



### D7.3. Education & training - Novel knowledge delivery activities 1

<b>Grant Agreement no.</b>	<b>825196</b>
<b>Project Title</b>	<b>Digital Technologies, Advanced Robotics and increased Cyber-security for Agile Production in Future European Manufacturing Ecosystems</b>
<b>Project Abbreviation</b>	<b>TRINITY</b>
<b>Project Funding Scheme</b>	<b>H2020 Innovation Action (IA)</b>
<b>Call Identifier</b>	<b>DT-ICT-02-2018: Robotics - Digital Innovation Hubs (DIH)</b>
<b>Project Website</b>	<b><a href="http://www.trinityrobotics.eu/">http://www.trinityrobotics.eu/</a></b>
<b>Project Start Date</b>	<b>1.1.2019</b>
<b>Project Duration</b>	<b>54 months</b>
<b>Deliverable Information</b>	<b>D7.3 - Education &amp; training - Novel knowledge delivery activities 1</b>
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<b>Contractual Deadline</b>	<b>M30– 30 June 2021</b>

*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825196.*

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## DOCUMENT LOG

VERSION	DATE	DESCRIPTION AND COMMENTS	AUTHOR
RV0.1	25.5.2021	First draft	LMS
RV0.2	24.6.2021	Edits to the content	TAU, JSI
RV0.3	28.6.2021	Final edits, language check, addition of pictures	LMS
RV0.4	30.6.2021	Final check	TAU

## DISSEMINATION LEVEL

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 demonstrations as also the reporting of the Training Activities until M30.

Under Task 7.4 - Development of web-based lectures/study modules, all the research partners have cooperated on setting up a concrete strategy for organizing remote sessions where the interested companies will have the change to familiarize with each DIH competences. Web-based lectures have been organized by the TRINITY DIH towards disseminating the technical / training / consulting services that each hub will be providing to external companies.

- Additionally, dedicated lectures have been prepared given for the demo cases set up at each DIH having a two-fold aim:
  - a) discuss on the technical aspects of the demo cases
  - b) communication the benefits of the demo cases in terms of their contribution of increasing agility in production.
- These sessions hosted in the TRINITY Training Platform that has been developed under task 7.3 and will take place regularly through the entire duration of the project under task 7.5.

TRINITY Training material is the main training service of TRINITY project linked and has important role in the future sustainability of the network. Moreover, training material, will enhance the exchange of knowledge, will disseminate the results of the demonstrators and through its functionalities that will presented analytical at the next sections will promote the collaboration with SMEs and etc. Until now, we have already over 4 hours of training material on use cases and modules. This does not include the DIH service sessions. TRINITY use cases have in total 28 videos and for the modules we have currently 16 videos.



## 2 External Demonstrators support

The selected 3rd parties' projects started in July 1st 2020 and are currently in the Implementation phase or the final Dissemination phase. Difference is due to Covid-19 related challenges that caused delays in the project implementation. To enhance the support to demonstration program SMEs, TRINITY assigned an individual mentor to each of the 19 demonstrators to track their progress and provide guided support, through regular monitoring session (Table 1). Mentoring system has received very positive feedback from the SMEs, helping them in technical issues, reporting and dissemination duties. At the table below is reported the specific support and assistance to each experiment.

