Robotics4EU

Boosting Wider Adoption of Robotics in Europe

Deliverable 4.3

Co-Creation Workshops to Test Robotics Applications

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Deliverable 4.3

Co-Creation workshops to test robotics applications

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1 Summary

This report provides a detailed overview and description of four Robotics4EU co-creation workshops arranged by the Robotics4EU project during 2023. The workshops are a part of Robotics4EU, a 3-year project funded under the European Union's Horizon 2020 research and innovation program. The project works to ensure a more widespread adoption of (AI-based) robots through the implementation of responsible robotics principles among the robotics community that results in societal acceptance of the robotics solutions.

The aim of the workshops was twofold, 1) to drive meaningful progress in the field of robotics while promoting responsible and user-centric innovation and 2) to use the workshops as a testing bed for the development of the Responsible Robotics Compass (RoboCompass) developed in Work Package 1 (WP1) of the Robotics4EU project.

Each of the four workshops were centred around one of the primary focus areas of the project, these being: *Healthcare, Agri-food, Agile production and Inspection and maintenance of infrastructure.* The co-creation workshop brought together 120 robot developers, manufactures, end-users and stakeholders to collaboratively discuss the societal aspects of specific robotics solutions. Together they assessed barriers, challenges and opportunities and co-created ideas for improvements.

At the centre of each of the four workshops was a discussion game designed and developed by The Danish Board of Technology. The game functioned as an interactive tool to help facilitate group discussions in such a way that allows participants to assess different aspects of societal acceptance of the specific robotic solutions presented at the workshops. The tool helped and encouraged the participants to talk about important societal topics inspired by the RoboCompass namely; ethics, socio-economics, data, legal, and engagement, human-experience and environment.

The report presents a detailed overview of the workshop design, procedure for planning and recruitment of participants as well as a presentation and analysis of the main outcomes of each of the four workshops.

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2 Introduction

The rapid development and implementation of new robotic technology is transforming various areas of our society, such as production, transportation, agriculture, healthcare. These areas and many others are becoming increasingly reliant on automation and robotic technology. In this transition, it is essential to explore how robots are perceived and received by society and those who will be using the robots. Critically assessing new and emerging robotic technologies is important. If we don't, we risk developing robots that are not aligned with the expectations and needs of the society and environment they are to take part in.

To address this challenge, it is imperative to engage stakeholders and end-users in the discussion on emerging technologies as a means towards creating responsible robotics and ensuring that new robotic solutions are properly integrated into society. One of the main aims of the project is to foster this engagement through a series of three different engagement activities:

1. **Citizen consultation on wished and concerns**, (task 4.1) completed in the fall/winter of 2021[1]
2. **Validating robotics business ideas with citizens,** (task 4.2) completed in the winter 2022/2023[2]
3. **Co-creation workshops to test robotics applications** (task 4.3) which is the work described in this report.

This deliverable presents the results from four co-creation workshops held by the Robotics4EU project during the winter, spring and fall of 2023. The co-creation workshop brought together robot developers and manufactures with end-users and stakeholders to discuss the societal aspects of specific robotics solutions and co-create ideas for improvements. Co-creation is a participatory method that was used to involve multiple stakeholders in the design and evaluation of robotic solutions, ensuring that they meet the needs and expectations of the society and the environment. By reflecting on the societal readiness of robotic solutions under development with various stakeholders, end-users and other societal representatives we expect that robot developers and manufacturers will be better equipped to make informed decisions about their products and avoid costly mistakes that may ultimately render their solutions(s) unfit for society.

A total of four co-creation workshops were organised and carried out. Each workshop on one of the four focus areas of the project: *Agri-food, Healthcare, Agile Production and Inspection and maintenance of infrastructure*. The workshops were designed and facilitated by The Danish Board of Technology in close collaboration with the project partner(s) responsible for each particular workshop. See the table on the following page for further details:

[1] https://www.robotics4eu.eu/publications/globalsay-on-robotics-citizen-consultations-on-wishes-and-concerns/
[2] https://www.robotics4eu.eu/publications/validating-robotics-business-ideas/

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Location	Partner	Topic	Date
Vilnius (LT)	Lead: AFL/DBT Contributing: CE, NTNU	Agri-food	February 7th, 2023
Oslo (NO)	Lead: NTNU/DBT Contributing: CE, NTNU	Healthcare	June 6th, 2023
Delft (NL)	Lead: NTNU/DBT Contributing: CE, NTNU, LNE	Agile Production	October 3rd, 2023
Delft (NL)	Lead: CE/DBT Contributing: CE, NTNU, LNE:	Inspection and Maintenance	October 4th, 2023

Table 1: Workshop Overview

The purpose of this report is to provide a comprehensive overview of the co-creation workshops conducted as part of the Robotics4EU project. The report is divided into the following sections:

1. **Introduction (Section 2)**: Presents an overview of the co-creation workshops relation to the Robotics4EU project.
2. **Workshop Design (Section 3)**: Explains the methodologies, aims, objectives, and the discussion game used as the main framework for the workshops. Additionally, the logistical planning and approach to recruitment of participants is also presented.
3. **Individual Workshops (Section 4 to 7)**: Presents detailed information about each of the four workshops and the main outcomes.
4. **Extra Session on the RoboCompass (Section 8)**: Highlights an additional session focused on the RoboCompass.
5. **Challenges and reflection (Section 9):** offers reflective insights on the challenges we met planning and executing the co-creation workshops.
6. **Conclusion (Section 10)**: Summarises the report's findings.

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2.1 About Robotics4EU

The workshops presented in this report is a part of Robotics4EU, a 3-year project funded under the European Union's Horizon 2020 research and innovation program. The project aims to ensure a more widespread adoption of (AI-based) robots within the areas of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production. To achieve this, focus will be on the implementation of the responsible robotics principles among the robotics community that result in societal acceptance of the robotics solutions in the four application areas.

Robotics4EU will empower the EU-wide responsible robotics community representing robotics innovators from companies and academia in the four application areas, as well as citizens/ users and policy/ decision makers by:

- Raising awareness about non-technological aspects of robotics by organising community building and co-creation events bringing together the robotics community and citizens.
- Advocating for the responsible use of robotics among all stakeholders' groups.
- Developing a responsible robotics compass and bringing the project results to the standardization bodies.

To accomplish the above, the project will implement the following set of activities:

1. Assessing the needs and developing a responsible robotics compass that is a practical tool for the robotics developers and helps them to strategically plan how to address the legal, societal and ethical aspects of robotics;
2. Empowering the robotics community by organizing capacity building events in healthcare, agri-food, agile production and infrastructure;
3. Ensuring citizen acceptance of robotics and assessing robotics ideas and applications provided by the industry with citizens and end-users (via online consultation and co-creation workshops);
4. Reaching out to the policy makers by compiling a responsible robotics advocacy report, organizing a high-level policy debate, and transferring the results to the standardization bodies.

2.1.1 The Co-Creation Workshops in the scope of the Robotics4EU project

For clarity it is necessary to further introduce an overview of the synergies between the different WPs of the project. The co-creation workshops are part of the WP4 in the Robotics4EU project. The co-creation workshops are closely connected to the work done in other parts of the project by both building on previous work and to use the results as input to other activities in the project. More specifically, the design of the discussion game used in the workshops drew heavily on the work done in WP1 concerning the RoboCompass and the Societal Readiness Level (SRL).

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The outputs of the workshops will feed into the further development of the RoboCompass in WP1, as input for the responsible robotics advocacy report in T4.4 in WP4 and communicated through WP5. For a full overview, see *figure 1* below:

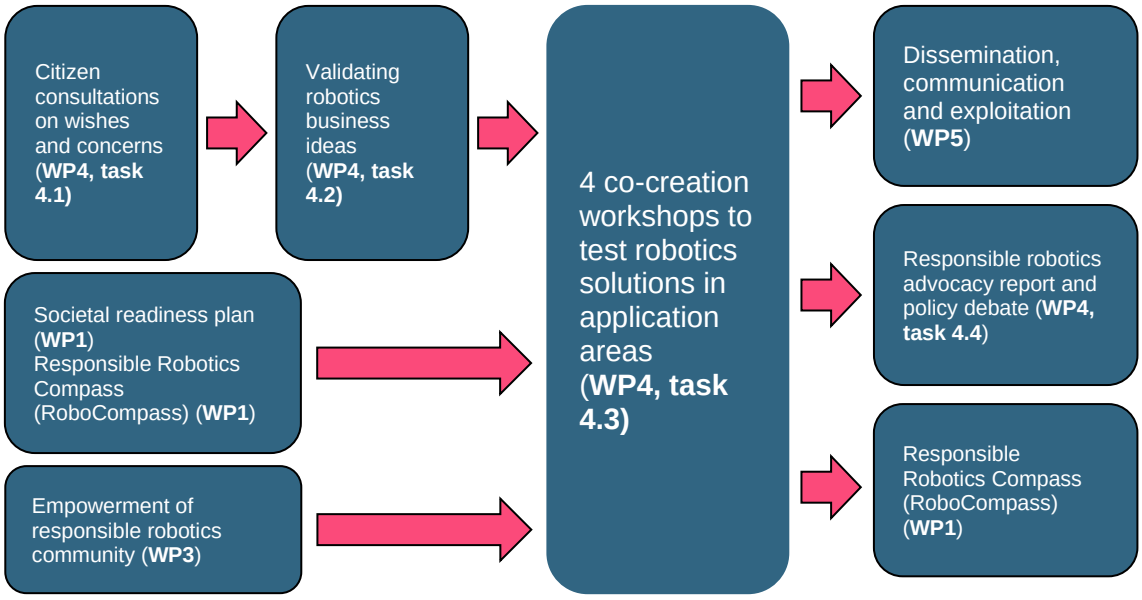

Figure 1: WP and task interconnectivity and shared outputs

2.1.2 Integrating and testing the Responsible Robotics Compass (RoboCompass)

One of the main outcomes of the Robotics4EU project is the development of a Responsible Robotics Compass in WP1, led by consortium partner LNE. An essential element of the co-creation workshops was to use the workshops as testbeds for certain aspects of the RoboCompass while it was under development. This section gives a brief introduction to the development process of the RoboCompass as this has also partially steered the development of the co-creation workshops and will be referenced several times throughout the report. Namely in the formulation of the questions, the decision whether to include SRLs, the usability of the tool, categorization, and prompts. The development process of the RoboCompass has been an iterative process as shown in the illustrated timeline.

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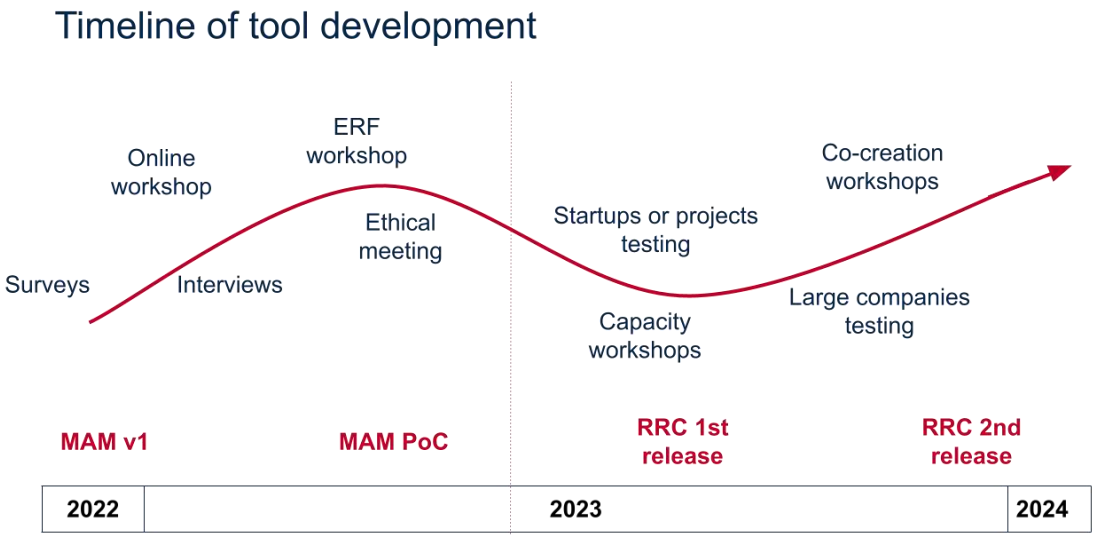

Figure 2: Timeline of the development process of RoboCompass

The RoboCompass has been under constant development during 2022 and 2023 and has throughout its development process changed from being called the Maturity Assessment Model (MAM) to being named The Responsible Robotics Compass (RoboCompass). The RoboCompass is an online tool designed to assess the non-technological aspects of responsible robotics. The assessment tool is meant to provide robot designers, developers and manufacturers with a comprehensive overview of the development of the aspects which affect the acceptance of a robot, such as socio-economic issues, human experience, environment, legal and data.

