

trinity ENGAGE WITH AGILE MANUFACTURING

D2.4. Personnel Exchange Review

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1 Introduction

Staff exchange was planned to ensure the transfer of needed knowledge between different DIHs. To maximize the impact of Trinity for the European society and SMEs it was planned to exchange researchers and SME employees. Personnel exchange results and learning are presented in this report. The main objective of this document is to review the success of personnel exchange, challenges caused mostly by COVID-19 to the planned actions and taken mitigation actions to ensure knowledge transfer between the partners. Online personnel exchange was one of the taken mitigation actions and deep dive events were implemented more extensively than originally planned. Deep dives filled, at least partially, the knowledge transfer gap caused by the COVID-19.



2 Deep dives

The concept of deep dives was popularized by the IDEO group for solving complex problems and develop new products and services late 1990's. The concept can be used for process improvement and customer service strategies. Process, organization, culture and leadership are the four distinct areas related to the concept.

A well-defined process is essential for a successful deep dive. It provides a framework for the team to follow, ensuring that they stay focused on the problem or opportunity at hand, and that they use consistent methods for gathering and analyzing data. The deep dive process also allows for iteration and experimentation, which is important for generating and testing new ideas.

The organization plays a key role in enabling and supporting the deep dive process. It is important to have a cross-functional team that includes experts from different areas, as well as support staff who can provide logistical and administrative support. Additionally, it is important to have a clear structure for decision-making, communication, and collaboration within the team.

The culture of the organization can impact the success of a deep dive. A culture that values innovation, creativity, and risk-taking is more likely to support and encourage the deep dive process. A culture that is hierarchical, bureaucratic, or risk-averse may stifle the creativity and experimentation that are necessary for a successful deep dive.

Effective leadership is essential for a successful deep dive. Leaders need to provide clear direction and support for the team, while also encouraging autonomy and creativity. They also need to be willing to take risks, experiment, and learn from failures. Additionally, leaders should foster a culture of openness, trust, and collaboration, which will facilitate the deep dive process and help to generate new ideas and insights.

The Trinity consortium have developed their own procedure for deep dives as shown in the Figure 1.

Research Topic/Issue/Challenge	Deep dive
Creative Metod	
Ideas	
Collection of ideas	
Evaluate	
Conclusion for a procedure / responsibilities for the further steps	

Figure 1 TRINITY approach for information exchange

The goal of Trinity deep dives is to inform each other of a specific topic field such as IoT, robotics, cybersecurity. Transfer of knowledge and specific experience of an organizing partner is at the core of the meetings. Typically deep dive events focus on a specific problem or challenge. Creativity, idea



development and solution determination are characteristics of meetings. SMEs and other stakeholders are invited to deep dives. Organized deep dives are listed below.

Table 1 DeepDive in Patras

Place	Date	Organizer	Attending	Summary of the event
Patras	12.2.2020	LMS	UiT, Fastems, MAKE, DNT, JSI, LP, TAU, EDI, F6S, LSEC, Centria, UiT, Civitta, BME, Cecimo, IWU	The Deep Dive in Patras was a one-day event held on the following day of the 3rd General Assembly meeting, which took place at the LMS facilities. The event began with introductory presentations by LMS representatives, providing an overview of the organization's profile and activities in TRINITY and other EU projects. These presentations were aimed for theindustries who attended the event, including local SMEs, integrators, and technology providers. During the LMS Deep Dive, several presentations were held by the aforementioned research and industrial partners. The presentations were organised into four parts covering various topics of lean and flexible manufacturing, like hybrid processes, Human-Robot Interaction, Predictive Maintenance and Task Planning. Moreover, The LMS Deep Dive event ended with a discussion session, providing the opportunity to the attendees to further elaborate on the presented topics, give their feedback and discuss potential future collaboration opportunities.
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Table 2 DeepDive in Ljubljana

Place	Date	Organizer	Attending partners	Summary of the event
Ljubljana	10.5.2022	JSI	BME, MAKE, TAU, UiT, Centria	A WP3 in person meeting was held in Ljubljana prior to the Deep Dive. The Ljubljana JSI Deep Dive itself lasted one day, including the drive to Budapest, where the BME Deep Dive was being held the next day. The JSI Deep Dive commenced with welcome and introduction, followed by presentations on adaptive visual quality control, SRIP FoF Ecosystem, exception strategies, robotic product inspection, and reconfiguration. Attendees took a break to enjoy coffee before the JSI robotic lab tour and demos, where they were able to see, among others, industrial agility increasing technologies in action. The deep dive ended with a discussion session and lunch, providing attendees with an opportunity to network and discuss the relevant topics
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Table 3 DeepDive in Budabest

