

#### **D2.2.** Co-Creation Workshop Review

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## **1** Summary

The held events in 2019 had been at ERF and EMO. Both Public Co-Creation Workshops were well attended and had an interesting mix of speakers from industry and research. The workshops helped to improve the attendance of Trinity partners for industrial needs in agile manufacturing. Since also limits and obstacles had been discussed in the interactive session between participants the understanding for suitable solutions and industrial requirements had been improved for involved academics. Especially in the beginning of a the project this is a main objective of the co-creation workshops. It is necessary for the success of the project to deeply understand and meet industrial requirements to develop the demonstrators accordingly.

To improve the exchange between academics and industrial players is also the goal of the co-cration workshops in 2020. Therefore, Trinity applied to held workshops as ERF and ICRA with a suitable mix of industrial and scientific speakers. The European Robotics Forum is the main European event of the Robotics community with a good mix of contributers from all stakeholders. At the world leading Robotics conference IEEE ICRA been held next year in Paris, France, the organizers of the workshop could get a perfect match of worldwide known researchers from MIT, TU Munich and Nanyang University as well as top industrial players from the technology provider and robotics point of view who will discuss latest research results with the requirements of the industry.

Due to the great success of Co-Creation workshops in 2019 the consortium already discussed the possibility to enlarge the nuber of planned events. The decision about helding other Workshops for example at Automatica fair in Munich 2020 or at other scientific conferences will be based on the schedule of the project partners.

## 2 Introduction

This Co-Creation Workshop Review presents the results of the organized Co-Creation Workshops within the Trinity project during the first 10 months. Therefore, the Section *3 Co-creation Workshop Strategy* explains the decision process within the consortium to choose suitable events. Other than described in the workplan there won't be an online wurvey for every sigle event. This decision is explained in the strategy as well. The consortium decided to have a European wide online survey to collect SME needs for agile manufacturing instead. The motivation and the content of the survey is described in section *4 Questionnaire/Survey on SME needs* in detail. The held workshops at ERF2019 and at EMO 2019 are described in section *5 TRINITY Public Co-Creation Workshops 2019*. Furthermore, an outlook on planned Workshops in 2020 is given in Section *6 TRINITY Public Co-Creation Workshops 2020*. The applications for ERF2020 and ICRA 2020 are introduced and other suitable events are listed.

As the consortium leaders had been encouraged by the organizers of European Robotics Forum to submit a Workshop proposal the project manager and WP2 leaders decided to start the *Task 2.2 Open co-creation Workshops* earlier than stated in the proposal (M7). Therefore already in month 1 of the project the preparation of the ERF 2019 started as a part of the WP2.

## 3 Co-creation Workshop Strategy

In the Trinity proposal the consortium agreed to held at least 2 Co-Creation Workshops per year and to raise an online questionnaire before every Workshop among the participants. Most of the suitable events to organize a workshop are not providing means for granting the workshop organizers access to the attendees





lists. The main reason is the EU General Data Protection Regulation (GDPR) to protect privacy of the attendees. Therefore, the online survey based on email lists among participants after a workshop was discussed. In either case the expected response rate was estimated as too low to get a reliable feedback.

Instead of hosting a questionnaire for every single event the organizers decided to host a survey to collect the industrial needs in the field of agile manufacturing from all over Europe within the Trinity project runtime. Thereby, it will be possible to track existing changes in the needs by different countries and company sizes as well as to measure processes over the time. The survey will be translated to most European languages to lower the barrier for participating SMEs. Results will be used to define required workshop topics. The state of the art in agile manufacturing has not been measured before on a European level which will bring interesting results for the project as well as for the local DIHs and the European Robotics Community.

Moreover, as a part of the Task 2.2 Open co-creation Workshops, a list of suitable events has been compiled to meet the proposal deadlines. The list will be constantly expanded according to the targeted audience. Possible events were Trinity members can decide to organize or apply for a Co-Creation Workshops are not limited to the listed events from Table 1. Since project partners regularly host events within the scope of Trinity topics the consortium is especially interested in organizing co-creation workshops at other events. Consortium members also organize Workshops with their local DIH besides the Co-Creation Workshops is shown in Table 1. It is based on expected target group, reputation and impact of the event.