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3 Workshop Design

This section presents the methodology for the workshops. First, a presentation of the aim and objective of the workshops, then a section about the theory and methodology behind the benefits of co-creation and lastly, we will go into more detail about the workshop design and planning process.

3.1 Aim and objectives of the workshops

The aim of the workshops is twofold, 1) to drive meaningful progress in the field of robotics while promoting responsible and user-centric innovation and 2) use the workshops as testing bed for certain elements in the development of the Responsible Robotics Compass in WP1.

To achieve the first aim, the workshops used real-world examples of robots as cases to facilitate insightful discussions among both those who develop the robots and those who will be using them, with a particular emphasis on fostering a broader acceptance among users and society and to ensure better integration of the robots. Concretely, the objective was to design a workshop focusing on directly benefiting participating companies and projects by offering a workshop-environment that could give concrete input from potential users and stakeholders to advance their robot's development and inspire them to do further engagement activities that can improve the societal readiness level (SRL). To create this workshop-environment we looked towards the concepts of co-creation and co-design.

To achieve the second aim, the workshops were designed to integrate, and test chosen elements from the RoboCompass. However, as the RoboCompass is aimed for online use and not a co-creation tool the objective was not to directly test it at the workshop but to translate certain elements into a workshop friendly format that could then be tested. Additionally, as the tool was under constant development during the period of which the four workshops were held it meant that we iterated on the workshop-design between each workshop to accommodate the development stages of the RoboCompass.

3.2 The Co-creation methodology

Co-creation is a concept often utilised by the DBT as an effective approach to facilitate collaboration among people with different backgrounds and understandings as was the case of the workshops where we sought to create a collaborative environment between developers, designers, and manufacturers of robotic solutions together with potential end-users, stakeholders and experts.

The concept of co-creation is often treated synonymously with the concepts of co-design and participatory design[3]. In essence they all stem from the same ground idea of involving external actors such as users' perspectives into the development process of new products, applications, services or systems, namely that: *"If we are to design the*

[3] Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. Co-design, 4(1), 5-18.

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futures we wish to live, then we need those whose futures they will be to actively participate in their design."[4] Furthermore, according to Sanders and Stappers:

> *"Co-creation refers to any act of collective creativity, i.e. creativity that is shared by two or more people. Co-creation is a very broad term with applications ranging from the physical to the metaphysical and from the material to the spiritual"*[5].

Co-creation emphasises user-centred innovation with the active engagement of users in the innovation and design processes, acknowledging their valuable knowledge, ideas, and experiences. Common for the concepts is that they all describe approaches to utilising stakeholder and citizens knowledge and resources to collaboratively explore and create new and potentially better ideas, solutions, or approaches. It is about democratising the process of design, by designing with users and stakeholders and not for them. By tapping into these insights, we can develop products, services, and experiences that are better tailored to meet specific needs and preferences of the society.

Traditionally the concepts have mainly been used as a design approach to improve consumer products and services but today we also see the concepts being used to facilitate engagement, inclusion, and collaboration in areas beyond consumer goods. This could for example be to engage communities and stakeholders in decision-making processes that affect them. As presented by Björgvinsson, Ehn & Hillgren (2012) participatory design is not just a tool for incremental innovation of consumer products but can also be seen as a process for radical change when designing for complex societal issues[6]. In the Robotics4EU project we see great potential in using the co-creation methodology as a stepping stone to align robots to the wants and needs of those who will be using them in order to ensure a better adoption and implementation into society. Co-creation encourages two-way communication fostering an environment not only bringing value to the workshop cases and organisers but also to the particapnts such as an opportunity to voice concerns, learn more about robot development and responsible robotics and or engage in field of robotics.

There are many different ways to go about co-creation. One of the ways is through the use of workshops where participants are engaging in facilitated collaborative activities. The workshop format presents and frames challenges that allows the participants to listen to each other's ideas and matters, thereby facilitating a more effective collaboration[7]. Co-creation workshops can be arranged in many different ways but central is that they often have the participants gather around an activity or exercise and with the use of material objects ranging anywhere from post-it notes and playdough to

[4] Robertson, T. and Simonsen, J. (2013): Participatory Design – Introduction. I Routledge International Handbook of Participatory Design, ed. Simonsen, J. page 1
[5] Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. Co-design, 4(1), 5-18. Page 6.
[6] Björgvinsson, E. Ehn, P. & Hillgren, P-A. (2012) Agonistic participatory design: working with marginalised social movements, CoDesign, 8:2-3, 127-144
[7] Sanders, Elizabeth B.N. 2000. "Generative tools for co-designing." Collaborative design. Springer, London: 3-12.

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specifically designed objects for the workshop. For the Robotics4EU workshops we chose to look towards the concept of design games and developed a discussion game.

Design games are a type of co-creation method that involve playful and creative activities to engage participants. It takes the fun, creative, and experimental elements from the game-world and utilises these to engage the participants to take part in dialogue and interaction. According to Vaajakallio and Mattelmäki a design game has the following features:

> *"(1) Creating a common design language; (2) Promoting a creative and explorative attitude; 3) Facilitating the players in envisioning and enacting 'what could be'; (4) Helping to define the roles of participants in the interaction during a session"*[8].

Design games can be used to explore, generate, and evaluate ideas, as well as to facilitate communication, collaboration, and learning among the participants. Design games can take various forms, such as card games, board games, role-playing games, or digital games, depending on the purpose and context of the workshop.

Some of the benefits of using design games in co-creation workshops are:

- They can stimulate a playful and creative mindset by providing a fun and relaxed atmosphere, where participants can express their opinions and preferences without fear of judgement or criticism.
- They can provide a common framework for discussion which can foster empathy and understanding by allowing participants to experience different perspectives.
- They can increase engagement and motivation by offering a rewarding and enjoyable experience.

Some of the challenges of using design games in co-creation workshops are:

- They require careful planning and preparation, such as designing the game, choosing the participants, setting the rules, and facilitating the game play.
- They depend on a facilitator, who needs to balance between guiding and supporting the participants, as well as managing the time, resources, and dynamics of the workshop.

The concrete discussion game developed for the workshops is presented later in the report.

[8] Vaajakallio, K. & Mattelmäki, T. (2014) Design games in codesign: as a tool, a mindset and a structure, CoDesign, 10:1, p. 66.

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3.3 Overall structure of the workshops

This section presents an overview of the overall structure of the workshops and the agenda they followed.

The methodology and baseline for each of the four workshops was the same, but each workshop was tailored to fit the specific needs for the concrete focus area and updated to fit the current development phase of the RoboCompass. The workshops invited companies and projects developing robots to come discuss societal aspects of specific robotics solutions with end-users, stakeholders, and researchers in the field and co-create ideas for improvements. During the workshop, the participants were divided into four to ten different groups, depending on the number of participants at the workshop, to focus their attention on one specific robot at each table in a facilitated discussion.

Each group consisted of 5-7 people:

- 1-2 representatives from the company/project developing or manufacturing the robot.
- 3 or more participants who were potential end-users, stakeholders or researchers or experts within the field of the robot.
- A group-facilitator

In addition to the facilitators in the groups a moderator made sure to guide everyone through the day, manage time, and be the gathering point of the workshop.

Workshop Agenda

The workshops are designed to last between 2 to 3.5 hours and had a common structure with some variations. The table below shows the main activities of the workshops and which of the activities that were included in the four different workshops. The first column lists the activities divided into six different blocks and the next four columns indicate whether they were part of the specific workshop or not. The concrete agenda for each workshop with a time schedule can be read in the individual chapters of each workshop in section 4, 5, 6 and 7.

Programme Activities	Agri-food workshop	Healthcare Workshop	Agile Production Workshop	I&M workshop
Block 1 - Setting the Stage				
Arrival and registration	X	X	X	X
Introduction to the Robotics4EU project	X	X	X	X
Presentation on the importance of discussing the	X	X	X	X

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non-technological aspects of robotics				
Block 2 - Introduction to the Robots				
Introduction in the groups	X	X	X	X
Pitch of participating robots and Q&A	X	X	X	X
Block 3 - Societal Readiness Level				
Presentation of Societal Readiness Level (SRL)	X	X		
Group activity: Identifying the robots SRL	X	X		
Block 4 - The Discussion Game				
Introduction to the Discussion Game	X	X	X	X
Playing the discussion Game	X	X	X	X
Block 5 - Ending Workshop				
Presentation from each group, summarising the day		X		
Wrap up	X	X	X	X
Lunch	X	X	X	X
Block 6 - Extra Session				
Separate session testing the RoboCompass			X	X

Table 2: Overview of the main activities of the workshops and which of the activities that were included in the four different workshops

The following section presents a general description of each of the blocks to give a glimpse of the flow of the workshops. As mentioned earlier the workshops did not follow the exact same agenda but to avoid repetition, we will give one general walk through of the workshop.

3.3.1 Block 1 - Setting the Stage

Each workshop started with registration of the participants and assigning them to their groups. After helping participants to their respective groups and places, the moderator from the DBT introduced themselves and the partners that were present, along with the agenda. This introduction was followed by a short introduction to the Robotics4EU

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project, its goals and the reasoning behind using co-creation. Here, the importance of including and discussing non-technological aspects, e.g. gender, cybersecurity, data protection, legal aspects, into the considerations in the design and development of robotics was expounded. Further, it was explained how inclusion of these can lead towards greater societal acceptance of robots and thus, increased uptake of robots by professional end-users and citizens. The full presentation from the last workshop can be found as an example in Appendix 1.

Figure 3: Picture from the Healthcare workshop with the moderator welcoming everyone.

3.3.2 Block 2 - Introduction to the Robots

Following the introduction, the attention was shifted to the participants in the room. Here the groups got a chance to introduce themselves to each other. In addition to this, each company or project representing a robot got the opportunity to present their robot to the group in a short pitch format. The representatives of the robot had been asked to prepare a pitch showcasing the purpose and capabilities of the robot. This was presented to ensure that everyone at the table had an idea of how the robot functioned so they could engage in fruitful discussions for the remaining blocks of the workshop. To assist the representatives pitch they could either display the robot physically or in a powerpoint presentation using photo and video material in case it was not possible to transport the robot to the workshop location.

Figure 4: Representative from Autonomous Units showcasing the robot to the rest of the group.

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3.3.3 Block 3 - Societal Readiness Level

Following the general introduction and presentation of the robots, Societal Readiness Level (SRL) was introduced and elaborated upon.

To set the stage for the workshop and make participants comfortable with the concept the introduction was made using a comparison with Technological Readiness Level (TRL). Here, it was explained how SRL mirrors the TRL by using the same nine stage model, but instead of focusing on the technological maturity of the innovation, SRL focuses on the societal aspects of the innovation processes and helps assess to what degree the innovation will be ready to be used in a societal context. This comparison helped the developers and end-users at the workshops to get acquainted with the concepts that they would be discussing, by drawing on a concept familiar to most within the industry of robotics. See the figure below:

Figure 5: PowerPoint slide presented on TRL and SRL overview.

SRL (shown on the right in the figure above) is: *"a way of assessing the level of societal adaptation of… a particular social project, a technology, a product, a process, or an innovation" that must be "integrated into society"* [9]. A low SRL essentially means that society is not quite ready for a particular innovation and that the innovation in question will require a well thought-through transition plan. If the SRL lags behind the TRL, the innovation will not get off the ground.

SRL is a fairly new concept developed by Innovation Fund Denmark and one that the Robotics4EU project has drawn on in order to ensure a responsible implementation of robotics into society[10]. As SRL can be somewhat difficult to navigate, it was important to

[9] "Societal Readiness Levels (SRL) defined according to Innovation Fund Denmark" https://innovationsfonden.dk/sites/default/files/2019-03/societal_readiness_levels_-_srl.pdf

[10] D1.1 Societal Readiness Plan: https://www.robotics4eu.eu/publications/deliverable-1-1-societal-readiness-plan/

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make sure that participants felt that they had been properly introduced to the concept before starting the discussion.

After the presentation of what SRL is the participants were asked to discuss the current SRL of the robot in their group and place a token on the estimated SRL they thought the company/project were currently on in their development process.