**Table 1 Support for external demonstrators**

<b>Demonstrator Name</b>	<b>Assistance and Support to the demonstrator</b>	<b>Mentoring TRINITY partners</b>
DynaMo	Mentoring team and DynaMo demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their work-plan and any assistance they might need from TRINITY project. After the kickoff meeting, bimonthly online meetings organized, and exchange of multiple emails exchanged to track demonstrators 'program. The mentoring provided them suggestions and assistance about the administration, about some technical details, about project organization, dissemination, documentation.	DNT, UiT, FASTEMS, MAKE
SALSA2d	Mentoring team and SALSA2d demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their work-plan and any assistance they might need from TRINITY project. After the kickoff meeting, bimonthly online meetings organized to track demonstrators' program. Assistance provided during the program was suggestions about the administration issues, about some technical details, about project organization and documentation.	JSI, TAU, UiT
ARGRIND	Mentoring team and AGRIND demonstrator communication were mainly through emails. A kick-off meeting was organized at the beginning of the experiment to discuss their work-plan and any assistance they might need from TRINITY project. After the kickoff meeting, the experiment didn't request any specific assistance or support on technical developments. The mentoring team advise them on dissemination activities and monitor them during the midterm evaluation.	BME, FASTEMS
AGILE	Mentoring team and AGILE demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. After the kickoff meeting, bimonthly	EDI, TAU, LMS



	online meetings organized and exchange of multiple emails exchanged to track demonstrators' program. The mentor assisted this team providing EDI modules, best-practices and know-how, suggestions on how to improve documentation and reports;	
SNIFE	Mentoring team and SNIFE demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. After the kickoff meeting, bimonthly online meetings organized, and exchange of multiple emails exchanged to track demonstrators' program. Suggestions on how to improve the documentation. Suggestions on overall direction of the project. Assistance with questions regarding the OCC expectations.	EDI
ALOFAP	Mentoring team and SALSA2d demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their work-plan and any assistance they might need from TRINITY project. The next months, suggestions on improving reporting and disseminating provided by the mentor. Moreover, technical discussions on mobile robotic and on the hardware that they would use took place. Due to covid19 situation email were the main communication channel.	MAKE
EACHPack	Mentoring team and EACHPACK demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Suggestions on how to improve the submitted reports provided by the mentor as also consultancy on cost justification in their IIP and mid-term report. The experiment team and the mentor agreed that tasks linked to the demonstrations had to be shifted due to COVID 19.	LMS
MYWAI-4-ROBOTICS	Mentoring team and MYWAY-4ROBOTICS demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Assistance in deliverables, documentation, dissemination, and clarifying some questions was provided by the mentoring team as also consultancy on cost justification in their IIP and mid-term report. The experiment had excellent progress during the program and became a new use case for TRINITY already in Open Call 2.	BME , EDI
LDM-AUTO	Mentoring team and LDM-AUTO demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Regular	MAKE



	communications and online meetings were organized during the programs as also two visits. The mentoring team advised them on certain issues that arised when integrating a cell for multi-robot operation. Moreover, the teams had some delays and issues due to covid as also some issues regarding the robot operations. However, everything discussed and solved with the assistance of mentoring team.	
LOMSAS	Mentoring team and LOMSAS demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Feedback on deliverables and reports were provided by the mentors as also guidance on machine learning applications. No problems or delays occurred with this demonstrator.	LSEC
AMS	Mentoring team and AMS demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Feedback on deliverables and reports were provided by the mentors as also guidance on machine learning applications. No problems or delays occurred with this demonstrator.	LSEC
RoboLibri	Mentoring team and RoboLibri demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Assistance in the deliverables and documentation provided from the mentoring team. Moreover, questions and delays clarified through email communication. Revision on midterm report requested during the midterm evaluation as also improvement of dissemination activities.	IWU, LP
WAAM CLAMP	Mentoring team and WAAM CLAMP demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their work-plan and any assistance they might need from TRINITY project. After the kickoff meeting, bimonthly online meetings organized, and exchange of multiple emails exchanged to track demonstrators 'program. The mentoring provided them suggestions and assistance about the administration, about some technical details, about project organization, dissemination, documentation.	DNT, UiT, TAU
RoSo-UPB	Mentoring team and RoSo-UPB demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Feedback on deliverables and reports were provided by the mentors as also guidance on machine learning applications. No problems or delays occurred with this demonstrator.	CENT