Relevant event	Abbreviation	Event type / Target group	Scheduled	WS-Proposal Deadline
European Robotics Forum	ERF	Forum: Research & Industry	March each year	September
European Robotics Week	ERW	Number of local events: Local focused Research & Industry	November each year	September
Exposition Mondiale de la Machine Outil	EMO	Trade fair: Industry	September	June
Automatica		Trade fair: Industry	June, every two years	March
International Conference on Robotics and Automation	ICRA	Scientific conference	May/June each year	September
International Conference on Intelligent Robots and Systems	IROS	Scientific conference	September- November each year	March
International Conference on Automation Science and Engineering	CASE	Scientific conference	August each year	April

Table 1: List of events with target groups, dates and typical proposal deadlines





## 4 Questionnaire / Survey on SME needs

### 4.1 Introduction

Based on the findings the workshop organizers created a survey to better quantify the specific needs of European SMEs for agile production. Thereby the Trinity consortium first of all wants to find out what is the status quo in Europe when it comes to end users, technology providers and integrators of different technologies. To prepare the Open calls starting by the end of 2019 according to specific needs of SMEs we also ask for their requirements to implement own Advanced Robotics and IoT solutions. We invite every European SME to participate in the survey which is available in the following European languages: German, English, Finnish, French, Latvian, Lithuanian, Norwegian (Bokmal), Polish, Swedish, Slovenian, Spanish.

The survey in English language is accessible online with this URL: <u>https://survey.apps.iwu.fraunhofer.de/index.php/439446?lang=en</u>

An export of the online survey can be found in Annex 7.2. The export conforms to the queXML schema (simple XML schema for describing questionnaires)<sup>2</sup>, is compatible with the DDI<sup>3</sup> standard for data description and was printed to a PDF.

#### 4.2 Motivation

The meaning of agile manufacturing is to be able to react and adapt itself quickly to changing external needs, such as new market demands, new opportunities or customer's requirements, and changing contexts (e.g. new materials, different logistics or changing production environments). Reaching a state of being agile in manufacturing is a hard and complex process of a company's transformation. Such a process needs to be planned and organised. In the beginning a phase of reflection must be pursued in order to get to know the status quo of an SME and to identify realistic steps to achieve the goal of being an agile manufacturing company.

Therefore, the purpose of this survey is to request current requirements and barriers of SMEs – the potential grantees of Trinity funding – regarding the digitalization of manufacturing and the complementary demand to be able to react and adapt itself faster to changing external needs and changing contexts. The results of this survey will contribute to the upcoming Open calls of the Trinity project in order to cover most of the current challenges of European SMEs. The intention is to conduct this survey once in the early phase of Trinity and once in the late phase of the project to derive a comparable before and after study.

#### 4.3 Content

The survey consists of sections A to F covering different aspects and thematic areas. The particular questions of the survey are not presented here but the sections are introduced shortly in the following.

#### 4.3.1 Section A: General Information

This section can be considered a meta-section which requests information regarding the origin of a company and its size. All countries of the European Union and Norway can be selected as origin. The purpose of this section is to be able to cluster the upcoming responds depending on the answers in this section. Thus, differences between countries and company size can be revealed.



<sup>&</sup>lt;sup>2</sup> https://quexml.acspri.org.au/

<sup>&</sup>lt;sup>3</sup> https://ddialliance.org/



#### 4.3.2 Section B: Self-Assessment

In order to be able to compare the objective current state and expectations of SMEs against the subjective self-assessment regarding their state of agile manufacturing, this section is used for deriving a company's own understanding of being agile. Questions target at companies' general capabilities and are separated into the three thematic areas of Trinity: Robotics, Internet of Things (IoT) and Cyber Security.

#### 4.3.3 Section C: Employees

This section asks for the subjective need of further qualification of an SME's employees regarding their personal skills or potential barriers. To achieve a realistic picture of the qualification demands, first the relevance of different technological areas (e.g. IT infrastructure, cyber security, collaboration software, etc.) inside the company is asked for. This section asks for both predetermined subject areas, in order to be able to structure and cluster the results, and further additional subject areas, to give room for answering the questions tailored to one company's current situation.

#### 4.3.4 Section D: Motivation and Obstacles

Own motivation and perceived obstacles should be revealed in this section in case a respondent considers agile manufacturing as relevant in the SME. In addition to asking for the current state also the required and expected support for implementing agile approaches is asked for in this section. The purpose is to derive required educational actions efficiently.

#### 4.3.5 Section E: Robotics

One crucial instrument for agility in manufacturing is robots since they complement human workers in an effective way and can take over tasks when environment, requirements or demands change. Therefore, the current state of using robots in ones company is asked for. Consequently, revealed problems and obstacles are also subject of this section. Again, predetermined but also specific ones can be contributed here in order to get a precise picture of the reasons why robots are not (yet) used in production environments.

#### 4.3.6 Section F: Cyber Security

This is the last section in this survey. The purpose is similar to Section E: Robotics since it asks for the relevance of cyber security solutions in SMEs and the associated state of implementation. Independent from that different levels of system protection is asked for, either in the informational or in the operational technology systems.

