trinity ENGAGE WITH AGILE MANUFACTURING

D7.4 Education & Training - Novel knowledge delivery activities 2

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Authors	**D.Dimosthenopoulos**
Contributors	**All partners**
Reviewers	**P.Karagiannis**
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PU	Public	x
PP	Restricted to other programme participants (incl. Commission Services)	
RE	Restricted to a group specified by the consortium (incl. Commission Services)	
CO	Confidential, only for the members of the consortium (incl. Commission Services)	

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1 Introduction

The main objective of this document is the description of the means of DIHs to support the SMEs during the execution of the demonstration programs as well as the reporting of the Training Activities until end on the project duration. In order to organize and better communicate the TRINITY Training material, a unified Training Platform has been created by LMS. This platform hosts all the training material created by the TRINITY partners and applicants regarding the TRINITY technical modules and use cases in the form of courses. These courses have been created to guide and support any interested party in implementing the provided technical solutions to their manufacturing systems. Also, the Training Platform serves as a dissemination channel for the results of the external demonstrations funded by TRINITY and for providing information on the TRINITY DIHs. A connection between the Training Platform and DAP was also established to further enhance the communication opportunities of the created material. A more in-depth presentation of the created training platform as well as the submission of the final version of the training material created in TRINITY will be elaborated in the following sections.

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2 External Demonstrators Programs

Since the previous report (D7.3) both the TRINITY Demonstration programs have been finalized under which the dedicated mentees and the TRINITY network in general provided significant support to the funded projects in various ways depending on the existing requirements. In order to measure and validate the impact of the provided support and the collaboration efficiency among the participants and the TRINITY network, feedback was requested from both sides (the mentors and the mentees) regarding their collaboration throughout each demonstration program. In the next sub-section, feedback from the participants of the second Open Call to the TRINITY partners is presented (the applicants' comments of the first Open Call were presented in D7.3). Also, questionnaires filled in by all the mentors of both Open Calls are provided in the sub-section 2.2.

2.1 External Demonstrators support program 2

The TRINITY Open Call 2 was published on the 14th of February 2021 and was closed on the 1st of June 2021. In total 78 proposals have been submitted to the call (out of 120 in preparation). Following the evaluation process including the remote evaluation and a series of consensus meetings, 18 applications have been selected for requested funding.

The selected third parties' projects started on October 1st, 2021, and completed on October 31st, 2022. Similarly with program 1, individual mentors from the DIHs were assigned to each of the selected programs to track their progress and provide guided support, through regular monitoring sessions. The mentoring system has received very positive feedback from the SMEs, helping them with technical issues, reporting and dissemination duties. At the table below (Table 1) is reported the feedback provided by the mentees regarding their collaboration with TRINITY.

Table 1: Feedback from third parties on the support received for their external demonstrators

Demonstrator Name	Feedback on the assistance and support on the demonstrator
TRINITY mentoring partners	
ATLANTES	ATLANTES team reported that they had excellent collaboration with their mentees from the TRINITY consortium who provided valuable guidelines and support mainly during the evaluation period.
EDI, CENT	
Aurora	Aurora team reported that they had smooth collaboration with their mentees who provided valuable support for reporting and dissemination activities.
FhG, LMS	
Brilliant	Brilliant team reported that they had very efficient collaboration with the TRINITY group and valuable support with the preparation of the reporting documents and the evaluation of potential solutions.
EDI, CENT	
CANNIER	CANNIER group reported that they were very satisfied with the results achieved with the support of the TRINITY partners.
LSEC, CENT	
CORS	The CORS group reported that they were very satisfied with the results achieved with the support of the TRINITY partners.
BME, TAU	
Dyncomm	

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TAU, EDI	Dyncomm group reported that they had very good collaboration with the TRINITY partners who provided support with a TRINITY module integration as well as with reporting and dissemination.
Inteli5.0	The Inteli5.0 group was very pleased with their collaboration with their TRINITY mentees who provided valuable support towards the successful implementation of their demonstration.
TAU, MAKE	
MCPPS	MCPPS team reported that they had excellent collaboration with their mentees from the TRINITY consortium who provided valuable guidelines and support mainly during the evaluation period.
UiT, FhG	
Proton Robots	Proton Robots team reported that they are very happy with their collaboration with the TRINITY network that provided technical and dissemination support to further advance their future business activities.
MAKE, JSI	
RAISE	RAISE team was very pleased with the work carried out in the TRINITY project and with the collaboration they had with their mentees.
BME, LSEC	
RECOPRODAS	RECOPRODAS team reported that they are highly satisfied with the support provided by TRINITY that allow them to implement their ideas in reality through the demonstration program.
JSI, BME	
Rob4steel	The Rob4steel team reported that they were very satisfied with the work done under TRINITY and they identified great advantages generated by the solution deployed under the project.
LMS, TAU	
RoboCut	The RoboCut team reported that they had excellent collaboration with the TRINITY project helping them achieve all the goals of the demonstrator.
LMS, UiT	
SHAFTS	SHAFTS team reported that they had excellent collaboration with their mentees from the TRINITY consortium who provided valuable guidelines and support mainly during the evaluation period.
MAKE, LSEC, TAU, BME	
SHARKY	SHARKY team reported that they had smooth collaboration with TRINITY who supported into raising interest towards their application.
JSI, CENT	
Shipweld	The Shipweld group reported that they had very good collaboration with the mentors throughout the project.
LSEC, UiT	
SpinEye	The SpinEye team was very pleased with their collaboration with TRINITY partners who supported them into maximizing the effect and impact of their demonstrator to their future business activities.
IWU, BME, EDI	
VisDeburr	VisDeburr team mentioned that they had very active and fruitful collaboration with TRINITY towards the implementation and integration of a TRINITY module to their demonstration.
CENT, UiT	

2.2 Demonstration Programs Support Questionnaires

In order to track the assistance and the support that the TRINITY consortium has offered in the form of mentorship in TRINITY External Demonstrators, dedicated questionnaires were created and filled in by the mentors after the end of each demonstration program. The comments provided by the mentors in these questionnaires validated the excellent and seamless collaboration between the TRINITY partners (mentors) and funded SMEs (mentees) reported by the external partners in the submitted final report of each external

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project. The following tables (Table 2 for demonstration program 1 and Table 3 for demonstration program 2) show the questionnaires filled in by the mentors after the end of each of the two demonstration programs.

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Table 2: Demonstrator Support Questionnaire program 1

Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
AGILE	Yes	Yes, Kick-Off Telco, Progress update Telcos, e-mail communication about progress;	Providing EDI modules, best-practices and know-how, suggestions on how to improve documentation and reports;	No	Yes	No	No	Yes	No
ALOFAP	Yes	Yes, initial kick-off meeting, regular updates via telco and email communication	Suggestions on improving reporting, disseminating, initially we also had technical discussions on mobile robotics	Delays due to covid.	No	No	No	Due to covid email communications were done.	We had discussions on hardware.
AMS	Regular monthly or bi-monthly meetings, good overall reporting	Yes, closely. Final site visit in Eindhoven.	Opening up for presentations at conferences, introducing discussions with potential customers	Some challenges in original setup, but pivoted and results generated.	No	Yes, cybersecurity and privacy.	No	Yes, bi-monthly and monthly.	Yes, wearables. Integration with vision system.