The instructions were as follows:

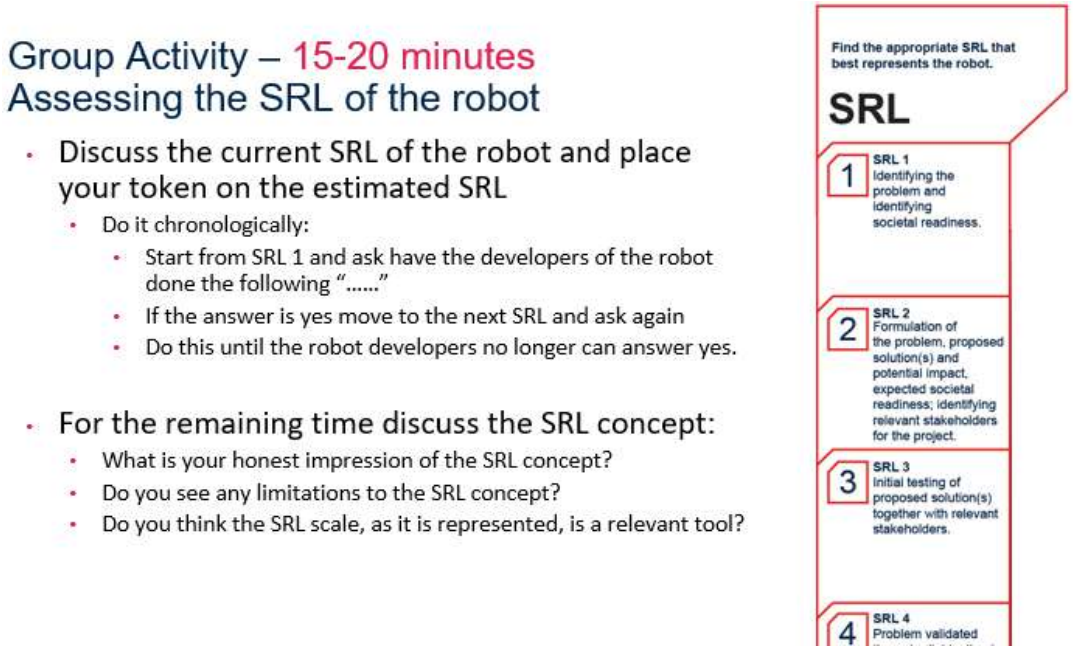

Figure 6: Slide with instructions to the groups on assessing the SRL of their robot.

3.3.4 Block 4 - The Discussion Game

At the centre of each of the four workshops was a discussion game designed and developed by the DBT. Taking inspiration from the concepts of design games we developed an interactive discussion game to help facilitate group discussions in such a way that allowed participants to assess different aspects of societal acceptance of the specific robotic solutions present at the workshops. The game helped and encouraged the participants to talk about important societal topics inspired by the RoboCompass namely; ethics, socio-economics, data, legal, and engagement, human-experience and environment.

The discussion game was continuously updated between the workshops as we gained new learnings and insights and as new updates to the RoboCompass were made. Therefore, the discussion game underwent three iterations over the course of the four workshops. The initial version was created for the agri-food workshop in February, the second for the healthcare workshop in June, and the final version for the last two workshops on agile production and inspection and maintenance held in October. Below is an overview of the three versions and their progression from each other. We will not go into detail with each version here, but instead give a detailed description of the latest version. The two first versions can be found in the Appendix 2,3.

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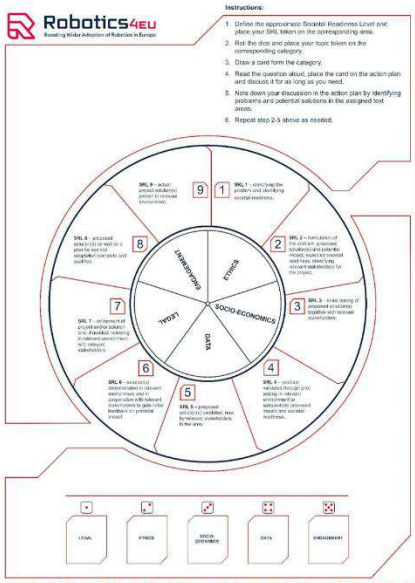
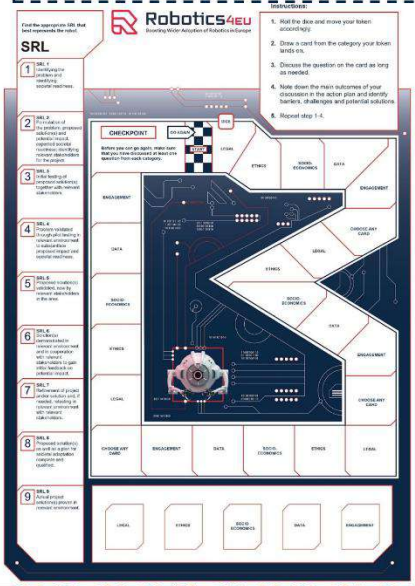


Version 1 – Agri food workshop

The first version of the tool was constructed in the following way:

First, the participants of each group discussed and ultimately identified the approximate Societal Readiness Level (SRL) of the robotic solution and placed a token in the outer circle.

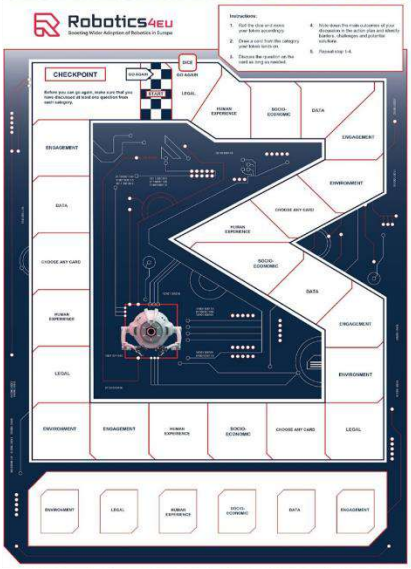
Secondly the participants then took turns rolling a dice to decide what topic to discuss. The five topics were presented visually in the inner circle of the gameboard. At the bottom of the board were five sets of cards each corresponding to one of the topics.



Version 2 – Healthcare workshop

The second version was similar to the first version, but with a new design optimized to enhance the flow of the game. Instead of moving around in a circle the layout was changed to invoke a feeling of progress similar to a traditional board game design.

Learnings from the first workshop found that the participants had difficulties in distinguishing between the first part of the game which was to identify the SRL and the second part which was to discuss the different themed question cards. Therefore, it was decided to clearly sperate the two exercises from each other on the gameboard.



Version 3 – Agile Production and I&M workshop

The last version of the gameboard was updated with new categories for the questions cards as the development team of the RoboCompass had updated the categories in the online tool. Therefore, it was decided to also update the categories for the workshop.

In the last version the exercise on identifying the SRL was excluded from the game. The results from the previous workshops had emphasized some of the difficulties working with the SRL concept. Further details on the exclusion of the SRL concepts can be found in section 4.2, 5.2 and 6.1.1.

Figure 7: All three versions can be found in their full version in Appendix 2,3,4.

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3.3.4.1 The Final version of the Discussion Game.

The discussion game is composed of three elements:

A gameboard (see figure 8 on page 23)

The gameboard was designed with 23 different fields with different categories on each field corresponding to the categories on the question cards. Players navigate on the gameboard by rolling a dice and moving a token corresponding to the number rolled on the dice. If the players manage to go all the way around, the game is designed to easily go again and continue playing as long as needed. In the top right corner of the gameboard, the instructions of the game are clearly stated.

Question cards with six different categories (See figure 9 on page 24-26)

The categories on the cards were chosen based on the categories presented in the RoboCompass and were therefore updated as the RoboCompass was further developed. Common for all topics was that they were to be considered when assessing and improving the non-technical aspects of robotics. For the first two workshops the categories were: **Ethics, Legal, Socio-Economic, Data and Engagement.** For the two last workshops the categories were updated to include: **Environment, Legal, Human Experience, Socio-Economic, Data and Engagement.**

An action plan (See figure 10 on page 27)

The action plan is a tool to collaboratively identify problems and discuss potential actions that could be further explored to increase the SRL of the robot. The action plan was a separate piece of paper where the participants noted down their discussions and reflections by filling in the main outcomes of the discussion, barriers and challenges they might have identified and potential solutions/mitigations to the identified barriers and challenges. The idea behind the action plan was to steer the participants into being concrete in their discussion. Additionally, it enhanced the collaboration as they were asked to make a concrete outcome from their discussions.