## 5 TRINITY Public Co-Creation Workshops 2019

#### 5.1 European Robotics Forum ERF 2019 in Bucharest

#### 5.1.1 Agile Production

With over 100 participants the TRINITY workshop about Agile Production was one of the most popular workshops at European Robotics Forum ERF2019, held in Bucharest, Romania at 20<sup>th</sup> March 2019.

#### <u>Agenda</u>

- 00:00-00:10 TRINITY approach to agile production in Europe Minna Lanz
- 00:10-00:20 DIH<sup>2</sup> as related DIH Ali Muhammad
- 00:20-00:35 3 Elevator pitches (4min each):

Robotics: Eddy Lotter (LP-Montagetechnik) Digital tools: Juho Vihonen (Cargotec Corporation)





Cyber security: Jan Reimann (Fraunhofer IWU) 00:40-01:15 TRINITY world cafe, 3 thematic areas (10 min per table) Robotics: Roel Pieters

Digital tools: Niki Kousi Cyber security: Jan Reimann 01:15-01:30 Conclusions / world cafe findings Minna Lanz

To boost the new started European DIH projects into the direction of SMEs needs the organizers wanted to collect opinions about the challenges of SME from the Robotics community. They collected answers from the community in form of a word cloud. Every participant could contribute with its own mobile device, also anonymously. All collected answers are shown in Figure 1 with the size of words being independent of the mentioned frequency.



Figure 1: Collected word cloud from participants





The project coordinator Professor Minna Lanz gave a short introduction about the idea behind the TRINITY DIH project as well as the importance of agile manufacturing to keep European's industry competitive. In times of demographic change and globalization technologies as Advanced robotics and industrial IoT offer possibilities to improve the ability to adopt to changes for producing enterprises. To prevent systems from unwanted access also Cyber Security issues have to be considered when developing new approaches. Especially for SMEs it is challenging to be aware of all necessary issues in parallel to their daily business.



Figure 2: Coordinator Professor Minna Lanz presenting the TRINITY project approach to participants and impressions of Workshop

After presenting the TRINITY approach including a critical mass of use cases demonstrating the actual use of these technologies to increase agility in production Ali Muhammad from VTT presented the related project DIH<sup>2</sup>. It also aims for an increased agile production. It connects 26 existing DIH in different countries by building partnerships between successful implemented and developing DIH infrastructures. Both projects will work together to manage the cascade funding process where European SME can apply for up to 300.000€ to improve, adapt and implement technologies in their facilities.

To hear directly from the industry how they deal with the mentioned challenges two industrial talks were held by Juho Vihonen from Cargotec and Edwin Lotter from LP Montagetechnik. Juho illustrated how Robotics and artificial intelligence already today influence the work of Cargotec. Smart algorithms help the company to offer intelligent services helping their team and their customers. Edwin as the owner of an integrating company focused on the demands of his customers. They mainly require highly flexible robot systems to avoid physical stress for their employees. The main challenge of collaborative robots can be seen in the high safety requirements leading with insensitive robots and parts to slow movements.

The main problem of Cyber Security in Robotics was addressed in a pitch by Jan Reimann from Fraunhofer IWU who sensitized the audience about a lack of existing solutions to prevent robots from unauthorized actions. Under the headline "Robots in Problems (RIP)" he highlighted different causes and topics of increased risk for attacking robot systems as the additional risk of cloud services and attacks with automated AI algorithms. The topic of Cyber Security was discussed in detail at the second TRINITY workshop at ERF2019 called "**Cyber Security for Robotics**" by Trinity member Ulrich Seldeslachts.



Missing Cybersecurity By Default, Design a Encycle security
 Missing Cybersecurity Risk Management & Policy from robot

producer to robot operators

Figure 3: Identified key influences on Cyber Security in Robotics

All held presentations can be found under the ERF 2019 section on Trinity-Website.





As the discussion with the Robotics community was a main objective of the workshop after the short motivation talks participants were divided into groups should contribute on the three main Trinity pillars Robotics, industrial IoT and Cyber Security in a World Café. The hosts of the tables were Roel Pieters from Tampere University, Niki Kousi from LMS in Patras and Jan Reiman from Fraunhofer IWU. The groups discussed main issues of the different topics for 10 minutes and went to the next table where the host was shortly introducing the discussion of the last group and asked for additional comments. After three rounds the results were presented by the hosts.



Figure 4: Impressions from the World Café discussions and presentation of discussion results





#### **Findings on Cyber Security**

All participants agreed about the raising risk of caber attacks when it comes to digitalization, cloud computing and increased use of robots and connectivity in manufacturing. By using algorithms to analyse machine performance and plan maintenance activities a defect can cause significant damage for a company. Furthermore also hardware defects and safety risks can result from software attacks. From the discussed challenges a large number of requirements for a secure operation were collected. A reliable Risk Management system was discussed as a good possibility to deal with the topic. It should be based on standards and considering different aspects of Cyber Security as hardware requirements, competence trainings for employees, appropriate infrastructure and the necessary awareness of the risks in SME. It could lead to a Cyber Security labelling for different products. The gathered results as a mind map can be found in Figure 6.