TRAINMAN-MAGOS	Mentoring team and TRAINMAN-MAGOS demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Then, monthly online meetings organized in order to check their deliverables and their progress. Moreover, this demonstrator needs a specific gripper for their developments and mentors tried to assist them checking for available grippers between TRINITY partners to before purchasing it.	LMS
ROBOBEND	Mentoring team and ROBOBEND demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their work-plan and any assistance they might need from TRINITY project. After the kickoff meeting, bimonthly online meetings organized, and exchange of multiple emails exchanged to track demonstrators 'program. The mentoring provided them suggestions and assistance about the administration, about some technical details, about project organization, dissemination, documentation.	DNT, UiT
X-Weld	Mentoring team and X-Weld demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and their workplan. Then a bimonthly online meeting organized in order to track the experiment's status and to discuss any question or difficulty the demonstrator team might have. Suggestions about the administration, about some technical details, about project organization and documentation were provided by the mentoring team.	JSI
Digi-SAAP	Mentoring team and demonstrator Digi-SAAP had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and any assistance they might need from TRINITY project. Assistance in the deliverables and documentation, answer of questions and clarification of delays of the experiment were provided by the mentors. Digi-SAAP requested to revise the midterm report and mentor guided them to apply the requested changes.	IWU, LP
ICON	Mentoring team and ICON demonstrator had smooth communication during the program. A kick-off meeting was organized at the beginning of the experiment to discuss their developments and their workplan. Then several teleconferences organized when was needed and regular email exchanged. Moreover, mentoring team provided feedback on reports and minor help on running the project. This demonstrator had as originally planned to use on of the TRINITY module that did not provide enough added value, so ICON changed one Trinity module to another after starting	CENT, TAU





	the project. Regarding the H/W issues, Tampere University assisted them on Integration of depth sensor and communication of alternate solution.	
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### 3 Use case Lectures

The last months of TRINITY project the main focus on WP7 was the preparation of use case lectures. The content of the use case lectures is to provide a general idea of TRINITY partners use cases, the technologies that have been used, the contribution to the agile production the advantages of them, the used hardware and the software tools and the connection with the modules. The outcome of these lectures should be to get interest on the use cases and to attract SMEs and new users. The web lectures for the use cases have been divided in two parts for a smooth introduction to the participant in them. Below are described the main points of each part.

#### Use Case Lecture – Part 1

At Part 1 of the use case lectures general info about the use case has been included.

The first part of use case lecture, is a short presentation which includes the following topics.

- TRINITY intro
  - All the videos started and ended with the TRINITY intro and outro
- Trinity project intro based on partner
  - Each Partner makes a short introduction of the organization and who is the presenter.
- Use case information and definition
  - Title of the use case and short description
  - Figures of the use case suggested to be used.
- Lecturer (general requirements)
  - Exaplanation of technical requirements for the next parts.
- Conclusion & next step
  - Conclude and refer the next parts.

#### Use Case Lecture – Part 2

Part 2 presents the main information about the use case. The main outcome of these lectures is to provide a clear explanation to no TRINITY involved companies and participants about the TRINITY use cases. The main goal of this activity is to promote and familiarize the participants with the use cases excluding technical and complex details. This part should be more marketing oriented and less training. There are several ways to present and discuss the following aspects. However, a presentation video with figures or a video in the lab facilities presenting the use case, or a video with the presenter to communicate the following points can be very effective and was selected from all the partners.

The second part of Use case lecture, is a short presentation which includes the following topics.

- TRINITY Intro
  - All the videos started and ended with the TRINITY intro and Outro that can be found on Wiki
- Use Case Benefits
  - Communication of the benefits of the use case
- Use case contribution to agile production
  - Discussion on application, external implementation sample, where to fit in industry, etc.
- How to implement this use case
  - Different kind of implementations in different scenarios in different industries
- Technical Specifications
  - Present the high level of specifications (big picture, ex: a diagram)
- How module connected with the use case
  - It is very important to explain the connection of your use case and your module
- Conclusion & next step
  - Conclude this part and refer which is the next part

- Summarize lectures
  - Short reminder of the previous parts of the lecture.
- Next steps (modules related to use case)
  - Guide the participants to the related Training module




All the use case Lectures have been uploaded at TRINITY Channel on Youtube (<https://www.youtube.com/channel/UC73uEsurvzyimwjFvh0L5cg>) and hosted also at TRINITY Training Platform. The duration of Introductory part is around 2 minutes and Part 1 is around 7-10 minutes. All the videos can be found [here](#).