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
			and industry partners.						
ARGRIND	Not really. Help and deeper communication were offered at the beginning in email. There was no need for deeper cooperation.	Yes, but only when it was needed. (IIP, Midterm report)	Suggestions on, disseminating.	No	No	No	No	Once in the beginning, but there was no demand for it	No
Digi-SAAP	Yes	Yes, a few times, kick-off, e-mails, check deliverables and advising	Assistance in the deliverables and documentation, clarify questions, clarify delays	Yes - revision on mid-term report, impact due to COVID, improvement of dissemination and examples for that	No	No	No	Yes, Kick-Off, interview on COVID impact and clarify questions in preparation to the reports	No
DynaMo	Yes	Yes, for their kick-off and then once per	Suggestions and assistance about the administration,	Delays due to covid.	No	No	No	Yes	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
		month online meeting with all participants	about some technical details, about project organization, dissemination, documentation.						
EACHPack	Yes	Yes, Kick-Off Telco, email communication, check deliverables for their progress.	Suggestions on how to improve the submitted reports. Consultancy on cost justification in their IIP and mid-term report.	Tasks linked to the demonstrations will have to be shifted due to COVID 19.	No	No	No	One Kick-Off Telco. In this meeting, it was agreed to use email communication with the applicants.	No.
ICON	Yes	Yes. Kick-off telco, telcos organised when needed, regular email exchange	Feedback on reports, minor help on running the project.	The originally planned module did not provide enough added value, so ICON changed one Trinity module to another after	one from TAU and one from EDI	Not yet	No	Yes	TAU: Integration of depth sensor, communication of alternate solution.

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
				starting the project.					
LDM-AUTO	TAU: In the beginning of the project the communication was good, but during 2021 no communication with TAU. FM: Regular communications and meetings with Flanders Make	Yes, regular monthly telco meetings plus two visits.	TAU: Discussions concerning processes and quality assurance. FM: Type of robots, robot control architecture, ease of programming	Delays and issues due to covid. Some issues regarding the robot operations as well	No	No	We advised them on certain issues that arise when integrating a cell for multi-robot operation	Yes. Regular meetings. telco and physical	Yes, regarding robot operations
LOMSAS	Overall smooth interactions and constructive sessions. Not always regular	Yes, closely	Facilitating promotional activities, introducing potential partners, investor discussion. Follow-up proposals	Some challenges in industrialising, alternative found.	No	Yes, cybersecurity and privacy	No	Yes, quarterly and monthly.	Yes, wearables
MYWAI-4-ROBOTICS	Yes	Yes, regular email	Assistance in deliverables,	The experiment	No	No,	No	Only a few telcos because the	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
		communication, few telcos as well.	documentation, dissemination, and clarifying some questions. Consultancy on cost justification in their IIP and mid-term report.	development went fine				experiment development went fine. The demo became a new use case for TRINITY already in OC2.	
ROBOBEND	Yes	Yes, Kick-Off and then once per month online meeting with all participants	Suggestions and assistance about the administration, about some technical details, about project organization, dissemination, documentation	No	No	No	No	Yes	No
RoboLibri	Yes	Yes, a few times, kick-off, e-mails, check deliverables and advising	Assistance in the deliverables and documentation, clarify questions, clarify delays,	Yes - revision on mid-term report, impact due to COVID, improvement of	No	No	No	Yes, Kick-Off, interview on COVID impact and clarify questions in preparation to the reports	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
				dissemination and examples for that					
RoSo-UPB	Yes	Yes. Kick-off telco, telcos organised when needed, regular email exchange	Feedback on reports	Discussions on using machine learning	No	Not yet	No	Yes	Not yet
SALSA2d	Yes	Yes, for their kick-off and then once per month online meeting with all participants	Suggestions about the administration, about some technical details, about project organization, documentation.	Not yet	Yes	No	No	Yes	At the beginning then no
SNIPE	Yes	Yes, initial telco and e-mail communication about progress. Additional	Suggestions on how to improve the documentation. Suggestions on overall direction of the project. Assistance with questions regarding	No	No	No	No	Yes	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
		telcos as necessary.	the OCC expectations.						
TRAINMAN-MAGOS	Yes	Yes. Kick-Off Telco, email communication when they are dealing with an issue, Monthly online meetings, check deliverables for their progress.	Check for available grippers between TRINITY partners to be tested by Trainman-Magos before purchasing it. Suggestions on how to improve the submitted reports.	Gripper supply has delayed due to covid-19 impact on supply chain. Also, Integration and Validation of the HW Components has delayed due to gripper's unavailability.	No	No	No	Yes	Yes
WAAM CLAMP	Yes	Yes, Kick-Off and then once per month online meeting with all participants	Suggestions and assistance about the administration, about some technical details, about project organization,	Delays due to covid.	No	No	No	Yes	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
			dissemination, documentation						
X-Weld	Yes	Yes, Kick-Off and then once per month on-line meeting with all participants	Suggestions about the administration, about some technical details, about project organization, documentation.	Not yet	Yes	No	No	Yes	At the beginning then no

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Table 3: Demonstrator Support Questionnaire program 2

Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming ?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
ATLANTES	Yes	Mainly during evaluation periods when material should be delivered	None	No	No	No	No	Yes, but not regularly	No
Aurora	Yes, often for questions during the project and for participation in events (deep dives, etc.)	Mutual on important issues, occasion-related	Assistance in reporting (formalities, submission date, preliminary examination of documents, questions)	No technical support. Just one meeting regarding the MTM Module, which was later replaced by and 3D scan application.	A discussion was made on the MTM module but wasn't used.	No	No	Yes, regular exchange (monthly).	No
Brilliant	Yes.	Yes, we organized meetings when required. The reports also were planned in an efficient way, and therefore the	Provided the access to the object detection module. Assisted in the preparation of	No.	Yes.	No.	The demonstrator didn't proceed with the integration of the object	No, meetings were organized only on request if needed. All the tracking was done through reports and	No.

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming ?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
		progress could be easily monitored through them.	the deliverables and all the other materials. Help with the evaluation of the possible solutions in the development of the demonstrator				detection module, as it was identified that it would not be feasible to pick tweezer blades from the box with a two-finger gripper, which is required for welding and polishing operations	regular communication through e-mails.	
CANNIER	Yes, sometimes challenging, but overall good interactions. Started with	Yes, closely.	Suggestions for promotional activities, business modelling, KPI's,	Some challenges in operationalising from demo to production, more time	No	Suggestions for privacy improvement and KPI detection and metrics.	Not applicable	Yes, regularly	Not applicable