#### **Findings on Robotics**

The different needs of end users were especially discussed in the Robotics table. The time consuming adaption due to safety documentation and needed programming skills were identified to be main reasons for end users to hesitate implementing robots in their plants. Also non-traditional ideas like rent-a-robot solutions had been mentioned and were discussed as a cost-efficient possibility for potential users to find out whether their ideas might work. As missing helpful tools to easily calculate the outcome of a robot system a ROI calculating tool and a checklist for possible improvements to the work environment as well as a list of best practise examples were discussed.

Furthermore there was a long discussion about the challenges about planning, implementing and using robots. A long list with reasons why users hesitate to have more robots was build. It reaches from high costs, lack of knowledge to challenging safety guidelines and a lack of acceptance of these systems from the workers. All participants agreed that it takes more than technical developments to finally implement more robots to make production sites more agile. The gathered results as a mind map can be found in Figure 7.

#### **<u>Findings on Digital Tools and IIoT</u>**

The world café table about digital tools and industrial IoT was mainly discussing the actual barriers and benefits of these technologies. Participants had different opinions about the ideal development of these tools. On the one hand it needs highly skilled staff as well as much effort to deploy technologies and attach to existing infrastructure. On the other hand the provided benefits are still rather unspecific and difficult to express in reduced time or costs. This makes it especially difficult for SME to invest their limited resources in digital tools. Nevertheless the participants agreed on the provided benefits and improvement that are possible with digitalization. A faster ramp up, predictions of errors and better adaption to changed conditions were only some of the collected possibilities by digital tools. The increasing digitalization will continue and especially for SME it is better to start now by trying technologies, training staff and adapting existing infrastructure than being too late. The gathered results as a mind map can be found in Figure 8.

#### 5.1.2 Cyber Security for Robotics

At ERF 2019 Trinity consortium hosted a second Workshop with a special focus on Cyber Security for Robotics. Cyber Security is one of the three main topics of Trinity with a identified high need to increase





knowledge within the Robotics community. To raise awareness for this important topic Cyber Security expert Ulrich Seldeslachts organized the workshop with European leaders in the field at ERF 2019.

#### Agenda

14.00h : Ulrich Seldeslachts, TRINITY -LSEC -introduction& discussion

14.10h : Bernhard Dieber, JoaneumResearch –SOTA in cyber security robotics research

14.20h : Fabio Martinelli, CNR - ECSO - Inter-PPP - cyber security research perspective

14.30h : GaraziJuezUriagereka, Tecnalia-CyberPhysical-eITUSproject activities

14.40h : Endika Gil Uriarte, Alias Robotics-Cyber Security for Robotics Solutions

14.50h : discussion & workshop

15.15h : wrap-up get together

15.30h : coffee break

After presentations from different viewpoints had been given by European experts on cyber security in robotics there had been a discussion among all participants. The audience could raise questions to the speakers.

#### **Discussion**

#### Questions in the Q&A :

- What are the gaps and opportunities in Cyber Security for Europe when taking research in Europe and around the world into account?
- How to align with ongoing research in Cyber Physical, IoT, Agile / Connected Manufacturing, Industrie4.0?
- Aligning with Robot Manufacturers, best practices approaches and maturity level assessments?
- Are there Use cases for manufacturers? → Trinity funding will help to demonstrate cyber security in Robotics

#### Ending notes :

- Aim to organize a Cyber Security Robotics Annual event in the fall. RFC's & Easychairto be established. Aim for a publication.
- Aim to gather other cyber security researchers from around the world
- Measuring the improvements : See you at ERF 2020

### 5.2 TRINITY Opening event EMO fair Hannover

As a part of the world leading fair on metalwork and production technologies Trinity consortium organized the official opening event in form of a conference at the Conference Center Hannover at 19<sup>a</sup> September 2019. With more than 50 registered participants the conference was very successful. Especially the session on robotics raised attention among the participatns as the competitors ABB Robotics and KUKA Robotics presented their solutions right after each other. Both Robotic suppliers focus especially on logistics with their new solutions. During the discussion with the audience Boris Fiedler (ABB) and Andreas Walbert (KUKA) highlighted the need of lean logstics solutions due to the high level of added value in manufacturing. During the session on cyber security Trinity partner Ulrich Seldeslachts introduced the risk of cyber security attacts by presenting some of the latest examples. He raised awareness by using the digital tool Mentimeter to get feedback from the audience about their current activities regarding cyber security.