The figures (from Figure 1 to Figure 8) present the examples of the use case Lectures on the platform.

## INTERNAL USE CASE DEMONSTRATORS

Learn more about the design and the execution of TRINITY Internal Demonstrators.

18 internal use case demonstrations to demonstrate novel robot technologies that can contribute to increase the agility of production processes in industrially relevant environment .

	Use Case 1: Collaborative assembly with vision-based safety system	<a href="#" style="background-color: #4CAF50; color: white; padding: 5px 10px; border-radius: 10px;">LEARN MORE</a>
	Use Case 2: Collaborative disassembly with augmented reality interaction	<a href="#" style="background-color: #4CAF50; color: white; padding: 5px 10px; border-radius: 10px;">LEARN MORE</a>
	Use Case 3: Collaborative robotics in large scale assembly, material handling and processing	<a href="#" style="background-color: #4CAF50; color: white; padding: 5px 10px; border-radius: 10px;">LEARN MORE</a>

**Figure 1 List with the TRINITY use cases**

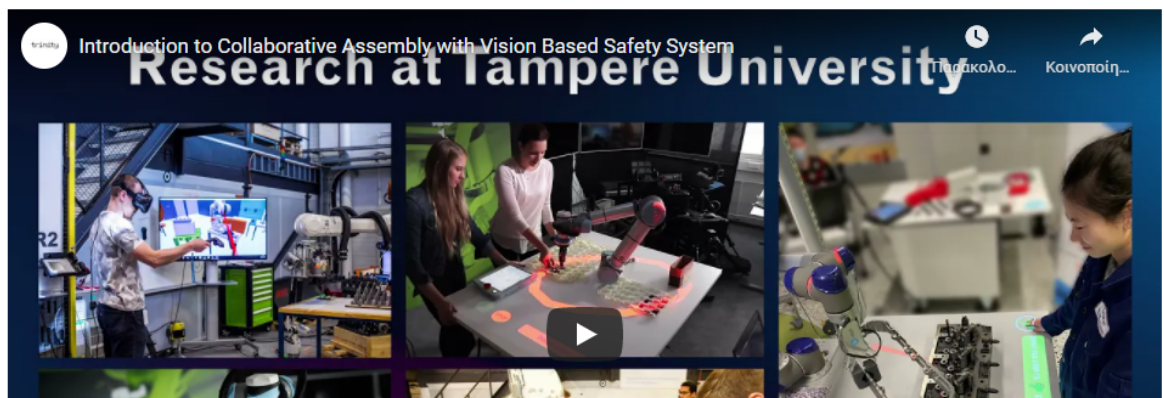
## COLLABORATIVE ASSEMBLY WITH VISION-BASED SAFETY SYSTEM

Material from the design and execution of this demonstration will become available here:

General Information about the Demonstrator can be found on TRINITY Website

[CLICK HERE FOR MORE INFORMATION](#)