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming ?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
	bi-monthly, turned into quarterly.		activities. Ensuring involvement of all partners, also demonstrator partner.	needed, but resolved.					
CORS	Yes	Few times during the project.	None - wasn't needed, the participants were very experienced.	No	No	No	No	No,	No, they didn't claim it.
Dyncomm	Yes, through emails.	Not much on technical level, mostly issues related to evaluation material	Assistance in reporting	No. The team run independentl y their demo.	No	No	No	No	No
Inteli5.0	Yes, often in format of emails.	Not on a technical level much. Mainly during evaluation periods when material should be delivered.	Assistance in reporting.	No. The team run independentl y their demo.	No	No	The demonstrator didn't proceed with the integration of AR-based	Yes, at the beginning was good. At the end of project, it went through just with emails.	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming ?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
							operator support in HRC, as they initiate the idea at the beginning of the project. We agreed if the time period would be sufficient, they can develop it, otherwise, they might integrate them later than the period of this project.		
MCPPS	Yes	Yes, but only when there are materials need to deliver. They will delivery	Explanation to the file delivery.	No	No	No	No	One meeting at the beginning of the project, then	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming ?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
		me the draft, then I look through it.	Guidance for the report.					mainly by email.	
Proton Robots	Yes	Via discussions during our Monthly Meetings, and via review of deliverables and reports.	Assistance in exploring TRINITY modules. Assistance in reporting and dissemination activities.	No	Yes, TRINITY UWB module. However due to unavailability of the HW and later discovering cheaper alternatives, they didn't need to use the module in the end.	Not directly but provided example firmware code and tutorial.	No	Yes, we had monthly status meetings, besides we arranged extra meetings around IIP, mid-term, and final reviews.	Yes, due to unavailability of UWB HW, we advised them about alternatives.
RAISE	Yes	Not on a technical level much. Mainly during evaluation periods when material should be delivered.	Related to the reporting.	No	The used module was the module from MYWAY developed during OC1.	No	No	No	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
RECOPRODAS	Yes	We have regular project meetings.	None	No	No	No	No	Yes, regularly.	No
Rob4steel	Yes. Very responsive in mails and meetings.	We did a monthly catch up and more intensively when material should be delivered.	Assistance with the development, we provided infrastructure and resources for demo purposes.	No. The team run independently their demo.	A discussion was made on UC10 module developed by LMS but was not used. Only for brainstorming purposes.	No.	Yes. Integration with a robot provided by LMS.	Yes, monthly.	No.
RoboCut	Yes. Mainly through mails.	Not on a technical level much. Mainly during evaluation periods when material should be delivered.	Assistance in reporting.	No. The team run independently their demo.	No.	No.	No.	No.	No.
SHAFTS	Yes	Via discussions during our Monthly Meetings, and via review of deliverables and reports	Assistance in reporting and dissemination activities.	No	No	No	No	Yes, we had monthly status meetings, besides we arranged extra meetings around	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming ?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
								IIP, mid-term, and final reviews.	
SHARKY	Yes	We have regular project meetings.	None	No	No	No	No	Yes, regularly.	No
Shipweld	Monthly or bi-monthly reporting meetings on progress and achievements.	Yes, actively. Went on site visit in Athens in May 2022 to see the demonstrator in action.	Facilitated access to promotional activities, suggested other dissemination and promotional activities. Discussions on technology use, use of data analytics	Some challenges in the vision system and robot operations but resoved.	Investigated, but not used.	CyberSecurity improvements suggestions	Not applicable	Yes, on regular basis. Progress reporting and auditing.	Yes, camera challenges
SpinEye	Yes, often for questions during the project and for	Mutual on important issues, occasion-related	Assistance in reporting (formalities, submission date,	No technical assistance.	Yes, EDI object detection	No	Yes, EDI provided some introduction	Yes, regular exchange (monthly).	No

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Demo Name	Do you have smooth communication with the demo team?	Have you monitored them?	What kind of assistance you have provided to the demo experiments?	Did the experiment have any problem with the demo, and did you solve it?	Do the experiment use or ask to use one of the mentor's available modules?	Do you provide any support in programming?	Do you help the demo team to resolve any integration issue?	Have you organized meetings to track their activities and their developments?	Do you advise them regarding a Hardware issue?
	participation in events (deep dives, etc.)		preliminary examination of documents, questions)				meeting to the system.		
VisDeburr	Yes.	Meetings approximately once a month where the progress is monitored. In addition, meetings, and e-mail exchange.	Mostly related to reporting.	The consortium solved all the challenged independently e.g., issues related to imaging reflective objects.	Yes, "Online trajectory generation with 3D camera for industrial robot".	No.	No, the main partner (CIT) was familiar with the module beforehand.	Yes, meetings approximately once a month.	No

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3 Training Platform

The purpose of this section is to provide a thorough presentation of the TRINITY Training Platform developed by LMS under WP7. The Platform has been designed and implemented to host all the training material created by the TRINITY consortium based on the provided Use Cases and Modules and provide an intuitive and interactive learning experience for users who wish to get familiarized with the provided technologies. This training material, as also described in previous deliverables, like D7.3, includes presentations, documents and video presentations related to the technologies each partner provides under the TRINITY project. However, all this material should be organized in such a way, to facilitate those who are not experts in the field to navigate and digest.

To address this issue, LMS developed a training platform that provides a structured and engaging way to access and learn from the material generated by the TRINITY project. The platform features a user-friendly interface based on the Moodle Platform that enables users to explore the material at their own pace and in a way that suits their learning style.

In the following sections, a detailed overview of the features and functionality of the training platform will be provided as well as the effort towards integrating the Training Platform with the TRINITY Digital Access Point (DAP) created by CIVITTA under WP4, to increase the impact of both platforms.

3.1 Moodle

The TRINITY Training Platform can be accessed from this link: https://trinity-trainingplatform.eu/ and has been built using Moodle, an open-source learning management system, widely used in educational institutions worldwide. Moodle provides a robust and flexible platform for developing and delivering online training material, and its user-friendly interface makes it easy for users to access and navigate the content. The TRINITY Training Platform leverages Moodle's capabilities to provide an engaging and effective learning experience for project partners and guests, who can freely access all the material. The main page of the training platform can be seen in the figure below.

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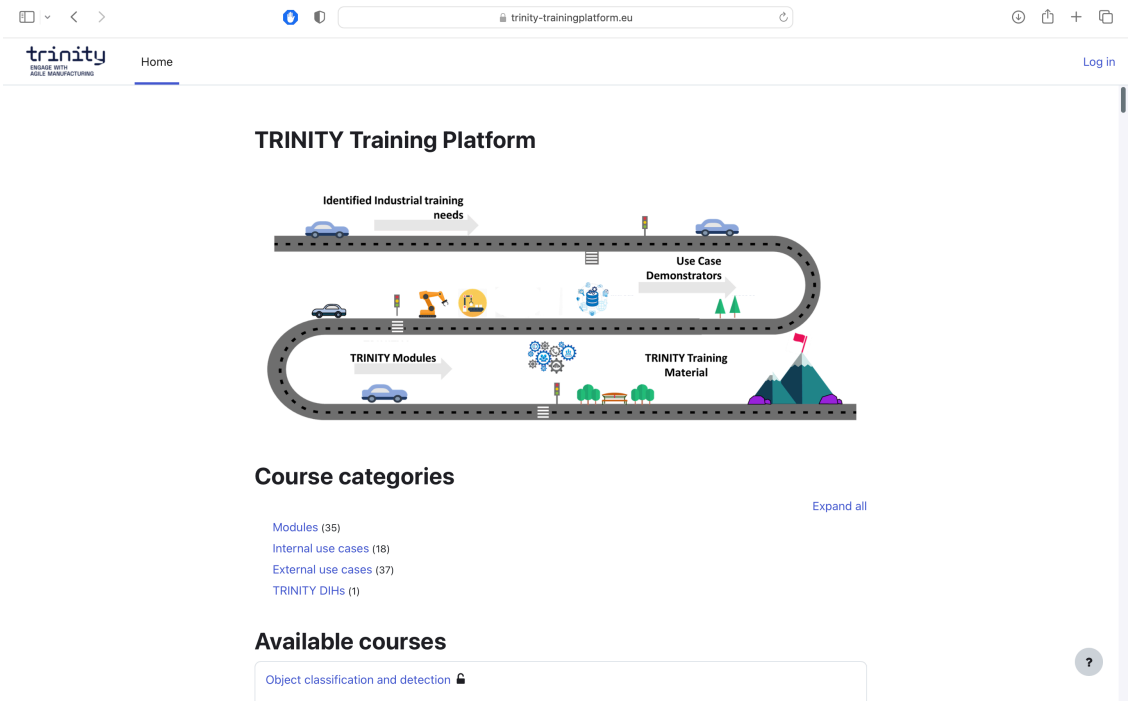