Florian Ernst from the cyber security company RESADO followed with solutions to protect existing IoT solutions in manufacturing from cyber attacks.

#### Agenda

09:15 - 09:45	Registration and welcome coffee
09:45 - 10:05	The TRINITY approach to agile production
	Minna Lanz, Professor and coordinator TRINITY project, Tampere University
Session on Ro	botics
10:05 - 10:25	Making lot size one economically feasible
	Tomi Kankainen, Chief Digital Officer and VP Digital Business Unit, Fastems
10:25 - 10:45	Robotic solutions for industrial environments- benefits and challenges
	Boris Fiedler, Digital Leader, ABB Robotics
10:45 - 11:05	Mobile and autonomous solutions for automatization of die & mould workshops
	Andreas Walbert, Business Development Manager, Kuka Robotics
	Pascal Haas, Head of Automation, Erowa
11:05 - 11:15	Q&A Session
Session on Cy	ber Security
11:15 - 11:30	All you needed to know and were afraid to ask: Ulrich Seldeslachts, CEO, LSEC Leaders
in security	
11:30 - 11:45	The Importance of Cyber Security – What IoT security solutions are available and how
reliable are	
	they? Florian Ernst, Managing Director, RESADO
11:45 - 12:00	Q&A Session
12:00 - 12:20	Applying secure robotics solutions in your company- TRINITY demonstrators and open
calls	
	Minna Lanz, Professor and coordinator TRINITY project, Tampere University
12:20 - 12:30	Q&A Session

### **Findings and Conclusion**

Robotics, automation and IoT play a critical role in the factories of the future. These technologies are essential for manufacturing companies to survive in the next decade, increase their competitiveness and production capacity. Nevertheless, only a small percentage of companies is using these technologies. Projects such as TRINITY can speed the technology transfer and shorten time to market. This was the main outcome of the opening eventorganized by the TRINITY project on 19 September 2019 during the EMO Hannoverfair. The shortage of highly skilled manufacturing workers was one of the manufacturing sector will experience real difficulties in finding skilled workers" said Minna Lanz, TRINITY project coordinator and professor at Tampere University. "In 2040 we won't have enough people to work in the factories. Automated factories are necessary in order to deal with this problem", she added. Another challenge is the increasing complexity and demand for customization of products. To this respect, Tomi Kankainen, CDO at Fastems, one of the TRINITY partners, highlighted the real challenge was not only about producing lot-size-one but about flexible batch production, thisis, producing lot sizes from one to hundreds or to thousands at the same time. He also explained how, as part of the TRINITY project,





Fastems developed a new robotized manufacturing cell able to adapt automatically to manufactured products and production lot-sizes thanks to is the reconfigurability of hardware and software.

Boris Fiedler, Digital Leader at ABB Robotics, highlighted the important role of robots in meeting these challenges and theirbenefits in terms of efficiency, reliability and flexibility. He provided a vision of the future factory based on the ABB new robotics factory in Shanghai. This vision was characterized by further convergence, digital integration and production based on automated cells rather than on fixed assembly lines. In this context, Automated Guided Vehicles (AGVs) would be used to deliver parts to the production robots and to collect finished parts and move them to other cells as necessary. Andreas Walbert, Business Development Manager at Kuka presented the Kuka matrix production system. A similar concept than the one presented by ABB, already successfully implemented in a factory of the futuredealing with the industrialisation of Additive Manufacturing at Premium AEROTEC in Varel (Germany). Together with Pascal Haas, Head of Automation at Erowa they showcased a concrete example on the automatization of die and mould workshops. The example highlighted the importance of logistics automation by using mobile robots. The need to raise awareness about cybersecurity risks in a context characterized by further integrationwas also highlightedby the speakers. Ulrich Seldeslachts, CEO of LSEC, another TRINITY partner pointed out that manufacturing, with 31% of all incidents, was leading the number of cybersecurity incidents reported. The number of attacks is increasing exponentially every year and it is important to raise awareness and take the necessary measures to avoid theft of sensitive data, financial losses, loss of productivity and damage to the company's reputation. Florian Ernst, Managing Director of RESADO pointed out that the long product lifetime of industrial equipment is an important challenge from the point of view of cybersecurity. He also introduced a new technology developed by his company aiming at protecting IoT devices. This new technology is based on the creation of a digital fingerprint for a device which allows for its unique identification and secure communication. Impressions from the described event are shown in Figure 5.







Figure 5: Impressions from Opening event EMO fair Hannover, Germany

All held presentations had been collected and published. The slides are publically available on the Trinity Website under <u>https://www.trinityrobotics.eu/event/trinity-opening-event-at-emo-hannover/</u>.