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The Gameboard

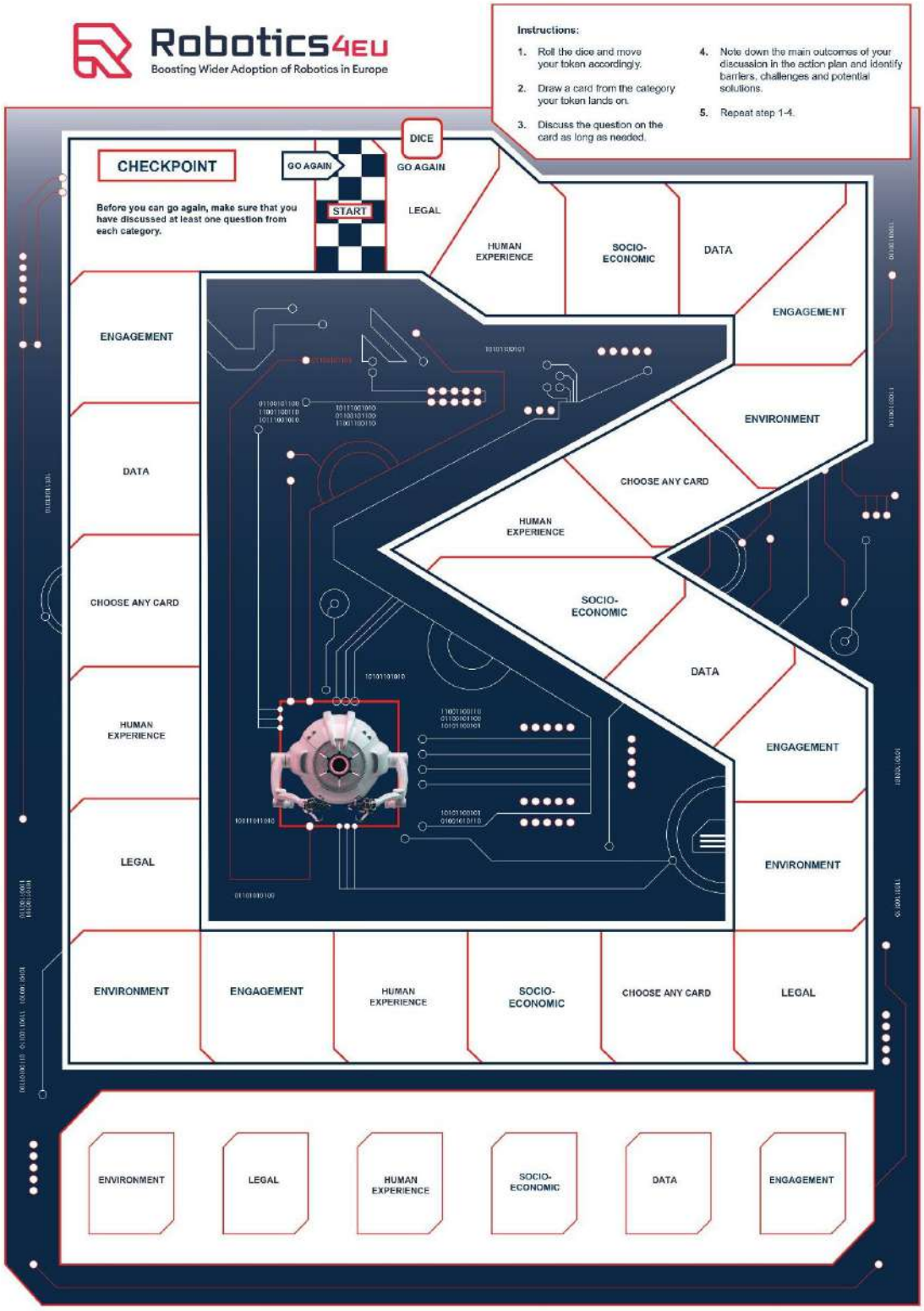

Figure 8: The gameboard of the latest version of the discussion game

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The Question Cards

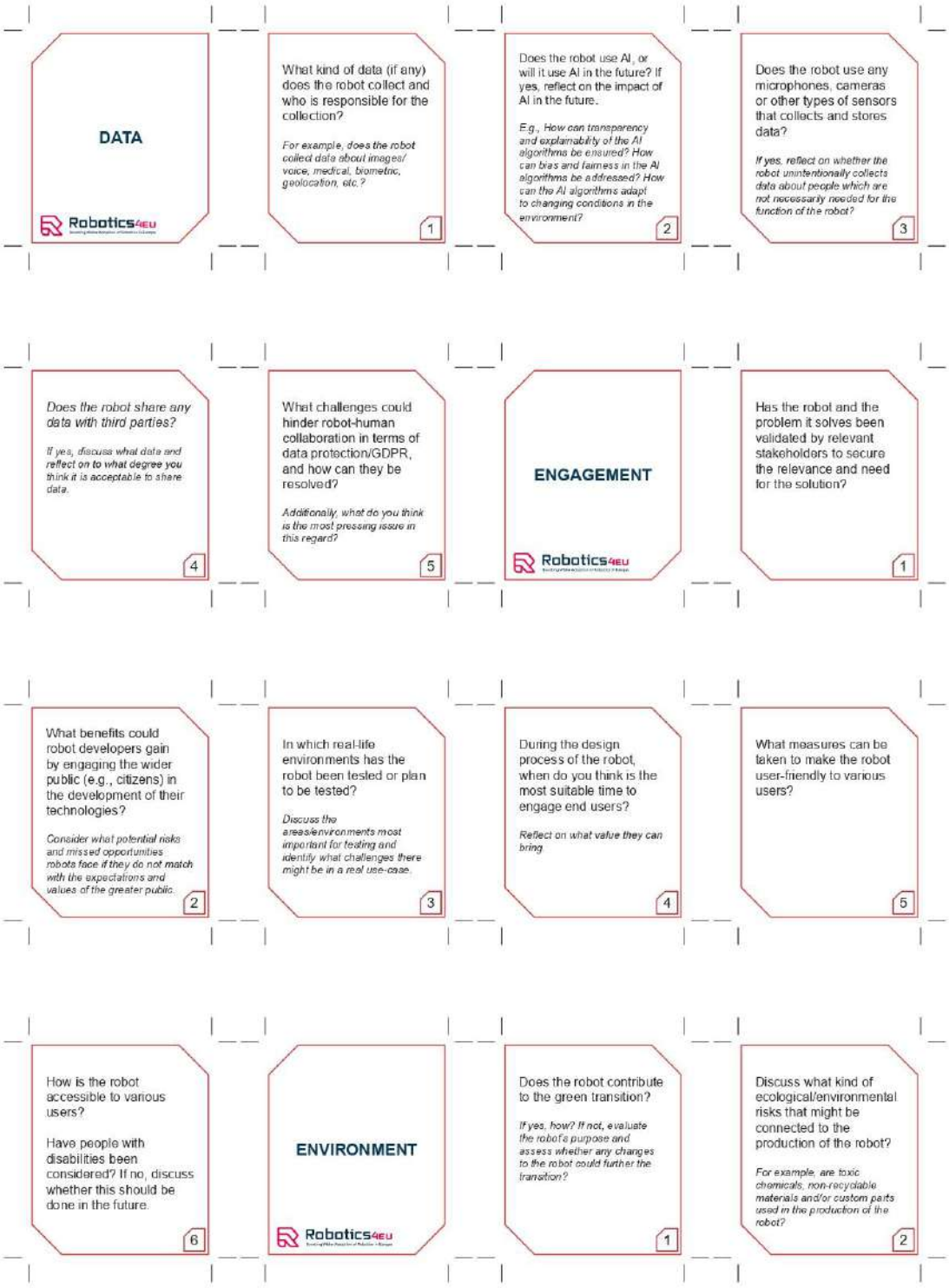

Figure 9: All question cards from version 3 of the discussion game

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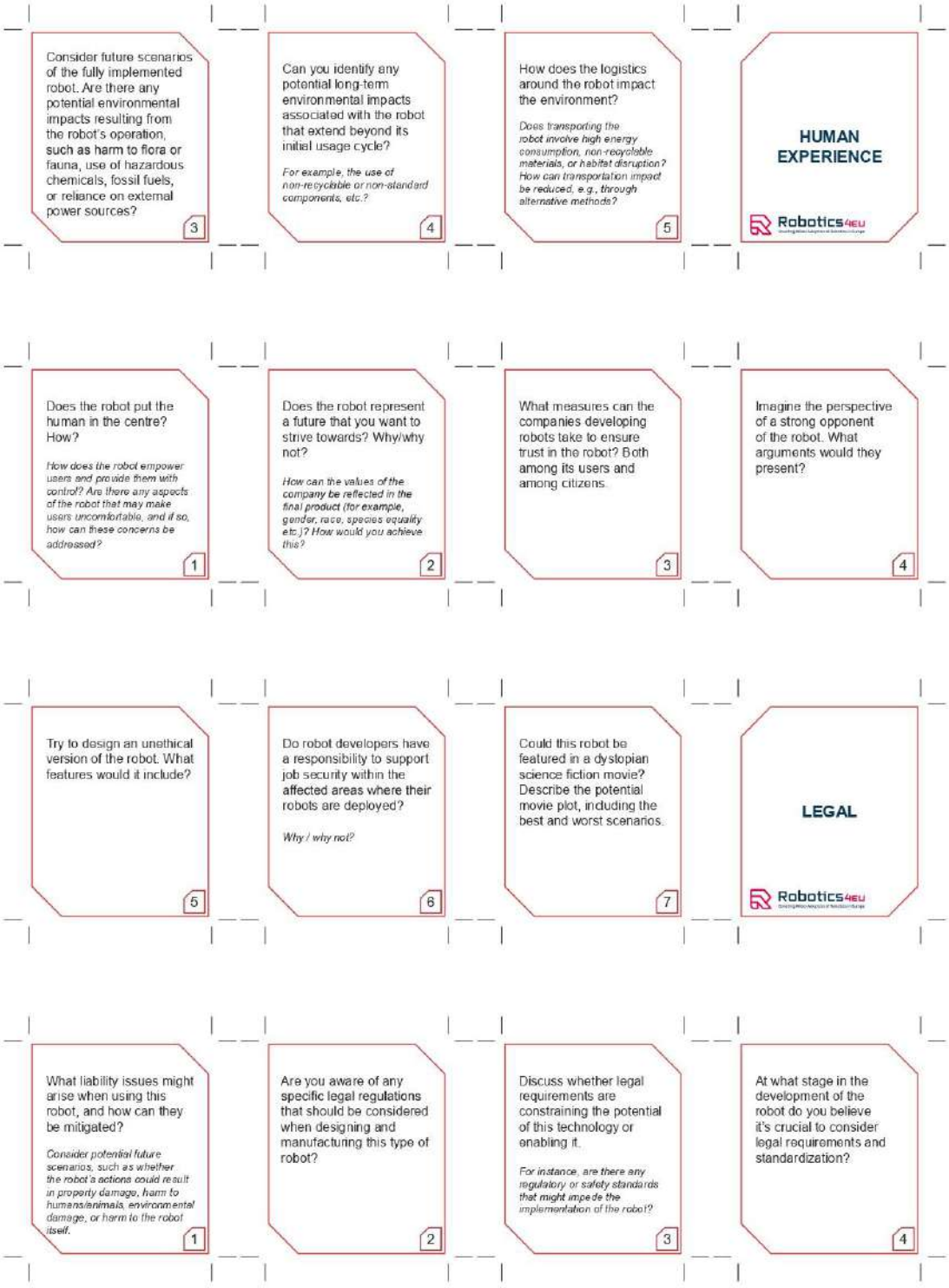

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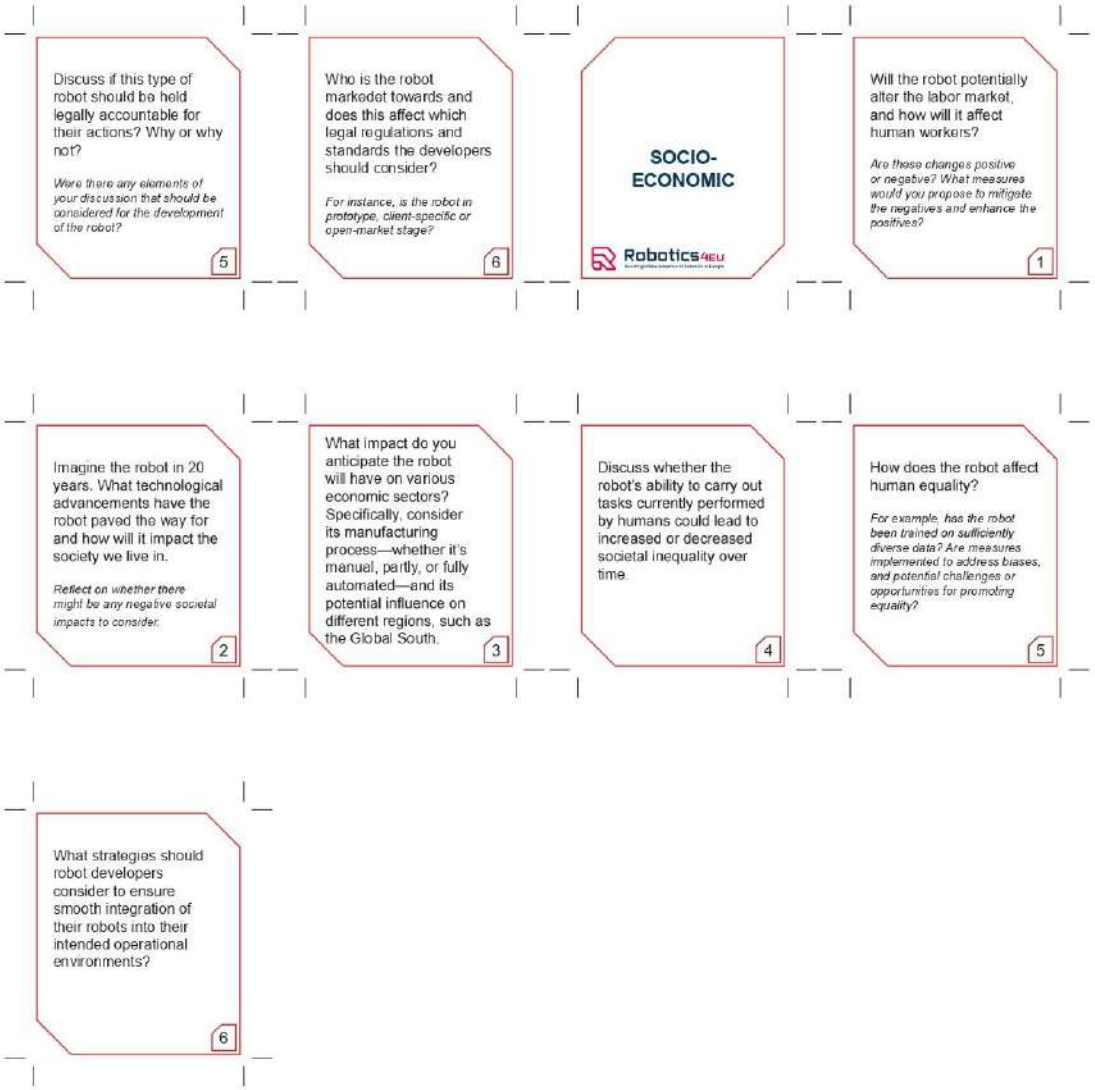