Place	Date	Organizer	Attending partners	Summary of the event
Budapest	11.5.2022	BME	TAU, JSI, UiT, Centria, MAKE	On the morning of the first day, after a short presentation about the department, the guests visited the Motion Capture lab, getting to know our biomechatronics-related research activities. During the morning, our ERC Advanced Grant award- winning researcher gave a presentation presenting the results of his research on vibrations influencing the manufacturing process. In the afternoon, we visited our FIEK (Higher Education and Industrial Cooperation Center) Z10 incubator center. After that, the participants were able to get to know the collection of our digitalization use cases located in the Industry 4.0 Technology Center, which was introduced by a presentation about the experiences of the digitalization of Hungarian SMEs. As the final event of the day, the participants visited the department's robotics lab and learned about our haptic device and telemanipulation device demos.



Table 4 DeepDive in Leuven

Place	Date	Organizer	Attending	Summary of the event
Place	Date	Organizer LSEC, MAKE	Attending partners UiT, Fastems, DNT, JSI, LP, TAU, EDI, F6S, Centria, UiT, Civitta, BME, Cecimo, IWU	Summary of the event This event was split into a deep dive at LSEC on CyberSecurity and a deep dive on robotics and agile manufacturing at Flanders Make. The LSEC industrial cybersecurity event took place as a hybrid public event - webinar in Leuven and was attended both by TRINITY partners, LSEC partners, industry representatives and online by industry oriented partners and participants. An introduction - update on CyberSecurity for Industrial environment, was followed by an in depth overview of IEC62443 (also following the suggestion from the TRINITY reviewers), and an in depth presentation of a robot vulnerability assessment on system and software level. The presentations were followed by a site visit to the research labs at LSEC - KU Leuven, presenting an overview of different tools and results of some of the system hacks. The session was recorded and being made available as a webinar. The day ended with a site visit of the AB Inbev brewery in Leuven, showcasing the production process and their automation activities. On the second day we got an insight into the project landscape of Flanders Make, the strategic research center for the manufacturing industry. In the morning, we conducted a retrospective on the
				project landscape of Flanders Make, the strategic research center for the manufacturing industry. In the morning, we conducted a retrospective on the current status of the TRINITY project. This was
				followed by presentations on the individual projects in the field of robotics at the research center. Throughout the day we got an insight into the laboratories, the know-how and the
				experience of Flanders Make with presentations and practical demonstrations.







Table 5 DeepDive in Riga

Place	Date	Organizer	Attending partners	Summary of the event
Riga	6 7.9.2022	EDI	LP, TAU, IWU, JSI, MAKE, BME	On the first day of the event, TRINITY project partners are introduced to EDI research directions, five commercialization projects, as well as robotics and wireless sensor network modules developed within TRINITY. In the second part of the day, guests had an excursion through EDI laboratories where demonstrations of technological solutions that EDI is working on were shown. The second day's meeting was focused on a workshop to bridge the gap between SMEs, who could benefit from advanced robotics solutions, and researchers/developers, who are experienced and knowledgeable in the field but are not entirely familiar with the specifics of different manufacturing processes. In the first part of the workshop, the participants of the event gave presentations, including the presentation of the project of the second TRINITY demonstrator program: the PROTON robots. During the workshop, Madara Cosmetics presented its challenges in the production process, where researchers and technology developers tried to find solutions and give advice on how to improve specific production stages.





Table 6 DeepDive in Narvik

Place	Date	Organizer	Attending partners	Summary of the event
Narvik	12 13.10.2022	UIT	TAU, EDI, IWU, BME, MAKE, Centria	During the first day of the Deep Dive in Narvik, partners were provided with insights into UiT's research on future-oriented manufacturing systems, with a focus on Self-reconfigurable Manufacturing System, Metal Additive Manufacturing, and Extended Reality. These interrelated topics contributed to advancing the TRINITY concept, with automation, agility, and cyber-security as embedded elements. The partners also toured relevant research facilities at UiT Narvik, including the Drone Laboratory and Satellite Lab, which provided insight into aviation robotics and possible applications in manufacturing. On the second day, the group delved into the digitalization, with key Norwegian energy companies (in energy, mining, construction, transport, and aquaculture) providing insights of current and future challenges. The second day ended with a company visit at LKAB Narvik, which is a main transportation harbor for LKAB which is one of the largest mining companies in the world.
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Table 7 DeepDive in Dresden