Figure 1: TRINITY Training Platform

As depicted in Figure 1, four different types of courses have been created inside the Training Platform. These four types refer to:

- The TRINITY Modules, including material from all the 35 Modules developed in TRINITY from all the partners.
- The TRINITY Internal Use cases, including material from the 18 use cases provided by the TRINITY partners
- The TRINITY External Use cases, including material from the 37 demonstrations funded under the two Open Calls
- The TRINITY DIHs, including presentations from members of the TRINITY DIH regarding their activities and the services they provide under the project.

A more thorough review of each type of course is provided in the following sub-sections.

3.1.1 Modules

Each course is focused on a specific module, and it is structured as presented in Figure 2. More specifically, the course starts with some general information about the module and an introductory section to the provided training material (Figure 3). Following these, information about the targeted audience of the course and any requirements that a participant should meet to be able to follow the course are provided as well as the three versions (please refer to D7.3 and/or section 4 of this document for more details on the different versions) of the training material (Figure 4).

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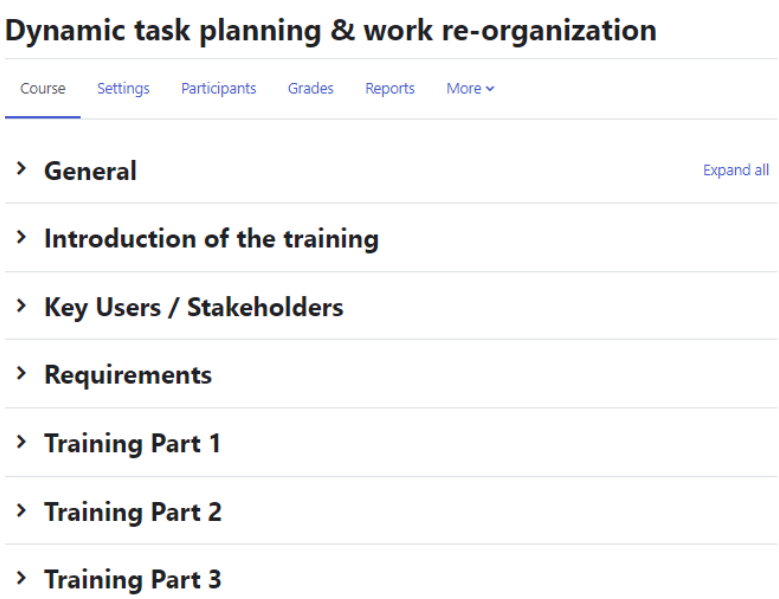

Figure 2: Module course structure

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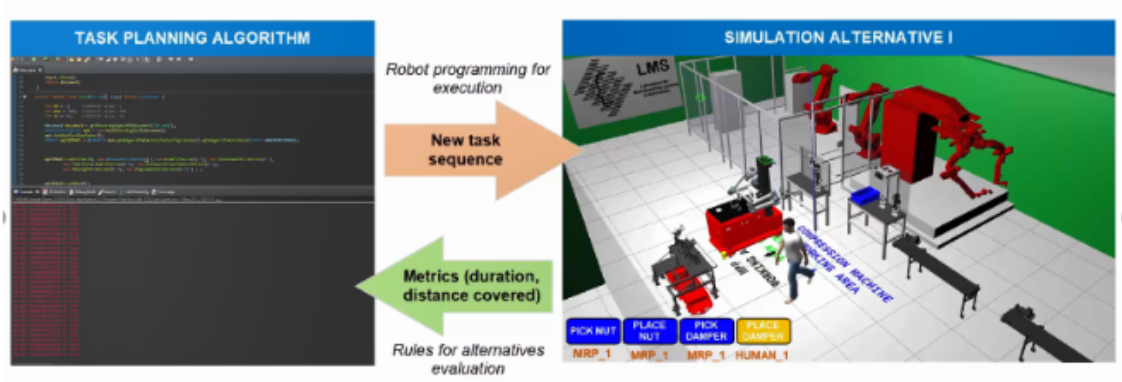
General

Collapse all



Time: < 2h
Language: English
Access: Free
Level: Intermediate

Introduction of the training

The training material of a decision making algorithm enabling the dynamic reconfiguration of a human robot collaborative environment will be introduced below.

This algorithm will take under consideration any task planning issue of an assembly process and reduce the time and the size of the designing team required to make any modification to an existing assembly line. The proposed software may be integrated inside any human-robot collaborative scenario introducing new manufacturing solutions for the task planning and dynamic work re-organization.

The main aim of this material is to introduce the basic knowledge about digital human simulation, workplace design, human process design and redesign in a human robot collaborative environment.

The training material of this module will give the opportunity to the user to be exercised in the generation of a schedule based on a set of assignment. Also, he will be able to dynamically distribute the different activities that will be carried out to every relevant resource and be familiarized with a graphical modeling of a manufacturing process following the described breakdown of tasks, jobs etc.

Through this training material, the user will learn about integrated manufacturing management tasks like planning, scheduling and evaluation of manufacturing processes and facilities. Also the user will be familiarized with the terms of factory's productivity, efficiency and quality.