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The Action Plan

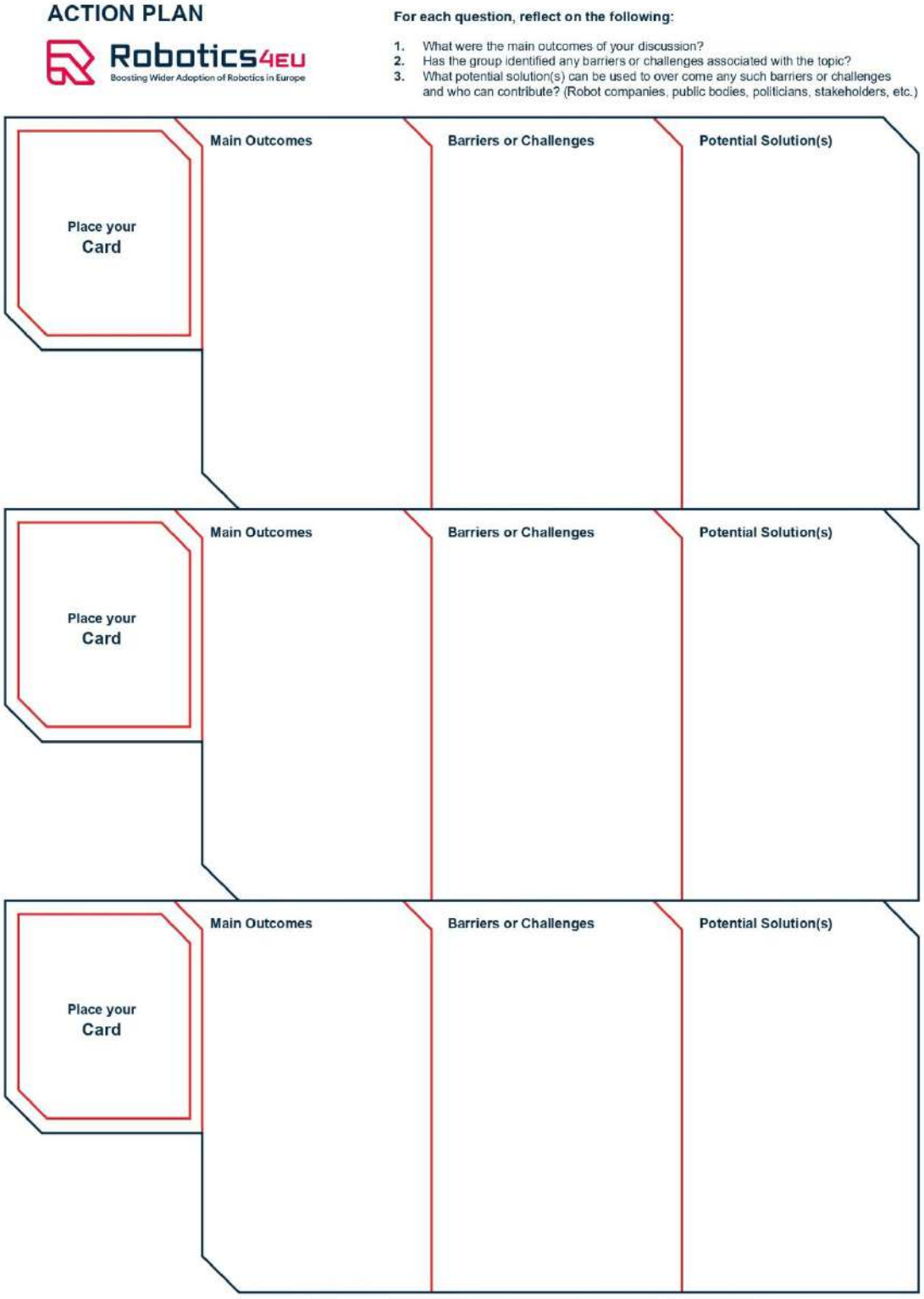

Figure 10: The Action Plan. The action plan is a tool to collaboratively identify problems and discuss potential actions that could be further explored to increase the SRL of the robot.

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The instructions for the game were:

1. Roll the dice and move your token accordingly.
2. Draw a card from the category your token lands on.
3. Discuss the question on the card as long as needed.
4. Note down the main outcomes of your discussion in the action plan and identify barriers, challenges and potential solutions.
5. Repeat step 1-4.
6. If the participants make it all around the gameboard they can start the game again. However, before a new round can start the players have to make sure they have discussed at least one question from each category.

Figure 11: Pictures of participants playing the game.

Together with the explanation of the game instructions, it was also important to introduce the main topics of the question cards, in order to frame the discussion. For each topic the following pitch was presented:

Ethics (used in version 1 and 2)

We are looking at ethics as it is one of, if not the most important non-technological aspect of how we plan on integrating new robotic solutions into our society. It is important for future implementations of robotics to be ethically viable, and we need to constantly conduct analysis and critique of the work being done. We aim to open the discussions and this workshop is centred around the notion that listening to other actors can improve the ethical aspects of new robotic development.

Socio-economics (used in all versions)

The socio-economic aspects are important as these often concern the status of workers and how their lives might change as a result of implementation of new robotic technology. Fears of losing one's job is among the key worries of citizens along with other worries such as inequality. We believe engaging relevant stakeholders can help pave the way for sustainable and responsible solutions.

Data (used in all versions)

Data is an encompassing aspect of much new technological development, and it is important that we constantly review how, why and when data is being collected and used. From our citizen consultations conducted in 2022 we know that

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problems and uncertainties pertaining to data is an area that concerns citizens a lot when it comes to implementation of new robotic technology.[11]

Legal (used in all versions)

Legal aspects should always be included in discussions about new robotic technology. Especially concerning the legal aspects of automated or partially automated technologies. Robots are increasingly becoming decision-makers on their own, completing complex tasks with little to no human input.

Engagement (used in all versions)

Engagement is closely related to many of the ethical aspects of technological implementation. Engaging citizens, end-users and other actors can bring new perspectives and improve development, especially if done early.

Environment (used in version 3)

The environmental impact of robotics is another crucial factor that we need to consider when developing and deploying new robotic solutions. Robotics can have both positive and negative effects on the environment, depending on how they are designed, used, and disposed of. We need to ensure that the environmental benefits of robotics outweigh the costs, and that we adopt eco-friendly practices throughout the life cycle of robotic systems.

Human-Experience (used in version 3)

The human-experience refers to how humans interact with, perceive, and are affected by robotics in various contexts and domains. The human-experience of robotics can influence the acceptance, adoption, and satisfaction of robotic solutions, as well as the well-being, safety, and dignity of human users. We want to understand the needs, preferences, and expectations of different groups of people regarding robotics, and how we can design and implement robotic solutions that enhance the human-experience and foster trust, collaboration, and empowerment.

All these topics were meant to make developers ask themselves: *Will society accept the robots that are presented to them?* This question is essential as it has important implications for several aspects of the future longevity of a robotic solution.

The game was designed to not have a winner nor an end. The playing time can be anywhere from 40 minutes to up to an estimate of 3 hours depending on the time available and how fast participants discuss the questions. The only end to the game is when there are no longer questions available. However, it is not expected that participants make it through all of the questions as the game can easily be played without doing so. This format was chosen to take away the competitive aspect of traditional games so the participants don't have to rush through their discussions and can get

[11] The results from the citizen consultation can be found here: https://www.robotics4eu.eu/publications/globalsay-on-robotics-citizen-consultations-on-wishes-and-concerns/

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engaged in each other's perspectives and views instead of trying to be the first ones to finish the game. The core idea behind the game was to motivate the participants into having engaging discussions in a more fun, creative and interactive setting.

3.3.5 Block 5 - Ending the Workshop

The moderator wrapped up the workshop by summarising some of the key-takeaways from the day and inviting the participants to share any last thoughts or comments. Hereafter lunch was served where participants were encouraged to network across the groups.

3.3.6 Block 6 - Extra Session

For the last two workshops an extra session was added to the agenda. In this session the latest version of the RoboCompass was tested to get feedback for further development and validation. The session on the RoboCompass will be described in a separate chapter 8.

3.4 Planning and logistics of the Workshops

The organisation and planning of the four workshops were led by DBT. The initial planning started in November 2022 at the project's consortium meeting in Tallinn, Estonia in November. Here the format of the workshops were discussed and agreements among the consortium partners were made, deciding that partner AFL, NTNU and Civitta would be co-organisers of the workshops primarily being responsible for recruitment of participants and helping with arranging the logistics of the workshops and being group-facilitators on the day. AFL would be co-responsible for the Agri-food workshop, NTNU for the Healthcare and Agile Production and Civitta for the Inspection & Maintenance. In addition to the help from the co-organisers, the project's communication partner LOBA assisted with creating promotional materials for the event.

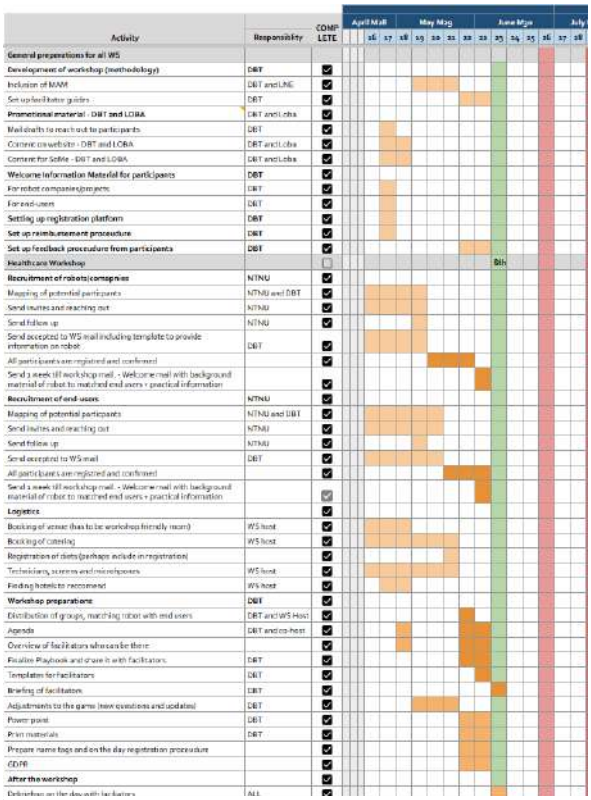

Figure 12: Screenshot of the Gantt chart with all the assignments and the first page of the Handbook for organisers. The idea behind was to create a repository for the planning of the workshops and to continuously develop this document as new materials were developed.

To ensure efficient collaboration DBT set up weekly meetings called Co-creation Fridays where relevant partners participated to plan, give updates on progress, and help each other with challenges as they arose. In addition to the weekly meetings, DBT set up an infrastructure on the project's file sharing system with all the relevant materials and guidelines for performing the task. For an easy overview DBT made a Gantt chart with all the tasks to be performed for each workshop and a handbook for the organisers which was continuously updated gathering all the instructions and links to where different materials could be found.

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3.4.1 Recruitment of participants

One of the main tasks in the workshop-organisation was the recruitment of participants to the events. DBT set the guidelines and targets for the recruitment and the co-organisers performed the task together with DBT. As the workshops were designed specifically around discussing concrete robotics applications with other participants the guidelines were set as follows for each workshop:

- Recruiting up to 10 robotics applications with 1-2 company/project representatives for each robot.
- Recruiting up to 30 participants that could give feedback on the robot, including potential end-users, stakeholders, researchers within the field or experts.

Originally the workshops were only meant to include representatives of robots from companies and projects and their potential end-users but due to high interest from stakeholders and researchers that were not a direct end-user, it was early on decided to broaden the scope of participants in order to include more diverse perspectives to the discussions.

To help with the recruitment the following materials and resources were prepared by DBT and LOBA: template for email invitation, registrations page, social media material and flyers (See an example from one of the workshops in appendix 4.)

A total of four co-creation workshops were organised and carried out with 120 participants attending. See the table below for further details:

Location	Partner	Topic	Date	Nr. of registered participants	Nr. of participants on the day
Vilnius (LT) StartUp Village Alliance event	Lead: AFL/DBT Contributing CE, NTNU	Agri-food	February 7th, 2023	N/A	32
Oslo (NO) In collaboration with OsloMet	Lead: NTNU/DBT Contributing CE, NTNU	Healthcare	June 6th 2023	64	44
Delft (NL) At TU Delft RobotHouse	Lead: NTNU/DBT Contributing CE, NTNU, LNE	Agile Production	October 3rd, 2023	39	26

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Delft (NL) At TU Delft RobotHouse	Lead: CE/DBT Contributing CE, NTNU, LNE	Inspection and Maintenance	October 4th, 2023	39	18
Total				**Min. 174**	**120**

Table 3: Overview of the workshops

3.4.1.1 Recruitment of company/project robots

For each workshop the recruitment process began with the robot representatives from companies and projects. We followed a structured recruitment process, as detailed below.

1. **Mapping Potential Participants**: The first step involved mapping out potential participants and creating a spreadsheet to manage our outreach efforts. This mapping spreadsheet was essential in keeping track of the companies we contacted and their responses.
2. **Initial Contact:** After identifying potential participants, we initiated contact with robot developers, designers, and manufacturers. While we provided draft invitation materials, we prioritised personalising each outreach effort to establish a genuine connection. In the event of no initial response, we followed up or attempted to contact them via phone.
3. **Optional Online or Phone Meetings:** As part of our recruitment strategy, we offered the option of online or phone meetings with interested companies.
4. **Securing Registration:** If a company expressed interest in participating, we implemented the following steps to secure their registration: a. Instructed them to register via the provided registration link. b. Sent them a registration template via email and requested that they complete it and return it to us.
5. **Confirming Participants:** Once the registration process was complete, we inserted the participating companies as a confirmed group in our participant spreadsheet. This helped us maintain a clear overview of all participating organisations.
6. **Inviting Potential Customers:** To maximise the reach, we proactively engaged with the participating companies to inquire if they had potential customers (end-users or stakeholders) who might be interested in joining.