Place	Date	Organizer	Attending partners	Summary of the event
Dresden	6 7.12.2022	IWU	LP, Flanders, JSI, Fastems, LMS, BME, TAU, Centria, F6S	On the first morning of our Deep Dive in Dresden, we heared a variety of presentations about automation solutions and robotics applications at Fraunhofer IWU. After lunch, we had a virtual exchange with other/similar EU projects such as FELICE, Drape Bot and ADMA TranS4MErs. Afterwards, we went on a tour of VW's Transparent Factory in Dresden. On the second day, we started with a guided tour through the research hall "Chair of Machine Tools Development and Adaptive Controls" at the Technische Universtiät Dresden (Dresden University of Technology). There we were given an insight into the current research projects and the TRINITY funded project MCPPS by Symate (company) and the University. Afterwards, we had an in-depth exchange with the project partners Symate and MetraLabs (project: RoboLIbri) as well as Infineon Technologies Dresden. After lunch, we attendet to the TRINITY internal General Assembly and the MBM.







Table 8 DeepDive in Tampere-Ylivieska

Place	Date	Organizer	Attending partners	Summary of the event
Tampere/ Ylivieska	28 29.3.2023	Fastems, Centria	IWU, Flanders, BME, UiT	Visit to headquarters of Fastems Oy at Tampere included introduction of Fastems Oy and a factory tour. This was followed by a visit to a machining company ST-Koneistus Oy where the CEO of the company represented the company. This visit included a factory tour. A round table discussion about flexible robotic automation was organized during the travel from Tampere to Ylivieska. In Ylivieska at Centria, Centria R&D introduced ongoing activities related to robotics and automation. Two company presentations about collaboration with Trinity were given by company representatives. As part of the event, laboratory visits to Robo3D Lab and Drone lab of Centria were organised. A workshop related to future of Trinity ended the event.
	Centra Robo3D Lab			<image/>
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3 Personnel Exchange

Visits between organizations were not recommended during the COVID-19 pandemic to prevent the spread of the virus. Organizations receiving visitors, such as workplaces, schools, and healthcare facilities, were potential hotspots for COVID-19 transmission. Visitors could unknowingly bring the virus into the organization and spread it to others. To reduce the risk of COVID-19 transmission, public health authorities recommended limiting visits between organizations, promoting remote work and virtual meetings. These actions were aimed at reducing the number of close contacts between people and minimizing the potential for virus transmission. Additionally, different countries and regions had different COVID-19 travel restrictions and quarantine measures. This made it extremely challenging to plan and organize personnel exchange, as visitors needed to comply with quarantine requirements or face unexpected travel restrictions or lockdowns. The aforementioned reasons and restrictions made the planned personnel exchange almost impossible. Instead, other alternative actions were planned and realized. Due to COVID-19 role of deep dives became more essential than the personnel exchange from the point of view of knowledge exchange/transfer.

3.1 FhG - TAU

Review-Summary Kathleen Delang, PhD student from Fraunhofer IWU visited University of Tampere for one month between 13.4.2019 and 11.5.2019.

The stay abroad at the Tampere University went very well. During my four weeks in Finland, I was able to discuss my PhD ideas and thesis with the university's experts and had an intensive exchange with local PhD candidates. In addition to the presentation of my topic in the working group meeting with a detailed, large round of questions, Prof. Minna Lanz gave me the opportunity to set my own priorities. I implemented these in the workplace design of human-robot systems together with local PhD students using an example assembly process. The professional exchange on procedures, task distribution between humans and robots as well as premises of the design was very purposeful for the validation of my work. In addition to the assembly process of an agricultural machinery engine, I was able to make another company excursion to a container crane manufacturer. There, mainly the requirements for software solutions were discussed.

In summary, my stay abroad is very positive, because on the one hand I received a broad technical input away from my own working group in Chemnitz and on the other hand, through the changed working environment, I built up the necessary distance to the dissertation to critically revise it.

Overall, the expectations of the stay were exceeded by a large number of positive experiences and moments of insight. The objective has changed during the stay abroad, but has been exceeded overall. At the beginning, I thought that a scientific article should be developed together with the host university. After presentation and exchange on previous scientific work and ideas, we spent a lot of time in the robotics lab, especially in the last two weeks, where we directly practically developed a demonstrator workstation for the fair presentation of the technology. Basically, working together in the lab and with the physical components of the workstation to be designed was much more valuable than theoretical work, as it requires physical presence. Jointly developed ideas laid the foundation for a journal or conference paper, which can also be coordinated through online exchanges.