Figure 3: Example of a module course generic information and introduction to training

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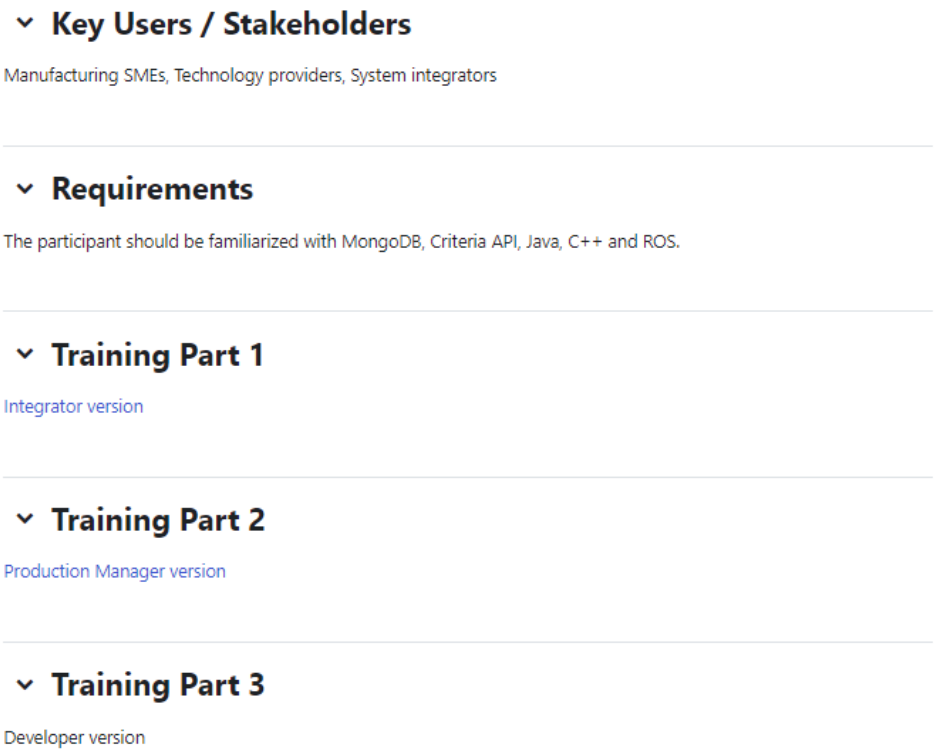

Figure 4: Example of a module course target, requirements, and training material

3.1.2 Internal Use cases

Each course is focused on a specific internal Use case, and it is structured in a similar way with the module courses, as presented in Figure 5. More specifically, the course starts with some general information about the Use case (Figure 6) followed by (one or more) web lectures (Figure 7) created by the owner of each use case presenting the Use Case, its benefits, and potential contributions to a manufacturing system as well as the modules included in the use cases and their specific roles.

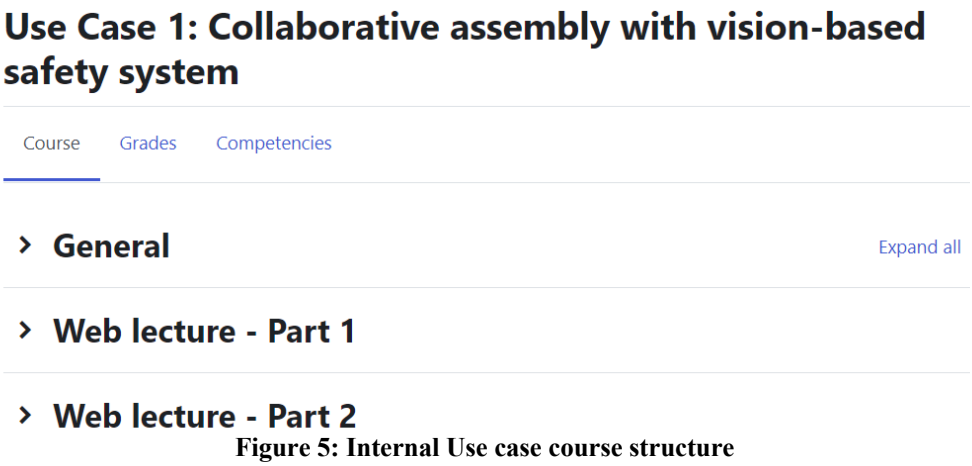

Figure 5: Internal Use case course structure

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General

Collapse all

This video is an introduction to online training material for TRINITY Use Case titled 'Collaborative Assembly with Vision Based Safety System' . This Use case presents a projector-based Human-Robot Interaction solution for more flexible human robot collaboration in industrial assembly applications.

General Information about the Demonstrator can be found on TRINITY Website

Figure 6: Example of a Use case course generic information

Web lecture - Part 1

At part 1 of this set of web lectures you will attend

- How our TRINITY solution contributes to agile manufacturing.
- What are the benefits of this solution in Human-Robot Collaboration.
- How could manufacturing companies benefit from this solution.
- What kind of investments are required.

Figure 7: Example of a Use case course web lecture

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3.1.3 External Use cases

Each course is focused on a specific external Use case funded under one of the two Open Call programs. Each course of this category includes material regarding the targeted demo in the form of text description, presentation, or video lecture (Figure 8), as well as a video presenting the project results (Figure 9).

Figure 8: Example of an external Use case course generic information

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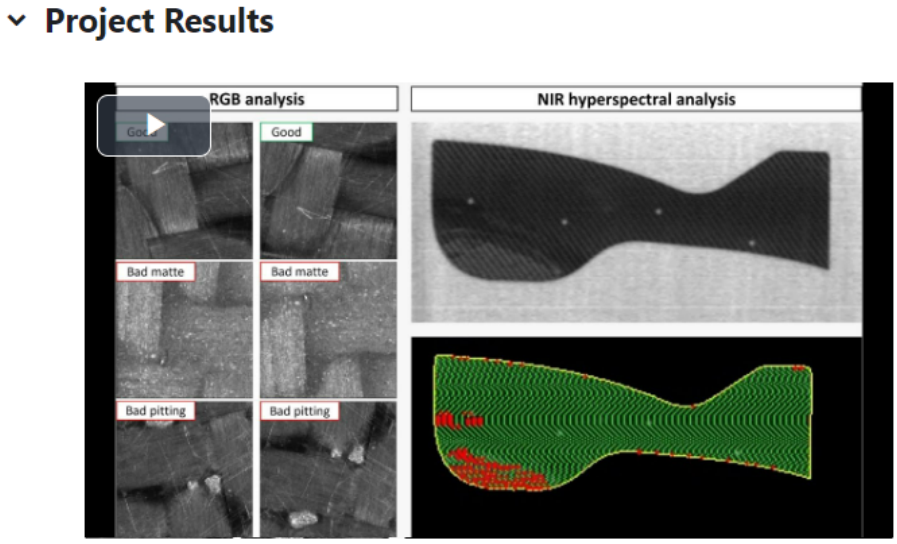

Figure 9: Example of an external Use case course project results

3.1.4 TRINITY DIHs

Under the TRINITY Training Platform, a dedicated course category has been created to host a series of remote sessions aimed at member organizations of TRINITY DIHs. These sessions are delivered in the form of video presentations, which have been prepared by each organization to provide an overview of their activities and the services they offer under the TRINITY project (Figure 10). These video presentations provide a valuable opportunity for member organizations to showcase their expertise and highlight their contributions to the project. By integrating these sessions into the Training Platform, users can access them at their own pace and revisit the material as needed, enabling a more flexible and convenient learning experience.