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The above process was followed for the Healthcare, Agile Production and I&M workshop. For the first Agri-food workshop the setup was a bit different as it was organised as part of an existing event called “start-up village”, meaning that the event managers helped to attract participants and ensured participation through those who had already signed up for the event. In addition to the above procedure all partners also made efforts to advertise for the workshops when attending events and through their network e.g., at ERF in March 2023 where flyers were handed out on the three remaining workshops.

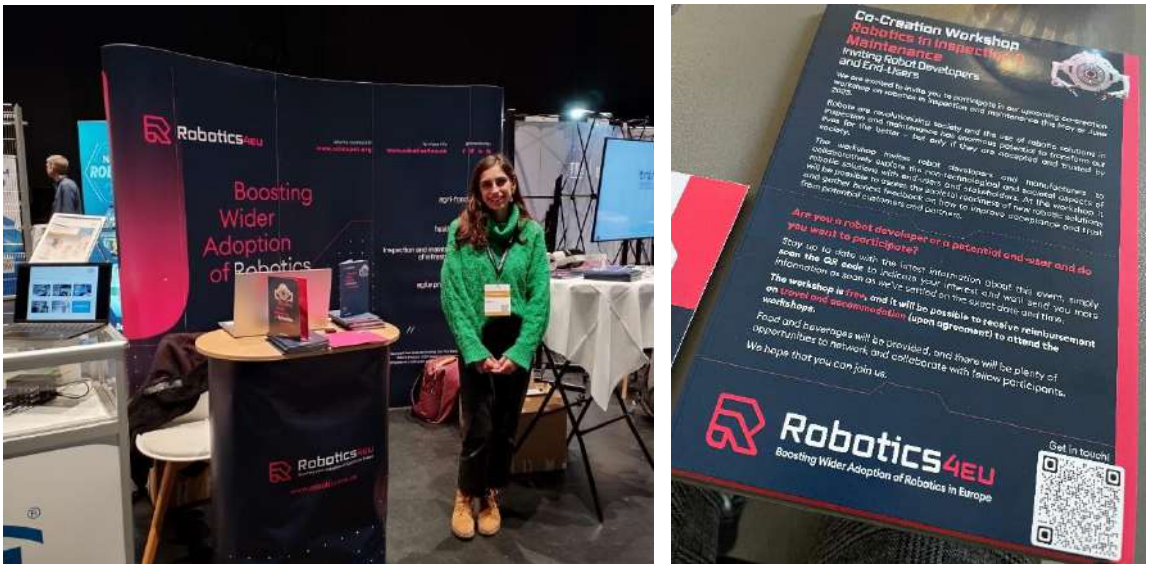

Figure 13: The Robotics4EU booth at ERF wherefrom flyers were handed out

Overall, it proved quite difficult to attract companies or projects who would like to showcase their robot within the different areas[12]. As can be seen in the table below the consortium had to reach out to a large number of people to secure participation.

Workshop	Number of contact points to companies/projects we reached out to *	Number of robots registered	Number of robots participating on the day
Agri-food	12	12	9 divided into 7 groups
Healthcare	50	10	9
Agile Production	91	5	5
I&M	61 + unknown number through the RIMA network	3	3
Total	**Min. 214**	**30**	**23**

*Table 44: Overview of companies/projects reached out to. * The above numbers are an estimation based on counting the number of contacts mapped in spreadsheets. There might be some uncertainties associated with these numbers as partners have also reached out to potential participants without tracking them in the*

[12] This is reflected upon further on in chapter 11: Reflecting on the challenges, limitations and feedback

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spreadsheet. Additionally, the above numbers do not account for our outreach through advertisement at physical networking when attending events (such as the ERF) and through our social media campaigns.

Despite the difficulty in recruiting companies DBT managed to adjust the workshop format accordingly to ensure four successful workshops.

3.4.1.2 Recruitment of end-users, stakeholders, researchers and experts

To recruit the remaining participants, we adopted a strategy similar to the one used for companies. However, we made adjustments by reducing the focus on crafting personalised emails and in-depth structural mapping. Instead, we placed a greater emphasis on reaching a wider audience.

Originally, the plan was to first identify the companies attending with their robots and then proceed to recruit appropriate end-users, stakeholders, and researchers associated with those robots. However, due to the difficulties in recruiting the companies with robots, this sequential approach proved unmanageable as it would have left us with insufficient time to recruit the remaining participants before the workshop dates. As a result, we simultaneously engaged in the recruitment of end-users and stakeholders while continuing our efforts to recruit companies. This meant that it was not possible to target concrete end-users of the robots but instead we had to recruit in a more general perspective.

The recruitment of end-users, stakeholders, researchers and experts proved to be easier than the recruitment of robots and we received multiple registrations by sending emails, newsletters, sharing the events on LinkedIn and through networking at events and word of mouth. Due to the workshop-design we had to constantly be aware of the ratio between the number of robots at the workshop and the amount of people registered to give feedback in order to ensure that we wouldn't end up in a situation where groups would be too big or too small. This was something we managed to successfully adjust for throughout the recruitment and workshop-planning.

In the following chapters we will go through each workshop and the results.

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4 Workshop 1: Agri-food, StartUp Village Alliance, Vilnius, Lithuania

The first co-creation workshop was held on February 7th in Vilnius, Lithuania, as part of the StartUp Village Alliance event hosted by project partner Agrifood Lithuania (AFL). Also present at the event were project partners: Civitta (Estonia, Lithuania), Norwegian University of Science and Technology (NTNU). The workshop was designed and presented by The Danish Board of Technology (DBT).

The event brought together developers, end-users and key stakeholders and sought to: *"encourage the creation of start-ups and innovation in rural areas and to create a space for debate and knowledge sharing to solve regional issues"* ("European Startup Village alliance – serious commitment putting it into practice"). Furthermore, the event sought to establish an environment and a shared space consisting of local businesses, farmers, research organisations, local governmental officials, and citizens to share insights and identify barriers and potential solutions.

The opening speech at the event was given by European commissioner for Innovation and Research Ms Mariya Gabriel. In her speech, Gabriel focused on the importance of rural areas in Europe, their importance to European culture, the problems they have faced and how start-ups might help revitalise these areas and make them attractive places for people to work and live. Further she outlined the plans for the Long-Term Vision for the EU's rural areas, and the New European Innovation Agenda and further explained that: *"The long-term vision for the EU's rural areas is our initiative to develop a common European vision for 2040. Innovation and its role in promoting rural well-being are the heart of the narrative of the Vision. The vision identifies several areas of action towards stronger, connected, resilient and prosperous rural areas by 2040. By acknowledging the enabling role of innovation in empowering citizens and entrepreneurs, the Vision includes a flagship action on research and innovation for rural communities."* (Gabriel, 2023).[13]

The event took place physically at the Vilnius town hall and was broadcasted online.

4.1 Organisation, planning and recruitment

Planning of the event started November 2022 at the Robotics4EU consortium meeting in Tallinn, Estonia. Planning of the workshops was done mainly by DBT who developed the methodology for the co-creation discussion game and prepared playbooks for all partners and created all the relevant content needed for the day. Recruitment of participants was done by AFL. Since they already were in the progress of recruiting attendants to the main event, they were able to attract both developers of relevant robotic solutions as well as end-users.

The workshop engaged a total of 32 participants divided into 7 groups of varying size. Originally, the total number of groups was meant to be 10 but due to a minor shortage of

[13] The full speech can be accessed here: https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_23_851

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participants that number was reduced to 7. Each group had a facilitator at their table to help guide them through the workshop and take notes.

Amongst the participating robotics companies and projects were:

Group nr	Company / Project	Robotics Solution
1	CSIC, CAR FlexiGroBots	Addresses the growing market needs for new robotic technologies and their adoption by ensuring efficient automation of precision agriculture operations and flexible use of multi-robot systems. An automated commercial vehicle for crop inspection and a harvesting assistance robot.
2	FLOX	The Healthy Chicken Company – using advanced Artificial Intelligence to bring better welfare, productivity and sustainability to the broiler supply chain.
	Earth Rover	Agri-tech start-up that focuses on smart innovative technologies, AI and robotics.
	Išmanusis drenažas	System for real time monitoring of soil moisture, drainage runoff, groundwater level and climatic data.
3	Cubilog	Cloud based automation platform with the purpose to give total control to the user over any brand of smart device. Used in farm monitoring & precision farming.
4	Vilniaus kolegija/University of Applied Sciences (VIKO)	Presented a research project with a multi functional quadruped robot used for different purposes, such as patrolling areas or inspection of crops.
5	Agrodronas/VDU doktorantas	Drones and autonomous robots for use in agriculture.
6	CSIC, CAR	Grape robot: Robert (acronym for 'Robot for collaborative manual harvesting') allows human workers to focus on the task of collecting the fruit while the robot provides the physical strength.
7	The Lithuanian Research Centre for Agriculture and Forestry (LAMMC)	Participated with the project: NOBALweath that focuses on new technologies, such as drone imaging and molecular genetics methods.

Table 5: Participating companies/projects showcasing a robot.

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4.1.1 Workshop Agenda

The duration of the workshop was 2 hours and the agenda was as follows:

Time	Program	Notes
10:45-11:00	**Arrival and registration**	Participants arrive and register
11:00-11:10	**Host welcomes and introduces the workshop and the Robotics4EU project**	Introduction in plenum Intro to: • Robotics4EU • CoCreation process • Game
11:10-11:25	**Introduction of the robots** **Groups identify Societal Readiness Level (SRL) of robot with SRL factsheet**	In groups the robot developer presents a pitch of the robot. Facilitators introduce SRL and have the group talk about the current SRL for the robot
11:25-12:50	**Groups use the discussion game**	Host gives information on the discussion game. In the groups the facilitators initiate the game and helps with filling in action plan templates
12:50-13.00	**Wrap-up**	Host rounds up and thanks for participation
13.00 -	**Lunch & attendance to the remaining part of the event**	

Table 6: Agenda for the Agri-food workshop

Figure 14: Pictures from the workshop

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4.2 Main Outcomes from the Session on SRL

Despite the introduction to SRL, the groups encountered several challenges while working with the concept.

In some of the groups there was a common dynamic where initially the developers took charge of the discussion and quickly identified the level they thought their solution had reached. However, as other participants asked follow-up questions, it became increasingly difficult to pinpoint the appropriate level. For example, they might have felt confident about fulfilling Level 6 related to testing the robot in a relevant environment but struggled to affirm all aspects of Level 2 regarding potential impact and expected societal readiness. This made it difficult to find the appropriate level as some aspects might have been fulfilled at one level but not at another. This almost became a barrier for discussions to evolve as it created an uncertainty for some of the groups when they couldn't determine the right level for the token placement. This uncertainty was demotivating and led to temporary stagnation in the discussion which had to be brought back to life by the facilitator.

One group faced a particular struggle with the assignment as they approached it in a scattered manner. Eventually, one participant took control by focusing on all the levels except Level 1. He asked, "Do we think the robot developers have accomplished this?" If the answer was yes, they moved on to the next level; if it was no, they halted the movement of the token. This systematic approach helped the group maintain focus as they progressed through the levels. Furthermore, participants found the visual representation of SRL as a circle to be confusing. Some suggested that a ladder design might be more helpful, emphasising the need to discuss and address each step sequentially. Furthermore, SRL is descriptive in the type of actions taken to validate and demonstrate the innovation in a relevant environment by a linear step-by-step basis. Many participants felt a disconnect with this because first, their own testing processes are often not linear, and second the discussion tool and RCC deal with the societal aspect themselves (legal, data, socioeconomic, human experience, environment) instead of the actions directly.

Lastly, participants observed that the SRL framework appeared somewhat vague, focusing heavily on engagement with stakeholders and testing and validating a problem. This contrasted with the presentation by the workshop moderator, who emphasised crucial topics like ethics, legal considerations, socioeconomics, and other societal aspects of innovation readiness.

Overall, the workshop revealed various challenges in applying the SRL framework, including difficulties in assessing the appropriate stage, uncertainty, and the need for a clearer visual representation of the framework. Additionally, participants highlighted the need to refine the framework's focus on key societal aspects, including those suggested by the workshop moderator, to provide a more comprehensive evaluation of societal readiness.