## 6 Planned TRINITY Public Co-Creation Workshops 2020

To prepare the Co-Creation Workshops in 2020 the TRINITY consortium prepared and submitted two Workshop proposals in 2019. They will reach the European Robotics community (ERF) and a worldwide scientific network from the renown conference ICRA. To cover industrial stake holders of the TRINITY project the consortium might decide to held a third Co-Creation Workshop at one of the industrial fairs, maybe Automatica 2020 (June 16-19 Munich, Germany). The two events where workshop proposals had been submitted are described below.

#### 6.1 European Robotics Forum ERF 2019 in Bucharest

The follow up workshop at ERF 2020 will build on the conclusions from ERF2019 and is titled "Bridging the technology gaps - the TRINITY DIH for Agile Production".

TRINITY DIH is tackling the agile manufacturing challenges of European companies with main target on SMEs. This workshop is continuum to the successful first TRINITY DIH workshop arranged at ERF2019. As the organizers got good feedback from the community about the main challenges in agile manufacturing the DIH building has been guided. In this next implementation we'll give an update how has the TRINITY DIH progressed. We'll present the finding from the European wide TRINITY robotics company survey <a href="http://trinityrobotics.eu/survey/">http://trinityrobotics.eu/survey/</a> to learn what the companies are looking for in terms of robotics, IoT and cyber security. Then well present some latest technological solutions from around the world trying to tackle





these problems. Last part of the workshop will be open discussion utilizing available networking tools. Goal of the interactive session is to find the gaps between the industry needs and the available research results. These gaps will be used to quide the activities in TRINITY project and can be utilized as topics in the coming TRINITY open calls.

00:00-00:15	First year of TRINITY DIH: Prof. Minna Lanz, University Tampere
00:15-00:30	Main findings from the TRINITY survey: Dr. Jan Reimann, Fraunhofer IWU
00:30-00:45	3 Technology sneakpeaks: latest technological solutions in robotics, IoT and cyber security
	contributing to agile manufactuing (3min each):
	1. SME talk: Intuitive Robotics: Georg Püschel, Wandelbots
	2.SME talk: 5G enabled sensors, Juhani Lempiäinen, Deltatron Ltd.
	3.SME talk: Flexible, assistive robots for customized production, Andreas Pichler,
Profactor	
00:50-01:20	Interactive session: Finding the gaps - latest technologies vs. real industrial needs
	World cafe divided into three topics based on the key technologies presented by guest
speakers.	
01:20-01:30	Conclusions / interactive session findings. Prof. Minna Lanz, University Tampere

#### 6.2 ICRA Conference Workshop Paris

At the highest ranked Robotics conference IEEE International Conference on Robotics and Automation ICRA 2020 the Trinity consortium (Fraunhofer IWU, Tampere University, Flanders Make and Joseph Stefan Institute) applied to organize a Workshop on Novel robot technologies for agile manufacturing. It aims to enable novel technologies to meet industrial requirements. Therefore a high ranked mix of academics and industrial experts is invited to exchange their ideas and approaches.

Research provides many ideas to help manufacturing end users improve their production systems by enabling agility. Technologies that help setting up advanced production processes, e.g. programming by demonstration, mobile/collaborative robots, passive reconfigurable fixtures and tools, are great examples of supportive ideas from academia. However, these novel technologies still have not been accepted by industry to a sufficient extent to fulfil modern agile manufacturing needs. One of the main obstacles is the existing gap from research to industrial usage. A solution oriented mindset and additional tools, such as safety standards and new interaction modalities, can support the needed innovation transfer. The main topic of this workshop will be how different approaches can support the dream of agile manufacturing.

The workshop consists of invited talks by top robotics researchers and practitioners with emphasis on the integration of new advanced robot technologies to support the implementation of agile manufacturing cells. All listed speakers confirmed their participation towards the organizers. Additionally the proposed workshop is supported by two Letters of support by IEEE Technical Commitees. An interactive session focusing on examples of agile production cells that have already been implemented in industrial settings is part of the program. To summarize the results of the workshop and propose new directions, a round table will be held at the end of the event.