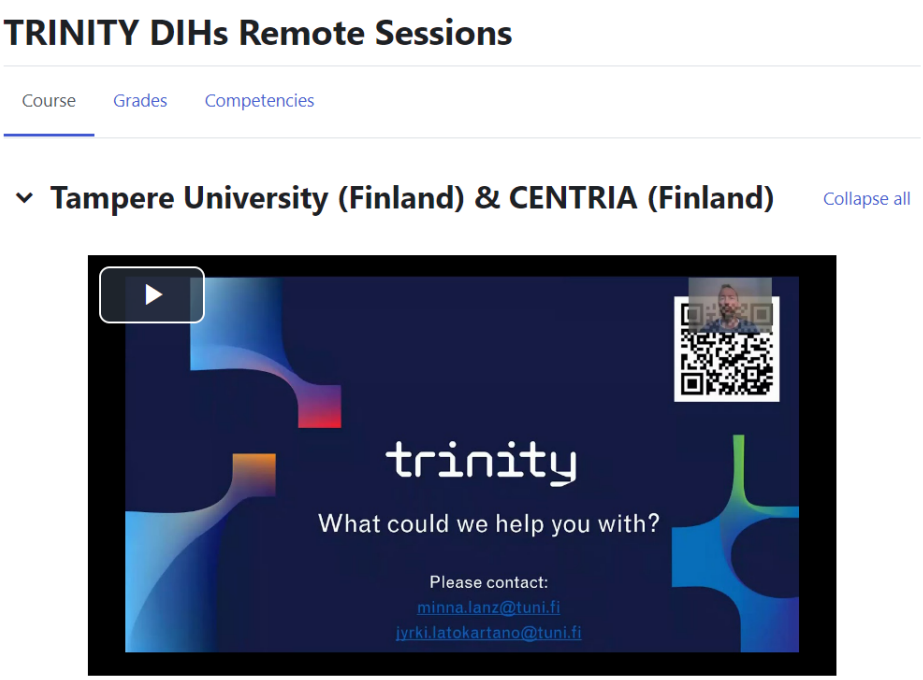

Figure 10: Example of TRINITY DIH member presentation (TAU and Centria)

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3.2 Training Platform – DAP Integration

To ensure that the training material created by the TRINITY consortium is easily accessible and visible to all interested parties, LMS worked in collaboration with CIVITTA towards integrating the TRINITY Training Platform and material uploaded there with the TRINITY Digital Access Point (DAP).
The integration of the TRINITY Training Platform with the TRINITY Digital Access Point (DAP) involved including a link inside each module and use case page of the DAP that leads to the dedicated page in the Training Platform. This approach allows interested parties to access the relevant training material for each module and use case directly from DAP. In order to proceed with the aforementioned integration approach, a detailed document has been created including all the relevant links for the modules and the use cases on both platforms, namely Training Platform and DAP, which have been enclosed below as well.

Table 4: Linking modules between Training Platform and DAP

Link to TRINITY Training Platform	Link to DAP
Object classification and detection	https://trinityrobotics.eu/modules/object-classification/?from=catalog https://trinityrobotics.eu/modules/object-detection/?from=catalog
WSN/IoT TestBed	https://trinityrobotics.eu/modules/edi-wsn-iot-testbed-2/?from=catalog
Robot Control for bin picking	https://trinityrobotics.eu/modules/robot-control-for-bin-picking/?from=catalog
KMR External Module	https://trinityrobotics.eu/modules/kmr-external-control-module/?from=catalog
UWB based indoor localization	https://trinityrobotics.eu/modules/uwb-based-indoor-localization-module/?from=catalog
Easy Programming	https://trinityrobotics.eu/modules/easy-programming-module/?from=catalog
Mobile robot motion control	https://trinityrobotics.eu/modules/mobile-robot-motion-control/?from=catalog
Robotino® communication	https://trinityrobotics.eu/modules/robotino-communication/?from=catalog
Queued Message Handler (QMH) software architecture	https://trinityrobotics.eu/modules/queued-message-handler-software-architecture/?from=catalog
Environment detection	https://trinityrobotics.eu/modules/environment-detection/?from=catalog
IIoT Network Fallback Simulation	https://trinityrobotics.eu/modules/iot-network-fallback-simulation/?from=catalog
IIoT Network Device Positioning	https://trinityrobotics.eu/modules/iiot-network-device-positioning/?from=catalog
Handling and Assembly	https://trinityrobotics.eu/modules/handling-and-assembly/?from=catalog
Vision System/Quality assurance	https://trinityrobotics.eu/modules/vision-system-and-quality-assurance/?from=catalog
ROS Peripheral Interface	https://trinityrobotics.eu/modules/ros-peripheral-interface/?from=catalog
Optimal locations and postures of reconfigurable fixtures	https://trinityrobotics.eu/modules/optimal-locations-and-postures-of-reconfigurable-fixtures/?from=catalog

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Link to TRINITY Training Platform	Link to DAP
Hardware & software interface for robot programming by manual guidance	https://trinityrobotics.eu/modules/hardware-software-interface-for-robot-programming-by-manual-guidance/?from=catalog
Virtualization of a robot cell with a real controller	https://trinityrobotics.eu/modules/virtualisation-of-a-robot-cell-with-a-real-controller/?from=catalog
Dynamic Online Trajectory Generation for Industrial Robot with 3D Camera	https://trinityrobotics.eu/modules/online-trajectory-generation/?from=catalog
Safe human detection in a collaborative work cell	https://trinityrobotics.eu/modules/safe-human-detection-in-a-collaborative-work-cell/?from=catalog
Online trajectory generation for industrial robot with 3D camera	https://trinityrobotics.eu/modules/dynamic-robot-trajectory-generation-based-on-information-from-3d-camera/?from=catalog
Digital Design Content Based Robot Trajectory Generation	https://trinityrobotics.eu/modules/robot-trajectory-generation-based-on-digital-design-content/?from=catalog
Virtual reality programming of a manufacturing cell	https://trinityrobotics.eu/modules/virtual-reality-programming-of-a-manufacturing-cell/?from=catalog
Rapid mapping of a production system in a virtual environment	https://trinityrobotics.eu/modules/rapid-mapping-of-a-production-system-in-a-virtual-environment/?from=catalog
Remote control for industrial robot	https://trinityrobotics.eu/modules/remote-control-of-industrial-robots/?from=catalog
Connecting virtual model with the physical model	https://trinityrobotics.eu/modules/connecting-virtual-model-with-the-physical-model/?from=catalog
Additive TiG Welding	https://trinityrobotics.eu/modules/additive-tig-welding/?from=catalog
Simulation Welding	https://trinityrobotics.eu/modules/simulation-welding/?from=catalog
Depth-sensor safety model for HRC	https://trinityrobotics.eu/modules/depth-sensor-safety-model-for-hrc/?from=catalog
Projection-based interaction interface for HRC	https://trinityrobotics.eu/modules/projection-based-interaction-interface-for-hrc/?from=catalog
Wearable AR-based interaction interface for HRC	https://trinityrobotics.eu/modules/wearable-ar-based-interaction-iknterface-for-hrc/?from=catalog
AR-based Operator Support in HRC	https://trinityrobotics.eu/modules/ar-based-operator-support-in-hrc/?from=catalog
Safety Logic Seamless for HRC	https://trinityrobotics.eu/modules/safety-logic-for-seamless-hrc/?from=catalog
Dynamic task planning & work re-organization	https://trinityrobotics.eu/modules/dynamic-task-planning-module/?from=catalog
MTM Universal Analysis System (UAS)	https://trinityrobotics.eu/modules/mtm-universal-analysis-system-uas-including-primary-secondary-analysis/?from=catalog

Table 5: Linking External use cases from the 1st Open Call between Training Platform and DAP