Through newly established as well as deepened existing relationships, my scientific network with the Tampere University, a partner city of Chemnitz, could be further expanded and more joint activities, such as a workshop at a scientific conference, are planned.



Questionnaire after the exchange:

How did the funded trip benefit your personal development and/or career?

My research exchange lead me to Tampere University in Finland were I could enhance and proof my PhD work in the field of Robotics. During the first two weeks it was more theoretical exchange with the Finnish colleagues since I presented my work in a team meeting and we discussed the task allocation between human workers and robots in new work cells. Afterwards I worked a lot in the robot lab with colleagues to design a work place for motor assembly and apply our ideas of task allocation and logistics.

The different working environment was very helpful to be creative and develop new approaches. It helped a lot to gain distance from my daily work to improve my thesis as well as rethink it. Last but not least I made very good friends with my colleagues in Finland and I am sure to keep the contact with them.

Which experience during your trip/your stay was especially positive and memorable for you?

Finnish nature in spring time is adorable! By walking or cycling through the forest and watch the ice on the lakes melt away I could process all professional input from my day. I also enjoyed spending time with my colleagues. Even though Finns are often described as shy or reserved people I got invited for BBQs, we made sport together or chatted over a coffee or burger. It was great to meet these welcoming and open minded people and very easy to make friends with them. A very memorable moment was watching the traditional dipping of the first year students in the very cold river at May 1st. The students celebrate this event with parades and the whole city turned into a street festival.

What kind of advice would you give others in regard to preparation and execution of the trip (regarding visa, accommodation, board, or infrastructure on site)?

Time is flying, so better get going from day one! Present your work and ideas to get feedback from other researchers than your colleagues at home. Thereby, you can develop your own approach as well as help your exchange partners with new input. By offering your help and asking questions you will get insights on their work and learn about applied solutions. To avoid busy teaching/exam periods and holidays you can ask for preferred times for your exchange.

I was very lucky with all organizational issues during my stay at Tampere University in Finland. At the exchange facility everything was well organized including a visiting researcher contract, needed lab introductions and prepared working environment. You can ask for those things in advance. Also the administrational issues with InProTUC went very well due to friendly and very helpful staff.

3.2 Centria - UiT

Due to the COVID-19 pandemic, the personnel exchange was implemented as an online robotics training by Centria to students and staff members of UiT. Tero Kaarlela from Centria and Beibei Shu from UiT created a plan and timetable to provide training in robotics simulation using RoboDK. The timetable consisted of eight online lectures to teach/learn RoboDK. We started with very basic exercises and evolved towards coding simulation functionalities using Python. At the end of the training, the students of UiT created a digital twin of a physical robot station at Centria, Ylivieska. They utilized the digital twin to validate the milling trajectories they had programmed with RoboDK. We had fourteen participants in the course, and the feedback was positive. Tero Kaarlela created the lecturing material for the course and was responsible for lecturing. Beibei Shu was responsible for opening the course at the UiT learning space and recruiting the students and staff members for the course.

How did the funded trip benefit your personal development and/or career?



I gained a lot of experience in preparing online lecturing material in English and also lecturing in English. Arranging an online course in collaboration with a foreign university was a new experience for me. In addition, I could test and collect empirical information of the robotic digital twin developed at Centria.



4 Discussion

Only one personnel exchange was realised as originally planned before the COVID-19 pandemic. Experience of this exchange was very positive and useful for both the exchange researcher and the hosting institute. During the pandemic, as an alternative method, one remote exchange was planned and realised. The remote collaboration was the only option to arrange an exchange during the beginning of COVID-19 due to lock downs. The remote exchange allowed development of remote education methods for robotics training and education. This was beneficial for both participating organizations and for developing remote robotics education and training services during rest of the pandemic. Obviously, this has longer term benefits and impact on remotely organised education.

In addition, to face the challenges, deep dive events were planned and implemented in a more comprehensive manner. Therefore, they became more essential than originally planned for knowledge transfer. Deep dives, as part of their nature, enable efficient dissemination and transfer of knowledge to larger audience at once if compared to individual exchange. Although deep dives will not go in detail on a specific topic, they provide a larger scope covering wide range of expertise of the organizing partner. Continuous discussions and exchange of ideas/brainstorming between the partners was found extremely beneficial for the existing and new collaboration.

