program faster
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	Don't exist for this kind of Industry
How fast and in what ways will the competition respond to this result?	Never less than three years
Who are the partners involved in the result?	TECNALIA
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	ELIMCO
Have you protected, or will you protect this result? How? When?	Software license
Pictures:	

Exploitable result No 3: Generation of robot planning from product CAD files for switchgear wiring

Reported by: IEMA	
Describe the innovation content of result	Interpretation of the 3D product design and description files for the planning of the robot operations to perform the wiring of switchgears.
Who will be the customer?	Mainly targeting end users and integrators. Potential customers: ABB, Anchor Electricals, Epsol, Schneider Electric, Siemens, Orecco Electric, SGC, Eaton
What benefit will it bring to the customers?	No need of robot reprogramming to change from a product to another one.
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	Don't exist for this kind of Industry
How fast and in what ways will the competition respond to this result?	Never less than three years
Who are the partners involved in the result?	UNIBO, IEMA
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	IEMA
Have you protected, or will you protect this result? How? When?	Software license
Pictures:	

Exploitable result No 4: Multi-sensorized modular and reconfigurable manipulation tools. **Reported by: UNIBO+UCLV**	
Describe the innovation content of result	Specific tools for the manipulation of deformable linear objects are not present on the market, only custom solutions for specific applications can be found.
Who will be the customer?	Any company involved in the manufacturing of deformable linear objects or manufacturing products in which deformable linear objects are constitutive components.
What benefit will it bring to the customers?	Simplify the implementation of robotic manufacturing applications involving the manipulation of deformable linear objects
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	Don't exist for this kind of Industry
How fast and in what ways will the competition respond to this result?	Never less than three years
Who are the partners involved in the result?	UNIBO, UCLV
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	IEMA, ELIMCO, ELVEZ, VW, ENKI
Have you protected, or will you protect this result? How? When?	A patent application will be submitted to protect these results
Pictures:	

Exploitable result No 5: Dual arm robotic platform for switchgear wiring **Reported by: IEMA**	
Describe the innovation content of result	A commercial automatic platform for the switchgear wiring does not exist. The proposed solution will exploit a dual arm robotic platform to perform switchgear wiring
Who will be the customer?	Mainly targeting end users and integrators. Potential customers: ABB, Anchor Electricals, Epsol, Schneider Electric, Siemens, Orecco Electric, SGC, Eaton
What benefit will it bring to the customers?	1. Reduced time to market 2. Higher customization 3. Lower product cost 4. Higher quality and traceability
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	Don't exist for this kind of Industry
How fast and in what ways will the competition respond to this result?	Never less than three years
Who are the partners involved in the result?	UNIBO, IEMA, UCLV
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	IEMA
Have you protected, or will you protect this result? How? When?	A patent application will be submitted to protect these results
Pictures:	

Exploitable result No 6: Manipulator for Quality Checks in Extrusion Processes in biomedical industry **Reported by: ENKI**	
Describe the innovation content of result	Change the Quality Check actually performed in line in ENKI's Extrusion with an automatic device
Who will be the customer?	ENKI Companies producing medical consumables
What benefit will it bring to the customers?	• Quality Check Faster • Quality Check improvements
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will guarantee an innovative QC and a better device quality.
Who are the competitors for this result?	Don't exist for this kind of Industry
How fast and in what ways will the competition respond to this result?	Never less than three years
Who are the partners involved in the result?	UNIBO,UCLV, ENKI
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	ENKI
Have you protected, or will you protect this result? How? When?	
Pictures:	

Exploitable result No 7: Dual Arm Robotic platform for Automotive Industry **Reported by: ELVEZ**	
Describe the innovation content of result	The current production process of wire harness assemblies is manual. The focus of TAU is to construct a dual arm industrial robot station and enable it to perform bimanual manipulation of the DLOs, and by enabling the programming by an intuitive teach by demonstration and expand on the existing knowledge.
Who will be the customer?	Potential for having all automotive manufacturers and suppliers who produce equipment on a large scale. Automotive Manufacturers: VW, Volvo, GM, etc. Suppliers: ELVEZ and similar
What benefit will it bring to the customers?	• Programming of complex manipulation tasks with DLOs • Use of high-level robot functionalities from intuitive interface
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	There are no competitors for DLO manipulation
How fast and in what ways will the competition respond to this result?	At least in 3 years
Who are the partners involved in the result?	TAU, ELVEZ, UNIBO
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	ELVEZ
Have you protected, or will you protect this result? How? When?	A patent application will be submitted to protect these results
Pictures:	

Exploitable result No 8: CAD Platform Interface to provide the system planner, the layout and product inputs **Reported by: UNIBO**	
Describe the innovation content of result	An intelligent module of the developed software implementation to extract relevant information from the layout, the handled product and the points of interaction in the physical system. And, providing the information in the format required by the planner module.
Who will be the customer?	Primary targets for exploiting the knowledge of this model would be end users and integrators of automation systems.
What benefit will it bring to the customers?	Enables for dynamic changes in different models of the same product for manufacturing
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	There are no competitors for DLO manipulation
How fast and in what ways will the competition respond to this result?	At least in 3 years
Who are the partners involved in the result?	UNIBO, IEMA, ELVEZ, ELIMCO, TAU
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	IEMA, ELVEZ, ELIMCO
Have you protected, or will you protect this result? How? When?	The preliminary developments were made by UNIBO and similar Software license would be a good solution.
Pictures:	