Link to TRINITY Training Platform	Title to DAP from SME's demos 1

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Use Case 1.1: Real time dynamic motion planning for industrial robots	DYNAMO
Use Case 1.2: Separation of Additive-Layer Supports by Automation via 2-way Digital Twin	SALSA2d
Use Case 1.3: Advanced Robotics for Accurate Grinding of Complex Metal Parts	ARGRIND
Use Case 1.4: Increasing the agility of the automotive cable assembly industry using TRINITY robotics solutions	AGILE
Use Case 1.5: Sensor Network for Intelligent Predictive Enterprise	SNIPE
Use Case 1.6: AMR Logistics Orchestration For Agile Production	ALOFAP
Use Case 1.7: End-to-end Automatic Handling of Small Packages	EACHPack
Use Case 1.8: Edge Intelligence for Robotics	MYWAI-4-ROBOTICS
Use Case 1.9: Development of an autonomy module to improve up-time and efficiency of a laser cladding cell for volume production	LDM-AUTO
Use Case 1.10: Location based safety for human-machine interactions	LOMSAS
Use Case 1.11: Affective Manufacturing System	AMS
Use Case 1.12: The Intalogistic Cornerstone for Agile Production	ROBOLIBRI
Use Case 1.13: Waam clamp-wire arc application of metal component linked to additive manufacturing for pipeline repair	WAAM CLAMP
Use Case 1.14: Robotic Sorter for Used Portable Batteries	RoSo-UPB
Use Case 1.15: Training of an industrial manipulator using the magos platform	TRAINMAN-MAGOS
Use Case 1.16: World's first standard bending robot	ROBOBEND
Use Case 1.17: Planning, Accuracy and 3D sensing for full automation robotic welding	X-WELD
Use Case 1.18: Digitalization of collaborative Screwdriver Applications in Agile Productions	Digi-SAAP
Use Case 1.19: Agile Electric Motor Manufacturing	ICON

Table 6: Linking External use cases from the 2nd Open Call between Training Platform and DAP

Link to TRINITY Training Platform	Title to DAP from SME's demonstrators 2
Use Case 2.1: Quality control of carbon parts based on machine vision	ATLANTES
Use Case 2.2: Datastream processing in Human-Robot-Collaboration	AURORA
Use Case 2.3: Collaborative solutions for flexible artisanal manufacturing	BRILLIANT
Use Case 2.4: Robotic lamination of composite parts	CANNIER
Use Case 2.5: Collaborative robotic solution for laser micromachining	CORS
Use Case 2.6: Dynamic collaborative control of mobile manipulators for complex picking	DynCOMM
Use Case 2.7: Toward Industry 5.0: Collaborative Intelligence for supporting enhanced human-cobot interaction in agile production, demonstrated through the creation of innovative in-process quality inspection services	Intelli5.0
Use Case 2.8: Demonstrator for a milling CPPS	MCPPS
Use Case 2.9: Precise positioning in alternating environments for autonomous railway inspection and parking lot striping robots	PROTON Robots
Use Case 2.10: Robots as an intelligent services ecosystem	RAISE24
Use Case 2.11: Reconfigurable Cobotic Production Assistant	RECOPRODAS
Use Case 2.12: Custom industrial packaging production robot	RoboCut

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Use Case 2.13: Robotized inspection system for high-temperature electric arc furnaces (EAF)	Robs4Steel
Use Case 2.14: Local demonstrations of predictable bin picking	SHAFTS
Use Case 2.15: Worker-centric programming tools for free designing of lightweight aluminium-based products	SHARKY
Use Case 2.16: Mobile, flexible robotic welding system to reshape the European shipbuilding industry	SHIPWELD
Use Case 2.17: AI & Cloud enabled vision system for agile teach-in of assembly processes	SPINEYE
Use Case 2.18: Vision guided deburring of welded seams	VISDEBURR

Table 7: Linking Internal use cases between Training Platform and DAP

Link to TRINITY Training Platform	Link to DAP
Use Case 1: Collaborative assembly with vision-based safety system	https://trinityrobotics.eu/use-cases/collaborative-assembly-with-vision-based-safety-system/
Use Case 2: Collaborative disassembly with augmented reality interaction	https://trinityrobotics.eu/use-cases/collaborative-disassembly-with-augmented-reality-interaction/
Use Case 3: Collaborative robotics in large scale assembly, material handling and processing	https://trinityrobotics.eu/use-cases/collaborative-robotics-in-large-scale-assembly-material-handling-and-processing/
Use Case 4: Integrating digital context (e.g. BIM) to the digital twin with AR/VR of the robotized production	https://trinityrobotics.eu/use-cases/integrating-digital-context-to-the-digital-twin-with-ar-vr-of-the-robotized-production/
Use Case 5: Wire arc additive manufacturing with industrial robots	https://trinityrobotics.eu/use-cases/automated-robotic-welding/
Use Case 6: Production flow simulation/supervision	https://trinityrobotics.eu/use-cases/digitalisation-of-a-production-environment/
Use Case 7: Robot workcell reconfiguration	https://trinityrobotics.eu/use-cases/uc7/
Use Case 8: Efficient programming of robot tasks by human demonstration	https://trinityrobotics.eu/use-cases/uc8/
Use Case 9: Dynamic task planning & work re-organization	https://trinityrobotics.eu/use-cases/dynamic-task-planning-work-re-organization/
Use Case 10: HRI framework for operator support application in human robot collaborative operations	https://trinityrobotics.eu/use-cases/hri-support-application-for-operator/
Use Case 11: Robotized serving of automated warehouse	https://trinityrobotics.eu/use-cases/1229/
Use Case 12: User-friendly human-robot collaborative tasks programming	https://trinityrobotics.eu/use-cases/user-friendly-human-robot-collaborative-tasks-programming/
Use Case 13: Deployment of mobile robots in collaborative work cell for assembly of product variants	https://trinityrobotics.eu/use-cases/deployment-of-mobile-robots-in-collaborative-work-cell-for-assembly-of-product-variants/
Use case 14: Virtualization of a robot cell with a real controller	https://trinityrobotics.eu/use-cases/uc14/
Use Case 15: IIoT Robustness Simulation	https://trinityrobotics.eu/use-cases/industrial-iot-robustness-simulation/

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Link to TRINITY Training Platform	Link to DAP
Use Case 16: Flexible automation for agile production	https://trinityrobotics.eu/use-cases/flexible-automation-for-agile-production/
Use Case 17: Artificial intelligence based stereo vision system for object detection, recognition, classification and pick-up by a robotic arm	https://trinityrobotics.eu/use-cases/post-office-package-sorting/
Use Case 18: Rapid development, testing and validation of large scale wireless sensor networks for production environment	https://trinityrobotics.eu/use-cases/rapid-development-testing-and-validation-of-large-scale-wireless-sensor-networks/

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4 Modules Training Material

During the design and implementation of the training material from the TRINITY partners, main focus was given to the technical modules offered by the partners, since the list of deployed modules is a key component in the list of services provided by TRINITY DIHs.
At this category of training material, the participants are able to dive deep into each module and get familiarized with its functionalities and benefits. Moreover, the created training material provided detailed technical guidelines to the participants on how to implement and deploy each module to their production system. The Modules training material has been used for example by the 2nd open call participants to implement and integrate the selected TRINITY modules into their demonstration program. At this point it needs to be clarified that each partner for the module training material was able to choose different delivery mechanisms. A proposed structure has been suggested by LMS to be followed by all the partners during the preparation of the modules training material in the form of generic guidelines. Some variation in delivery mechanisms did occur as expected and noted in D7.3 due to the different nature of technologies presented.
In the context of D7.3, two categories of training material for the module were identified. However, during the preparation of the training material it became evident that for some modules a more thorough and in-depth technical material was needed in order for a person unfamiliar with the module to be able to implement it. For these modules, a third category of training material has been prepared to provide more technical details to the interested, namely the Developer version. The structure of the modules training material provided by the TRINITY partners can be summarized into the following schema (Figure 11).