#### Agenda

00.00	00.1-	
09.00	09.15	Introduction by organizers
09:15	10:15	Research Session, part 1: Research on novel robot technologies for agile manufacturing
09:15	09:45	Minna Lanz (University of Tampere)
09:45	10:15	I-Ming Chen (Nanyang Technological University)
10:15	10:55	Industrial Session, part 1: Industrial solutions for novel robot technologies for agile
manufa	acturing	
10:15	10:35	Fabio Bonomo (CEO, qbrobotics)
10:35	10:55	Bert Willaert (CTO, Pick-it 3D)
10:55	11:30	Coffee break
11:30	12:30	Interactive session, part 1: Poster & Video session & Demonstrator contributions
11:30	11:45	Introduction of interactive session: Video presentation and Poster pitches
11:45	12:30	Demonstrator presentations and poster session
12:30	14:00	Lunch break
14:00	15:00	Research Session, part 2: Research on novel robot technologies for agile manufacturing
14:00	14:30	Sami Haddadin (Technical University of Munich)
14:30	15:00	Julie Shah (MIT)
15:00	15:45	Industrial Session, part 2: Provided robotic solutions for agile manufacturing
15:00	15:25	Christopher Schneider (Product manager collaborative robots, Yaskawa Europe)
15:25	15:45	Rainer Bischoff (Vice President for Corporate Research, KUKA Robotics)
15:45	16:00	Coffee break
16:00	17:00	Interactive session, part 2: Expert round table discussion: involving the audience

#### 6.3 Other suitable events in 2020 for Co-Creation Workshops

The following events might be suitable to organize Co-Cration Workshops within the Trinity scope in 2020. The consortium will decide about applying for an event based on the schedule of interested partners in cooperation with the WP1 leading project partner.

Relevant event	Event type / Target group	Scheduled 2020	WS-Proposal Deadline
CIRP CATS (Patras, Greek)	Scientific conference	May 20-22	November 2019
Automatica (Munich, Germany)	Trade fair: Industry	June 16-19	March

#### Table 2: List of events taking place 2020 in scope of Trinity





- 7 Annex
- 7.1 Mind Map Results of the ERF 2019 Workshop "Agile Production"







Figure 6: Overview of discussed topics on Cyber Security table



Figure 7: Overview of discussed topics on Robotics







Figure 8: Overview of discussed topics on Digital Tools and IoT





## 7.2 Online Survey as queXML-exported PDF



Trinity is a EU-funded project to increase agility in European manufacturing industry. By demonstrating the value of IoT-technologies and Advanced Robotics for SMEs the project aims to bring these technologies in industrial applications. Trinity offers the opportunity to apply for funding to all European SME that would like to demonstrate the improvement of agile production in own use-cases. We need your help to address the specific needs and topics of SME in the call. Please help us to drive agility in production forward by answering the following questions about your company's initial situation and objectives in digitalization and agility. Further information about the Trinity project can be found on our website: www.trinityrobotics.eu

Agile manufacturing is the capability of the manufacturing organisation to adapt itself quickly to new market demands, new opportunities and new challenges. It differs from smart manufacturing, in its ease of adoption, but usually requires smart and digital technologies. It differs from digital in the way it doesn't necessarily require all processes or technologies to be fully digitized, but digital platforms are a strong enabler to smart and agile manufacturing. Agile manufacturing is different from traditional ways of manufacturing in that it adapts faster to other materials, different logistics, and changes in the production environments.

## Section A:

## A1. Country of Origin

Austria	
Belgium	
Bulgaria	
Croatia	
Cyprus	
Czechia	
Denmark	
Estonia	
Finland	
France	
Germany	
Greece	
Hungary	
Ireland	
Italy	
Latvia	
Lithuania	
Luxembourg	
Malta	
Netherlands	
Norway	
Poland	
Portugal	
Romania	
Slovakia	
Slovenia	
Spain	
Sweden	
United Kingdom	

A2.	Company Size (including all related companies)	
	0-10 Employees	
	11-50 Employees	
	51-250 Employees	
	251-500 Employees	
	> 500 Employees	
Secti	ion B: Self-assessment	
B1.	Where would you classify your company in terms of agile production capability?	
	Ability must be developed	
	Ability existent	
	Ability strongly developed	
<b>B2.</b>	How far has agile production developed in your company?	
	We have not dealt with this issue yet	
	The topic is in the observation and analysis phase	
	The topic is in the planning and testing phase	
	We pursue individual operational projects in the area of agile production	
	Agile production is comprehensively implemented in our operations	
<b>B3.</b>	How do you assess your agility in these domains?	
	Not/hardly developed	Fully developed
	Robotics	
	Internet of things	



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Overall agility

## Section C: Employees

# C1. How do you assess the skills of your employees when it comes to the future requirements in the context of agile production?