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



**Figure 2 Collaborative Assembly with vision-based safety system Introductory Part - Example**

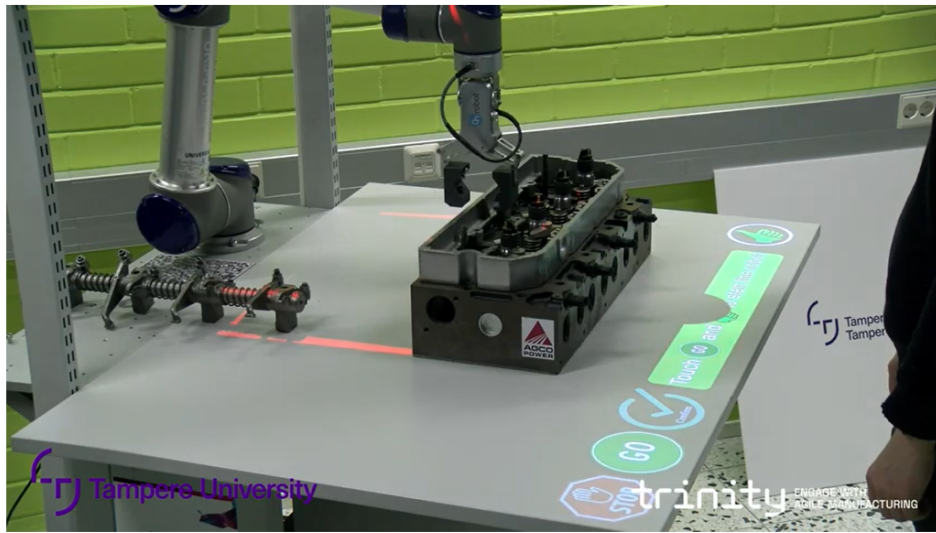


### Web Lectures:

#### 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 and short conclusions



**Figure 3 Collaborative Assembly with vision-based safety system Part 1 – Example**

[Home](#)   [Use Cases](#)   [Modules](#)   [Web Lectures](#)


## AUTOMATED ROBOTIC WELDING

Material from the design and execution of this demonstration will become available here:

General Information about the Demonstrator can be found on TRINITY Website

[CLICK HERE FOR MORE INFORMATION](#)

This video is an introduction to online training material for TRINITY Use Case titled 'Automated Robotic Welding'. This Use case presents how an industrial robot can be used for robotic welding and wire arc additive manufacturing (WAAM).



**Figure 4 Automated Robotic Welding Introductory Part – Example**



Web Lectures:

Part 1:



Figure 5 Automated Robotic Welding Part 1 – Example

Web Lectures:

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 and short conclusions



Figure 6 Dynamic Task Planning & Work re-organization Part 1 – Example



This video is an introduction to online training material for TRINITY Use Case titled 'Collaborative Robotics in large scale assembly, material handling and processing'. This Use case presents the possibilities of large-scale industrial robotics in collaborative tasks.



What will you learn from the lectures below:

This video introduces a TRINITY use case focusing on a novel combination of safety sensors and additional devices that make true human-robot collaboration possible, while still following safety regulations and standards.

**Figure 7 Collaborative Robotics in large scale assembly, material handling and processing Intro – Example**

#### 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 and short conclusions



**Figure 8 Collaborative Robotics in large scale assembly, material handling and processing Part 1 – Example**





## 4 DIH Services Web Lectures

TRINITY DIHs organized during the second open call several webinars to disseminate and inform their network about TRINITY project, objectives, what TRINITY offers, the open call requirements, and what TRINITY is funding. Moreover, one of the main goals of these webinars was to give the interested companies to have a chance to familiarize them with each DIH competences. So, a part of these webinars was the presentation of DIH organization, DIH services and their research focus.

These parts of the webinars have been recorded by TRINITY partners and have been uploaded on TRINITY Training Platform. Recordings are available for the companies that are interested to be part of TRINITY Network or to collaborate with one of the DIHs.

These remote sessions, include:

- Partners' Organization presentation
- Main research focus of the organization
- Offered services to TRINITY as a mentor and role on the project
- Short presentation of use case Demonstrators and modules
- Two presentations on research developments that can contribute to Agile Manufacturing.

Some of the TRINITY partners organized in collaboration these webinars as for example and Tampere University and Centria that are both located in Finland. Their webinar focused on interested companies from their region. Examples of the DIH sessions on the platform are presented in Figures 8 to 11.