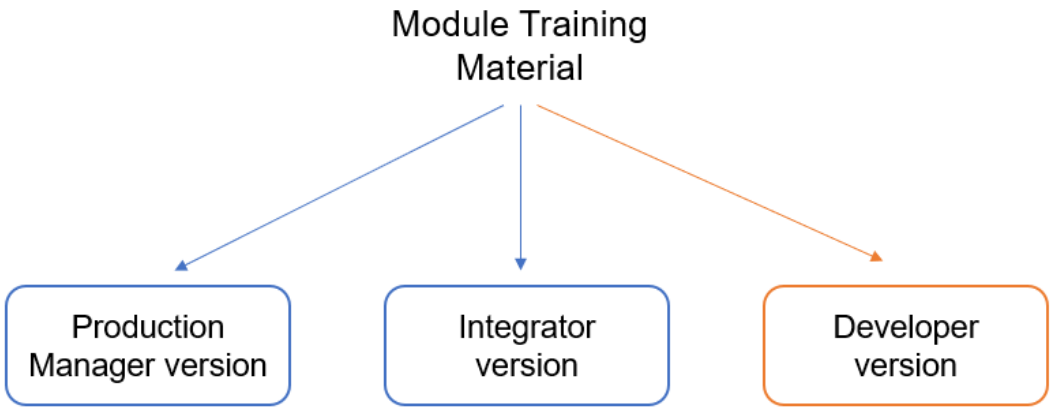

Figure 11: The 2+1 categories for the training material

4.1 Training Module – Production Manager and Integrator versions

The structure and the proposed content of the Production Manager and Integrator versions of the Training material have already been reported in D7.3 and the related material has been prepared by the partners and uploaded to the TRINITY Training platform inside the "course" dedicated for each module created inside the platform as presented in detail in section 3.1.1. Therefore, this report will not focus on these specific versions of the training material. Instead, this report will highlight the creation of the Developer version, as presented in the next sub-section.

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4.2 Training Module – Developer version

As mentioned earlier, during the creation phase of the training material by the TRINITY project partners, it became apparent that some modules required more detailed technical information for participants to implement and deploy the modules in their use cases. While the material provided in the context of the Production Manager and Integrator versions was mature enough for some modules, it has been recognized that an additional version, the Developer version, should be included in the categories of the provided material. This decision was made to ensure that all the necessary technical information is available to participants and to enable them to fully comprehend the implementation and deployment of any module. Therefore, the responsible partner of each module can decide whether the Developer version needs to be included in a module's course, depending on the requirements of the module and the needs of the participants.
The proposed form of the Developer version material follows a similar structure to the other two versions presented in D7.3. More specifically, in this category the included training material is focused on the developers that will implement the module and the main items discussed under this category are listed below:

- Guidelines on how to develop a similar module:
  - Presentation and explanation of the technical details of each module components
  - In depth explanation of the system requirements
- Guidelines both for experiences and inexperienced developers on how to use the software components.
- Presentation and explanation of the basic fundamentals required to build a solid foundation and understanding of the referred module.

As mentioned above, the Developer version of the training material has been integrated into each module's dedicated course in the TRINITY Training Platform (if it was required). This integration ensures that developers have access to the technical knowledge necessary to successfully implement and deploy each module.

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5 TRINITY Events using Training Material

During the execution of the TRINITY project, partners used the training material to demonstrate the TRINITY use cases and modules developed in the project. The target audience was open to everyone, including school students, university students, young engineers and other manufacturing stakeholders. The detailed list of events is described in the WP8 deliverables, but indicatively, below are enclosed a few examples.

5.1 School visits to Robolab Tampere and HRC Pilot line

TAU invited school groups to visit our labs and to get familiar with agile manufacturing automation and robotics. Besides the hands-on demonstrations also presentations were given on how to study robotics and find an interesting career in the field. TRINITY demonstrations were shown and information about the training platform was given. Two separate visits were arranged during spring term 2023.

5.1.1 Riihimäki high school, April 24th

A group of 10 students and teachers from Riihimäki robotics campus visited Robotlab Tampere and HRC Pilot Line. Main topic of the visit was TAU robotics education and possible future careers. Also, collaboration with Riihimäki Robotics Campus was discussed to provide the future talents with a clear robotics pipeline from pre-school all the way to university degree. During the visit TRINITY demonstrations were presented and tested among other agile manufacturing demonstrations.

Figure 12: Riihimäki school visit to TAU premises

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5.1.2 Tampere Vocational College Tredu, April 28th

A robotics demonstration and training day was arranged to a group of automation technology vocational students. Possibilities to continue at university after the vocational education was presented. Main topic of the day were the demonstrations and exercises with TRINITY demo setups and the other Robolab Tampere robots.

Figure 13: Vocational school visit to TAU premises

5.2 Partner visits to LMS Machine Shop

Another visit from partners of the EU project OMICRON, took place in LMS premises during the fall of 2022. The attendees had the opportunity to see the use case 9 "Dynamic task planning & work re-organization platform", developed by LMS as well as information about the training platform was given.

Figure 14: Partners visit to LMS premises

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6 Conclusions

This deliverable describes the means of DIHs to support the SMEs during the execution of the demonstrations during the Second Demonstrator program. Feedback from the mentees regarding their collaboration with the TRINITY partners was collected and presented. Moreover, questionnaires were prepared under WP7 to track the support and the assistance that was provided by the Mentors to the demonstrations of both programs. These questionnaires were filled in during the demonstration programs by the mentors and are also available in this document.

Moreover, under this document the TRINITY Training Platform created by LMS is presented. The TRINITY Training Platform is built using the Moodle Platform, hosting the training material created by the TRINITY partners for their respective modules and use cases. The Training Platform also serves as dissemination channel for the demonstration programs funded by TRINITY to present the projects and showcase the obtained results and for the TRINITY DIH to present the partners involved. Additionally, the document presented the integration efforts towards linking the TRINITY Training Platform with the TRINITY Digital Access Point (DAP), the webpage created under WP4 and is the main communication interface between TRINITY and the outside world.

Finally, this deliverable provided a description of the steps done towards finalizing the training material by the partners by including an extra category of training material, the Developer version. For the modules where more technical details were required, and the information provided by the two previous versions of the training material, the Production Manager and the Integrator versions, was considered inadequate and needed more content. This was improved on the final period in the TRINITY.

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