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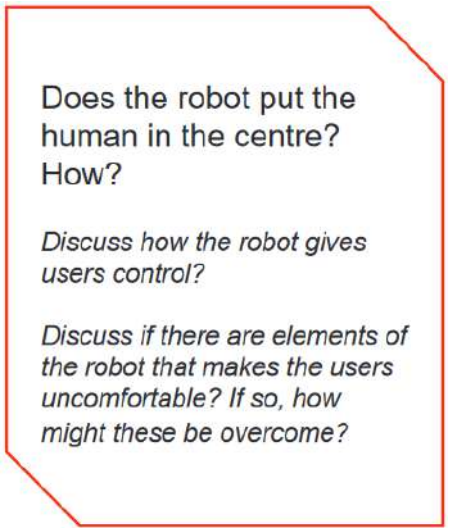
4.3 Main Outcomes from the Discussion Game

For the discussion game the participants engaged in lively discussions on the topics presented. It was clearly visible how the elements of the discussion game played a considerable role regarding the flow of the discussion. Further, the inclusion of these elements also served as an ice-breaker, helping participants to engage with each other. The results are presented thematically by the topics of the question cards and further thematized in the conclusion highlighting the central themes discussed in the workshop. We will not cover all the groups' discussions in detail, but provide snippets from the different discussions and provide a summary of the main themes and findings that emerged from the workshop.

4.3.1 Ethics

Discussions on ethics was something that each group showed considerable interest in. However, since ethics is a broad and encompassing field containing a myriad of subcategories and interpretations some groups had difficulty honing in on a common understanding of the topic and concepts involved. However, in the end such difficulties proved useful , as they prompted groups to reflect on what they considered ethics in relation to their specific robotic solution and *how* they could use these concepts to discuss relevant barriers and challenges. This led many groups to discuss areas such as AI ethics (e.g., data/big data ethics, surveillance ethics and the ethics of automation and employment) and the ethics of human-robot-interaction.



Several groups drew and discussed the question card of whether the robot puts the human in the centre[14]. For this question there were different approaches across the groups.

Some saw the question as an opportunity to discuss whether the robot put the human in the centre by means of its function, the tasks that it does, or the output it creates where others discussed whether the robot puts the human at the centre in a more concrete way, i.e., how the robot behaves as a machine working in close vicinity to humans. For example, one group argued that their solution put the human at the centre by creating standardised procedures for agrifood and thereby making it healthier and by making the end-product healthier and placing a lot of focus on human health, thereby putting the human at the centre.

However, most that discussed this question talked about the more direct human-robot interaction. Some argued that their robots had to put the human at the centre, because

[14] **Ethics Question 1:** Does the robot put the human in the centre? How? *Discuss how the robot gives users control? Discuss if there are elements of the robot that makes the users uncomfortable? If so, how might these be overcome?*

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otherwise their business model would simply not work. Here, it was argued that creating robots for agri-food that does not place the human at the centre is a non-starter, making the product unattractive for the end-users. Others saw an opportunity to discuss whether the human working with the robot is always able to have the final say when it comes to the action that the robot is performing.

Several groups discussed that they could indeed do more to make the interaction between human and robot better and to put more focus on the human in the work situation. One example was to incorporate more parameters that the operator of the robot has direct control over, giving the human more control over the situation. Others discussed equipping their solutions with more sensors to make them more aware of the humans around them. This discussion evolved to include how the robot could be evolved to be more aware and considerate of its surroundings. Such sensors could be used by the robot to be more aware of flora and fauna in the areas where it is working.

Figure 15: Drone from Agrodronas working on drones and autonomous robots for use in agriculture.

The workshop also involved more creative and hypothetical questions. Such as whether they could design an unethical version of the robot[15]. This question was included to get participants to consider elements of their robotic solution that they might not have considered before and to engage the groups in different ways of thinking about their robots. For some groups this question acted as a stepping stone for further discussions and as a positive catalyst for the dynamic of the group, while others found them a bit too fantastical and not relevant in regard to their robotic solution.

4.3.2 Socio-Economics

Discussions on the socio-economic changes that are brought about by the increasing use of robotics are important. For many developers the aim is to make life easier and more convenient for people working in the agri-food sector. However, there are several important considerations that need to be fully evaluated before these types of robots can be successfully integrated into society. Identifying the pros and cons of one's own product can be very difficult but is also a very necessary step towards a successful adoption of a robotic solution. It is necessary to mention that for many groups, it was difficult to talk about the socio-economic consequences as a whole, so many discussions instead revolved around the consequences for the individual worker/farmer as this was a more tangible approach for most.

[15] **Ethics Question 2:** Try to design an unethical version of your solution – what features would it have?

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> Will the robot potentially create changes in the job market and how does the robot impact the job market for human workers?
>
> *Could the workers be offered internal training to work in collaboration with the robot or to find a more qualified job.*

Under this topic, many of the groups discussed the question of whether their robot would bring about significant changes in the job market[16]. Many of the developers argued that their solutions would bring about positive changes in the job market as they allow for the potential to automate repetitive and undesirable tasks to a large extent. This in turn means that workers can focus on other tasks and that they are relieved from physically demanding tasks. For the most part, this was seen as a positive development for workers within the agri-food area.

Another group discussed specifically how the financial elements involved can have severe consequences and why we need to consider a potential increase between rich and poor in society. They argued that the investments needed for this type of automation might place small and/or local businesses at a considerable disadvantage because they might not be able to invest in the robotic solutions and this might affect the agriculture community. Some of the solutions that were discussed pertaining to this problem were that governments need to make sure that profit of automation is fairly evenly distributed and that the interest of developers should not be to maximise profits but rather to ensure a sustainable demand for the solutions. Further solutions could include grants for local or smaller farms to give them the financial overhead to implement robotic solutions.

Figure 16: CSIC, CAR presented a grape robot: Robert (acronym for 'Robot for collaborative manual harvesting') that allows human workers to focus on the task of collecting the fruit while the robot provides the physical strength.

For the majority however, discussions were focused on the positive changes in the job market that were expected to be brought about. Here, it was argued that many of the jobs that people are currently undertaking within the agrifood area are unattractive and undesirable and that the automation of these jobs will in turn create more valuable jobs and jobs with higher salaries.

[16] **Socio Economic Question 1:** Will the robot potentially create changes in the job market and how does the robot impact the job market for human workers? *Could the workers be offered internal training to work in collaboration with the robot or to find a more qualified job.*

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4.3.3 Data

Questions concerning data were of considerable interest for all groups at the workshop. Here, participants mainly discussed if and how their robotic solutions collect and shared data with third parties and whether the solution uses any form of Artificial Intelligence (AI)[17].

Several of the robotic agri-food solutions present at the workshop utilised cameras and/or sensory equipment in some way or another to perform their tasks. Because of this, it is extremely important to consider what pitfalls and barriers there might be towards workers feeling comfortable and safe working in close vicinity to these types of robotic solutions. Many of the barriers that were discussed did indeed concern the amount of data that is being collected as well as if and how it is shared. One particular barrier that was identified was the discrepancy between the necessary need for extensive data collection and sharing with 3rd parties and the unintended collection of data on the workers who are working with the robot. For example, how can companies make sure that workers are not being unknowingly monitored (e.g., on the quality of their work). Solutions towards barriers such as this were discussed at length and some of the proposed solutions were to make the data public. Either available to the workers or widely available to the public, so workers are able to be informed about what data is being collected about them and when.

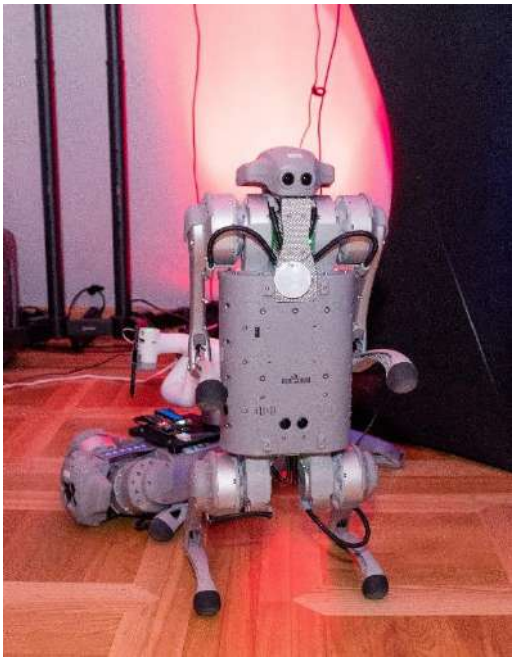

Figure 17: Vilniaus kolegija/University of Applied Sciences (VIKO) presented Presented a research project with a multi functional quadruped robot used for different purposes, such as patrolling areas or inspection of crops

To make workers more comfortable it was also suggested that during the implementation period of a new robotic solution, workers could be involved in the process and learn about how the solution collects and uses data, for example through interactive training courses designed to fit the specific robotic solution. Other potential solutions included not sharing data with any 3rd parties and one company had already taken it upon themselves to build the software as well as the hardware to make sure that all data that is being collected by the robot stays within their control. This solution was coupled with ideas pertaining to limiting the amount of data collected, as well as taking steps to anonymising the data that is being collected. Even for companies that did not yet collect or share data, these discussions were important for making sure that future iterations of their solutions could succeed.

[17] **Data Question 1:** What kind of data will be collected by the robot, and how will it be used?

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One group discussed how their robot was controlled by an app and that they were not sure what data (if any) the app shares with 3rd parties[18]. As this particular robot was a quadruped dog-like robot and therefore very mobile, the discussion turned toward potential hacking of the robot with malicious intentions – such as surveillance, trespassing or warfare. Concerns about the use of the app were raised and it was discussed whether an app that shares data with 3rd parties should be used and if it should, effort was needed to make sure that the data was encrypted.

4.3.4 Legal

As with the discussions on ethics, matters concerning the legal issues concerning robotics were somewhat difficult to discuss for some of the groups. For some, they simply did not see it as a responsibility that the developers and designers should have. It was argued that this kind of awareness and adherence to the rules and regulations is something that needs to happen higher up the chain of command within the company that develops the robot. Other discussions focused on the importance of EU or international treaties. Here, a lot of focus was put on having regulations on robotics within specific areas. For example, for very mobile robots ideas such as “no walking” zones were discussed, similar to the geo-zones that apply to UAS (drones) and are used to indicate whether flying is facilitated, restricted or excluded.[19] Suggestions such as these were seen as a means to help boost the uptake of robotics and make them more easily accepted by arguing for sector specific clear and coherent regulation.

Figure 18: The Lithuanian Research Centre for Agriculture and Forestry (LAMMC) participated with the project: NOBALweath that focuses on new technologies, such as drone imaging and molecular genetics methods.

[18] **Data Question 7:** Does the company share any data with third parties? If yes, discuss what data and reflect on to what degree the users think it is acceptable to share data.
[19] An overview of the UAS geo-zones regulations can be found here: https://www.easa.europa.eu/en/light/topics/geo-zones-know-where-fly-your-drone

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4.3.5 Engagement

Some of the companies expressed difficulties with involving citizens in the testing and development of their robot, they simply did not know how to do it[20]. However, despite this barrier there was a general sentiment that engaging citizens and stakeholders is a very important aspect and one that is needed to make long lasting and successful robotic solutions. It was discussed how engaging stakeholders and citizens has multiple benefits that can be good for sales of the solution as well as is important for a broader acceptance of it. One of the examples of how to increase involvement of citizens in the processes of robotic development was to set out surveys for citizens, so that next time they do a field test of the robot it is possible to involve social dimensions. Among this, there should also be focus on including a wider pool of stakeholders and doing so more often, for example by doing customer interviews to uncover their wants and needs. Such practices should ultimately be coupled with focus on a more constant worker/operator inclusion as this can help uncover some of the barriers that there might be between the worker and the adoption of new robotic technology. This process should be iterative, meaning that the feedback of all involved stakeholders should be implemented into the continuous development of the solution.

Figure 19: Earth Rover and Agri-tech start-up that focuses on smart innovative technologies, AI and robotics.

Although many productive discussions were had on the topic of engagement, there were some that did not see any potential for inclusion and engagement at the current stage or their solution.

4.4 Conclusions of the Agri-food workshop

The event brought together stakeholders and end-users to discuss non-technological aspects of robotics within the field of agri-food. The discussions were framed around concrete robotic solutions that were presented by the developers present at the workshop.