**TRINITY DIHS REMOTE SESSIONS**


Meet and get familiarized with TRINITY DIHs and the services they offer

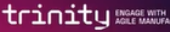
TAMPERE UNIVERSITY (Finland) and CENTRIA (Finland)

**TRINITY modules by Tampere University**

- **Projection-based Interaction Interface for HRC**
- **Depth-sensor Safety Model for HRC**
- **Wearable AR-based Interaction Interface for HRC**
- For TRINITY modules TAU can offer technical guidance to interested SMEs
- All code open source
- Supporting training material available at TRINITY training platform.
- Terms for actual technical support and implementation work need to be negotiated separately
- Some videos already uploaded to [TRINITY YouTube](https://trinityrobotics.eu/catalogue/)

<https://trinityrobotics.eu/catalogue/>





ENGAGE WITH AGILE MANUFACTURING

Figure 9 TAU and CENTRIA DIH Session - Example





UiT The Arctic University of Norway



Figure 10 UiT DIH Session – Example

EDI – Institute of electronics and computer science



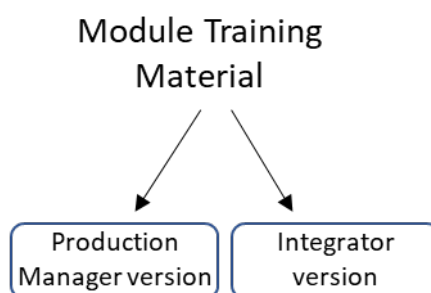
Figure 11 EDI DIH Session - Example



## 5 Modules Training Material

At this category of training material, the participants will be able penetrate to the modules. The Module training material will be used for example by the 2nd open call participants that will use TRINITY Modules. At this point it needs to be clarified that each partner for the module training material is able to choose different delivery mechanism. A proposed structure has been suggested to be followed from all the partners during the preparation of the module training material. Some variation in delivery mechanisms will however occur due to different nature of the technical modules.

Two categories of training material for the module have been identified



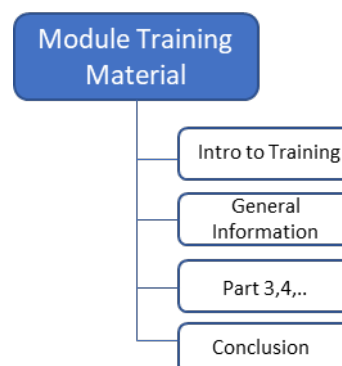
**Figure 12 The two categories for the training material**

**Production manager version:** This category of Training Material will introduce the technical components, structure and the functionality of TRINITY technical module.

**Integrator version:** This category of Training Material describes how to set up and program the TRINITY technical module.

The training material for the modules are suggested to be divided in several parts or steps. The reason is to guide the participants step by step and to keep a smooth teaching process.

At the Figure 13 you can see the structure of the proposed parts. Below are described the main points that is required to be included under each part.



**Figure 13 Training material taxonomy**



## Training Module – Intro to Training - Part 1

All the module training material either focused on the Integrator either at production manager category will have a short introduction. The main parts of this introduction are described below.

### Main sections or main items to be presented:

- TRINITY Intro
  - All the videos will start and end with the TRINITY intro and Outro that can be found on Wiki
  - Add a name for the video at the first slides. For example: Part 1 – Introduction to XXX
- Requirements for the training (if any)
  - Explanation of the training requirements, any tool for the training or need to have specific background
- Concept and approach
  - Presentation of the concept and approach of the module.
- Related use case (Link to the web lecture)
  - Explanation the connection with the use case
- Application of the module
  - Explanation of how this module can be applied and where
- Benefits of the training
  - Communication of the benefits of this training
- Describe the structure
  - Presentation of the structure of the training
- Conclusion & next step
  - Conclusion of the Part 1 and explanation of the next step

## Training Module – General Information - Part 2

Moreover, all the module training material will include the second part with the more general information about the Training.