IT infrastructure Automation technology Data analytics Data security/Communication security/Cybersecurity	Not       Not-       but         relevant       existent       inadequate       Adequate
Development or application of assistance systems Collaboration software	
Non-technical skills such as systems thinking and process understanding	
C2. What do you see as the biggest hurdles when it come empowerment in the course of agile production?	s to employee
the lack of	qualification of employees
the lack of	f interest of the employees
the few qualification	on measures for employees
the fears of	f employees to be replaced
the fea	ars of employees of change
the lack	of internal communication
the shortag	e of young skilled workers
ť	he old age of professionals
the lack of acceptance of new	technologies by employees
	Kita:
Kita:	

C3.	In which subject areas do you see a need for qualification for your employees?	
	Cybersecurity & ICT/OT - security	
	Handling of specific IT systems	
	Process know-how	
	Data protection and privacy	
	eCommerce, customer relationship management	
	Robotics	
	Kita:	
	Kita:	
Sect	ion D: Motivations and Obstacles	
D1	What are the motives for agility measures in your company?	
<i>D</i> 1.	Increase of internal efficiency	
	Transparency in processes, e.g. in production	
	Cost reductions	
	Competitive advantage through modern products	
	Strengthening the interface to the customer	
	Sales increase through new business models	
	Sales increase through additional services (e.g. predictive maintenance)	
	Possibility for economical individualized production	
	Shorter development times	
	Requirements of business partners & customers (e.g. OEM)	
	None	

Kita:	
Kita:	
Where do you see obstacles to adapting to the trend of agile production?	
Lack of technical solutions	
Requirements for Cybersecurity IT/OT - security	
Protection of trade secrets	
Lack of technical standards	
Legal uncertainties	
Inadequate competence of employees	
High investment costs	
Insufficient broadband connection	
Age structure within the company	
Lack of ability to change in the organization	
Kita:	
Kita:	
What kind of support do you wish for the implementation of agile production?	
Use cases/more published Best-Practice-Examples	
Information events	
Exchange of experience	
Development projects with regional universities and research institutions	
Participation in technical working groups	
Qualification/Seminars	
Forums on the internet	

	Regular newsletters		
	More precise instructions		
	More cooperation between companies		
	More cooperation between companies and research institutions		
	Public contact point, clear contact person		
	Kita:		
	Kita:	•	
Se	ection E: Robotics		
E1.	Do you use robots?		
	No, not needed	Ļ	
	No, but planned		
	Yes, more robots are planned		
	Yes		
E2.	What kind of interactive robots are used in your company?		
	None	Ļ	
	Automated, enclosed robots without interaction capability		
	Interactive safe robots (without fences) with task separation		
	Interactive and possibly mobile robots, collaborative task sharing with explicit instruction/communication		
	Collaborative, learning and, if necessary, mobile robots; tasks are performed together, used flexibly depending on the respective task		
E3.	For which tasks should robots be used?		
	Dangerous works		
	Physically heavy work		
	Monotonous tasks		
	Unpleasant tasks		
	Error-prone work		
	Particularly safety-relevant work		

	Quality requirements For none Kita:	
E4.	What obstacles/problems do you see when using interactive robots in production?	
	Difficult operation	
	Financing	
	Safety while collaboration	
	Difficult reconfiguration/lack of agility	
	Lack of use cases	
	Cybersecurity - lack of security	
	None	
	Kita:	
	Kita:	•
Sect	ion F: IT security	
F1.	What cybersecurity/data security measures did you implement in your company?	
	No cybersecurity/OT/information security measures	
	Basic technical information security measures (firewall, virus protection) existent	
	Basic security rules (classification of information, confidentiality) in writing	
	Measures from recognized standards (e.g. according to ITIL, ISO/IEC27001) are used	
	Complete information security management system according to ISO/IEC27001 implemented	

How far advanced are your IT/OT cybersecurity solutions?			
	Not Relevant, Solution relevant for but not Solution Solution in implemente us planned planned progress d		
Security in internal data st	orage		
Security of data in cloud sec	rvices		
Security of communications for in-house data exc	hange		
Security of communications in transit for data exchange business pa	e with rtners		
GDPR Se	curity		
F3. How are your IT/OT systems cybersecured/protected?			
Cybersecurity/OT/IT security is not being monitored			
Basic security systems protecting end points & network			
IT/Cybersecurity has a high priority in the company. Measures to increase cybersecurity have been implemented and professional protection exists for both OT & IT operations			
The company's OT & IT security have been certified, e.g. with BSI/CyberEssentials,ISO,ISA certifications, or offers similarly comprehensive protection. In addition, employee awareness programs exist			
Cybersecurity is regularly assessed, certified and employees are fully aware of the importance of IT/cybersecurity. Risks with regard to cybersecurity are raised regularly and measures to reduce risks are implemented			

Thanks for your valuable time by taking part in this survey. The results help us to define topics of interests for our SME calls. If you would like to stay informed about the Trinity project and to become one of the first to gain information about our open calls, please <u>enter your e-mail address</u> or get in touch with us: <u>www.trinityrobotics.eu</u>, <u>info@trinityrobotics.eu</u>, Twitter: <u>@eu\_trinity</u>, LinkedIn:

www.linkedin.com/groups/12177835