Exploitable result No 9: Integrated dual arm manipulation system for interconnection systems automatic manufacturing process. **Reported by: ELIMCO**	
Describe the innovation content of result	Now days interconnection systems manufacturing process in aerospace industry has a high handmade dependence due to inherent normative regulations. ELIMCO objective is to implement an optimized integrated dual arm manipulation system for interconnection systems automatic manufacturing process with a flexible programming platform for robotics to demonstrate that the technology is able for an entire manufacturing certification process.
Who will be the customer?	ELIMCO, ARIBUS, BOEING, LATELEC, LABINAL, ALESTIS, AERNNOVA etc.
What benefit will it bring to the customers?	On quality, on time and on cost improvements.
When is the expected date of achievement in the project (mm/yy)?	10/2023
When is the time to market (mm/yy)?	Initial calculation by M36
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M36
What is the approximate price range of this result / price of licenses?	Initial calculation by M36
What is the market size in M€ for this result and relevant trend?	Initial calculation by M36
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over quality, cost and on time feasibility.
Who are the competitors for this result?	Don't exist for this kind of Industry
How fast and in what ways will the competition respond to this result?	Never less than three years
Who are the partners involved in the result?	TECNALIA, ELIMCO
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	IEMA, ELVEZ, VW, TAU.
Have you protected, or will you protect this result? How? When?	Hardware and software usability license
Pictures:	

Exploitable result No 10: Automated robot / sensor calibration toolkit **Reported by:**	
Describe the innovation content of result	A collection of software tools to calibrate 1) the extrinsic pose of eye-in-hand depth sensors, 2) the kinematic chain of a robot and 3) the extrinsic poses of multiple robot arms without relying on external calibration objects.
Who will be the customer?	Automation industry, as well as large industrial companies having their own in-house system integration / production automation unit.
What benefit will it bring to the customers?	The system will allow an automated self-calibration of a multi-robot setup equipped with eye-in-hand sensors. It will significantly reduce the time required for the initial calibration as well as re-calibration after maintenance or repairs, and avoid cost of specific calibration hardware or calibration objects and calibration objects.
When is the expected date of achievement in the project (mm/yy)?	Around M18
When is the time to market (mm/yy)?	Initial calculation by M20
What are the costs to be incurred after the project and before exploitation?	Initial calculation by M20
What is the approximate price range of this result / price of licenses?	Initial calculation by M22
What is the market size in M€ for this result and relevant trend?	Initial calculation by M22
How this result will rank against competing products in terms of price / performance?	There are no similar products on the market yet.
Who are the competitors for this result?	LEONI advantec TCP (requires specific hardware)
How fast and in what ways will the competition respond to this result?	Not clear yet.
Who are the partners involved in the result?	TUM, IEMA, ELVEZ, ELIMCO, VWP
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	IEMA, ELVEZ, VWP, ELIMCO
Have you protected, or will you protect this result? How? When?	Due to a lack of software patents in the EU we can only try to protect our knowledge by NDAs
Pictures:	

Exploitable result No 11: Bimanual manipulation system for wiring harness manipulation. **Reported by: VWP**	
Describe the innovation content of result	Arranging wires and cables along predefined paths using robotic bimanual manipulation. Currently such task at the assembly line are done manually.
Who will be the customer?	Automotive industry, car manufacturers – assembly lines.
What benefit will it bring to the customers?	Programmable and repeatable process of arranging wiring harnesses, e.g. in cockpit assembly line.
When is the expected date of achievement in the project (mm/yy)?	04/23
When is the time to market (mm/yy)?	*Initial calculation by M36*
What are the costs to be incurred after the project and before exploitation?	*Initial calculation by M36*
What is the approximate price range of this result / price of licenses?	*Initial calculation by M36*
What is the market size in M€ for this result and relevant trend?	*Initial calculation by M36*
How this result will rank against competing products in terms of price / performance?	It will compete favoring high performance over price
Who are the competitors for this result?	There are no competitors for DLO manipulation
How fast and in what ways will the competition respond to this result?	At least in 2 years
Who are the partners involved in the result?	VWP, PUT, UNIBO, UCLV, TAU
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	VWP
Have you protected, or will you protect this result? How? When?	Initially will be kept as the know-how. If patentable, a patent application will be submitted to protect these results.
Pictures:	

Exploitable result No 12: Interactive perception module exploiting vision and touch **Reported by: PUT**	
Describe the innovation content of result	The proposed module is joining the vision and touch in single framework. The solution breaks with the sense-plan-act paradigm.
Who will be the customer?	Integrators of the robots on the assembly lines. Producers of the robots building eco-systems around their manipulator, e.g. UR+.
What benefit will it bring to the customers?	The customers will obtain system capable of fusing touch and vision data. Currently these two sensing modalities are mainly disjoint in the robotic systems.
When is the expected date of achievement in the project (mm/yy)?	09/23
When is the time to market (mm/yy)?	*Initial calculation by M36*
What are the costs to be incurred after the project and before exploitation?	*Initial calculation by M36*
What is the approximate price range of this result / price of licenses?	*Initial calculation by M36*
What is the market size in M€ for this result and relevant trend?	*Initial calculation by M36*
How this result will rank against competing products in terms of price / performance?	It will compete favoring price over price
Who are the competitors for this result?	Other robotics start-ups working on perception systems.
How fast and in what ways will the competition respond to this result?	At least in 2 years
Who are the partners involved in the result?	UNIBO, UCLV, TAU, TUM, PUT
Who are the industrial partners interested in the result (partners, sponsors, etc. …)?	VWP, ELVEZ, ELIMCO, IEMA, ENKI, robotics start-ups,
Have you protected, or will you protect this result? How? When?	Initially will be kept as the know-how. If patentable, a patent application will be submitted to protect these results.
Pictures:	