### Main sections or main items to be discussed at this part:

- TRINITY Intro
  - All the videos will start and end with the TRINITY intro and Outro that can be found on Wiki
  - A name for the video will be added at the first slides. For example: Part 1 – Introduction to “Module Name”
- A description of the requirements of the technical requirements of the module will be provided (devices, technologies)
  - Provide information about the hardware and the software of the module
- Prerequisites (lecture, other modules)
  - Information will be provided about the training module that the participants should have participated in order to follow this training/
- Content
  - Based on document, define chapters such software, input/output, standards.
- Conclusion & next steps of the training



## Training Module – Production Manager Version - Part 3 and 4

This category describes the training material that will be focused on Production Manager. At least two parts of training material should be prepared for this category. The main structure of these is described below.

### Main sections or main items to be discussed at this part

- Each partner will decide the topics of the next parts regarding the module.
- There will be two different versions of the Training modules:
  - Production manager version
  - Integrator version
- All parts will start with TRINITY Intro and end with TRINITY Outro

To assist the TRINITY partners, the following script prepared in order to guide them on the topics that need to be analyzed on Part3 and 4 of their Training Material.

### Script description of *module name*

This video introduces the technical components, the structure and the functionality of TRINITY use case/technical module XXX

- In this video we'll present... (short content list)
- Use-case / module component
  - Required Components
  - Specification
  - Justification of required component
- Use-case/ module environmental requirement
- How to integrate this system with the rest of product line?
- Describe Adaptability of system
- Discussion about: Accuracy, latency, ...
- Possible alternative components
  - Alternative components
  - Alternative environment
- Future development, internally or by other contributors
- Any proof to demonstrate and analyze the benefits of module (for example, results from demonstrator of open calls)

The same approach has been followed also for the Integrator version of Module Training Material. The script below describes the main points that the training material analyze.

## Training Module Integrator version- *Module name, installation, and setup* – Part 3 and 4

This category describes the training material that will be focused on Integrators or operators or developers. At least two parts of training material should be prepared for this category. The main structure of these is described below.





The main sections or main items to be discussed at this part of training material are listed below.

- This video describes how to set up and program the TRINITY use case/technical module XXX
- In this video <introduction of the video content>
- Presentation and explanation of the component requirements
  - Explanation of the required Hardware
  - Explanation of the required Software
- Guidelines on how to setup the components of the system.
  - Guidelines on how to set up the hardware of the module
  - Guidelines on how to set up communication and Connection
  - Guidelines about the verification of the system
- Guidelines on how to initiate and run system?
- Presentation and explanation of how to operate inside the system
  - Explanation and presentation of the human task
  - Explanation and presentation of the robot task
- Presentation of the expected Result

Module Training Material have not been finalized yet from all the partners. The preparation of Training Material will be an ongoing action for the next months. The Module Training Material will be available [here](#).



## 6 Conclusion

This deliverable describes the means of DIHs to support the SMEs during the execution of the demonstrations during the First Demonstrator program. A questionnaire was prepared under WP7 to track the support and the assistance that was provided by the Mentors. This questionnaire was available online and was updated regularly during the demonstration program by the mentors. A summary of the responses for each experiment

The objective was to describe the Training Material that has been prepared until M30 of the project. More specific, the development of web-based lectures and study modules. All the research partners organized remote sessions where the interested companies had and will have the change to familiarize with each DIH competences. Web-based lectures organized and recorded by the TRINITY DIH towards disseminating the technical, training and consulting services that each hub provides to external companies. Additionally, dedicated lectures developed for the demo cases.

Moreover, an analytical description of the structure and the main points of the Web Lectures and the Module training material was provided at section 4 and 5.

As next step of WP7 is the preparation of audio/visual guides, training material for programming support, remote assistance, and tele-installation of the TRINITY modules. All the training material will be available on the TRINITY Training Platform. LMS will be responsible to update the platform regularly with the material that will be prepared by TRINITY partners.