The central themes that came of the discussions of the workshop were:

Safety: Increasing safety by putting more focus on human-centric design, user control, and improving the interaction between humans and robots as well as the need for human operators to have control and autonomy over the robot's behaviour, emphasising the importance of user-friendly interfaces and direct control.

Concerns around income disparity: For example the concern that automation may worsen the wealth gap, with small and local businesses potentially being

[20] **Engagement Question 1:** Have developers mapped relevant stakeholders (e.g., industry, citizens, users) to engage in testing of the robot? How and when will relevant stakeholders be part of the (design) process?

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disadvantaged in adopting robotic solutions due to financial constraints - i.e., the potential disparities in access to and benefits from automation.

Data protection concerns: For example about the storage, handling and collection and sharing of data.

Algorithmic surveillance: Worries about increased monitoring and surveillance at the workplace.

Worker involvement in decision-making processes: As a means to make workers more comfortable with the implementation of new technology, for example by interactive training courses.

Cybersecurity: Concerns about potential vulnerabilities particularly regarding sharing data with third parties as well as worries concerning potential hacking incidents, with malicious intentions such as surveillance or warfare. As well as a call for the emphasised need for data encryption as a protective measure to secure the data and prevent unauthorised access.

Lack of awareness: for example, concerning how to involve relevant stakeholders, citizens etc. into the development of a robotic solution.

Stakeholder and citizen engagement: As a beneficial way to ensure broader acceptance of the robotic solution. Active involvement not only contributes to the commercial success of the solution by enhancing sales but also plays a pivotal role in fostering a more widespread and inclusive acceptance of the technology.

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5 Workshop 2: Healthcare, Oslomet, Oslo, Norway

The second co-creation workshop was held on June 6th in Oslo, Norway at the Oslo Metropolitan University (OsloMet). The workshop was arranged as a collaboration with the LifeBots exchange project[21] and OsloMet. Present at the event were project partners: The Danish Board of Technology (DBT), Civitta (Estonia), Norwegian University of Science and Technology (NTNU).

The workshop was a half-day standalone Robotics4EU event focusing on various robots that can be used within healthcare both in preventive healthcare, curative healthcare and robots that operate in the environment around healthcare. The event brought together developers, end-users, students and key stakeholders and sought to further explore the concept of SRL and to test the categories in the RoboCompass.

5.1 Organisation, Planning and Recruitment

Planning of the event started in April 2023. The logistical planning of the workshops was done mainly by NTNU with support of DBT. DBT further developed the methodology for the co-creation discussion game and prepared playbooks for all partners and created all the relevant content needed for the day, while NTNU recruited particapants.

Through the collaborative partnerships for the event a special deal was made with OsloMet making it possible to borrow a venue for the workshop within the university at a central location in Oslo. And through the collaboration with the LifeBots exchange project we could use an existing network of robot companies and stakeholders working in the field to find some of the participants.

The workshop engaged a total of 44 end-users, stakeholders and robot developers, along with 8 students from OsloMet and 11 facilitators/helpers and 1 moderator for a total of 64 people present at the workshop. The participants were divided into 9 groups of 4-7 participants. Each group had a facilitator at their table to help guide them through the workshop and take notes.

Amongst the participating robotics companies and projects were:

Group nr	Company / Project	Robotics Solution
1	**Lifeline Robotics**	Automated throat swab robot
2	**No Isolation and OsloMet**	AV1, a telepresence robot for remote learning.
3	**IDmind**	The robot HARMONY is an assistive robot for Repetitive and on-demand deliveries, manipulation of small objects

[21] See more here: https://cordis.europa.eu/project/id/824047

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		and social interaction.
4	**IDmind**	Elmo is a tabletop solution developed to be an embodiment of telepresence or interface.
5	**Intuitive and Lancaster University**	Surgical robot for minimally invasive surgery.
6	**Jodacare**	Social robot that uses AI to keep elderly people less lonely.
7	**University of Southern Denmark**	home-based rehabilitation robot for physiotherapy.
8	**Autonomous units**	Disinfection robot.
9	**Miro-E and University of Hertfordshire**	A pet-like robot that can function as a remote learning and teaching tool.

Table 7: Participating companies/projects showcasing a robot at the healthcare workshop

5.1.1 Workshop Agenda

The duration of the workshop was 3 hours and the agenda was as follows:

Time	Program	Notes
9:30-10:00	**Registration and welcoming coffee**	Participants register and receive name tags
10:00-10:10	**Welcome and introduction**	Moderator introduces R4EU and Workshop
10:10-10:25	**Internal group introductions and pitch of robot in each group**	Participants introduces themselves to each other and get a pitch of the robot
10:25-10:50	**Each group identify Robot's SRL**	Moderator introduces SRL afterwards each group works together to identify the SRL of their robot
10:50-12:00	**The discussion game**	Moderator introduce the R4EU game and all groups start playing game
12:00-12:30	**Summarising workshop in plenary**	Moderator ends the game and groups discuss which 3 main outcomes from WS they wish to share with other participants in plenary.

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12:30-12:45	**Ending workshop**	Moderator thanks participants, facilitators and helpers for contributing to the workshop
13:00-14:00	**Networking lunch**	Lunch for everyone attending the workshop

Tabel 8: Agenda for the healthcare workshop

Figure 20: Pictures from the healthcare workshop

The workshop followed the same structure as the first workshop on agri-food however with some modifications:

1) A new version of the discussion game was developed to improve on some of the challenges identified with the gameplay from the first workshop. The categories for the questions remained the same, but the questions were updated and improved. The biggest change was to separate the SRL to its own section of the gameboard to make a clear differentiation between the SRL and the discussion game. Simultaneously to the planning of the workshop, extensive efforts were underway to enhance the RoboCompass, with plans for a comprehensive update following the workshop. Essential for the RoboCompass was to do one last test of the concept of SRL in order to make a final decision on whether to include the concept in the RoboCompass or to leave it out.
2) More time was allocated for the different sections of the workshop extending the workshop by one hour. Reflecting on the experience with the SRL from the first workshop it was important to set aside a bit more time for the participants to get better acquainted with the concept to fully understand if it was the time-

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constrained circumstances of the workshop that made the SRL difficult to work with.

3) Adding a summarising session to round of the day. Here each group presented their main takeaways from the day.

5.2 Main Outcomes from the Session on SRL

Due to the challenges faced by participants in comprehending the SRL session during the first workshop on agri-food, we tried to improve on this session for the Healthcare workshop. We allocated additional time for participants to have more time to get acquainted with the concept, and the moderator exerted extra effort to explain the concept. These changes seemed to improve the session and the participants felt more comfortable with the assignment and most groups were successful in identifying the SRL for the individual robots which was not the case in the agri-food workshop.

Below is an overview of what SRL the groups identified for their robot:

Group nr	Company / Project	SRL
1	**Lifeline Robotics**	3
2	**No Isolation and OsloMet**	3
3	**IDmind**	2/3
4	**IDmind**	4
5	**Intuitive and Lancaster University**	9
6	**Jodacare**	2
7	**University of Southern Denmark**	6
8	**Autonomous units**	7
9	**Miro-E and University of Hertfordshire**	N/A.

Table 9: Overview of the robots assesed SRL level

In addition to writing notes about the identified SRL, we also asked the facilitators to pay special attention to the participants' experiences with the concept of SRL. We wanted to know how easy or challenging the participants found deciding on their current SRL, what aspects of the exercise worked well and what did not. These insights were just as important as identifying the SRL levels as the development team of the RoboCompass in WP1 could use these reflections as contribution to their determination of whether to use the concept of SRL in the RoboCompass or not.

Upon reflection, we found that the exercise was easier but certain aspects of the SRL were still challenging for the participants. The workshop revealed that, for many groups, the conversation flowed smoothly, yet some struggled to stay focused on the topics of

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SRL. While some approached the exercise with a structured mindset, others faced difficulties in answering one level at a time, as it was not always possible give clear yes or no answers and secondly there was the same issues as in the agri-food workshop of what to do in cases where robots fulfilled aspects of higher levels without meeting the criteria of lower stages.

Several challenges surfaced during the exercise. Some groups encountered difficulty in distinguishing between closely aligned SRL levels, leading to discussions that may have been more time-consuming than anticipated. Moreover, the terminology used in the SRL framework presented a challenge, with terms like "identified," "tested," and "validated" causing confusion as this terminology for the participants made much more sense in technical/engineering contexts than in a discussion on the social contexts. This confusion often steered conversations toward technical aspects, contrary to the workshop's goal of emphasising societal considerations.This resonates well with the point made in the first workshop regarding the concept overlooking important aspects of the societal context such as ethics, socio-economics etc. by mainly focusing on testing and validating the robot with stakeholders.

Overall the workshop's findings underscored the need for further refinement and clarification of the SRL framework to enhance its effectiveness in fostering awareness of the several societal aspects of robotics, if it was to be used in the RoboCompass.

5.3 Main Outcomes of Discussion Game

This section describes the main outcomes of the workshop. The results are presented thematically by the topics of the question cards and further thematized in the conclusion highlighting the central themes discussed in the workshop. At each table participants engaged in lively discussions via the discussion game that acted as the central element for engagement and facilitation. The design of the discussion game played a big part in engaging the participants at the workshop and that the gamification helped ease the discussion along. We will not cover all the groups' discussions in detail, but provide snippets from the different discussions and provide a summary of the main themes and findings that emerged from the workshop.

5.3.1 Ethics

As the theme of the workshop was healthcare robots, it was expected that questions concerning ethics would be of considerable interest to the participants.This was indeed

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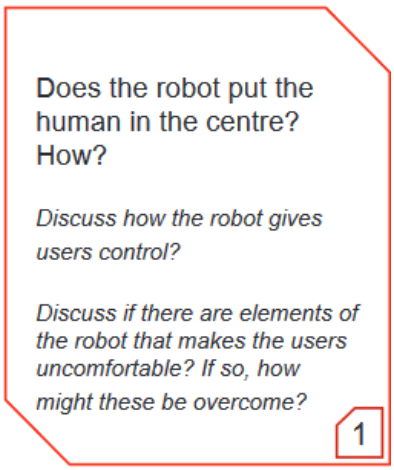
the case and questions concerning ethics were widely discussed by all groups at the workshop and was something that the participants were all very engaged in.

Concerning the question of whether the robot puts the human in the centre participants discussed the challenges, barriers and potential solutions that there might be concerning a human-centric approach to robots in healthcare[22]. Groups were in agreement that their solution did indeed place the human in the centre and that users have control. Many participants emphasised the importance of granting humans the ultimate authority over the robot, considering it as a crucial factor in maintaining a human-centric approach. For example, robots that utilise cameras (or sensory equipment) might make some users uncomfortable in various ways - even when the robot is turned off. Users might feel that they are being watched and they might not be able to verify that they are not. One possible solution to similar challenges could be to focus on creating solutions with simple and user-friendly interfaces that allow turning off certain features giving them greater control. Although this solution may not address every privacy concern among users, it can contribute to enhancing the perception of control and potentially alleviate some of their concerns.



One group discussed the possibilities that came with their robot being modular. Having a modular design can help put the human in the centre in multiple different ways, one of these being that the robot is able to quickly adapt to the needs of its environment. Such an approach can be useful as it fosters multiple possibilities for customization, flexibility, scalability etc. This could mean that in situations where users might be uncomfortable with a certain asset or feature of the robot, this might be removed or changed for each specific use of the solution. Making the robot able to adapt to its needs and environment helps put the human in the centre as users gain control.

Almost all of the groups and participants discussed the possibilities for including the end-users (or other relevant persons that will be interacting with the robot) as much and as early as possible.

The group discussing the DMD4000 disinfection robot from Autonomous Units (figure 16) specifically discussed giving employees that are going to be interacting and working with the robot the opportunity to play and engage with it. The idea is that such engagement

Figure 21: Robot from Autonomous Units

[22] **Ethics Question 1:** Does the robot put the human in the centre? How? *Discuss how the robot gives users control? Discuss if there are elements of the robot that makes the users uncomfortable? If so, how might these be overcome?*

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can help users learn what to do and what not to do and that this will in turn increase trust in the application. This also gives the users/employees a chance to learn how the robot reacts in different situations and consequently how humans can react to it. This idea partially came from a worry about one specific barrier, namely the cost of the robot. In the case of this specific robot, employees were well aware of the price of the robot and were afraid to "mess it up" as they are not used to working with this kind of expensive material. Therefore, inclusion is important as participants argued that just one bad experience with the robot can create a general negative attitude towards it and getting to know the robot by interacting with it can play an important part overcoming fears and prejudice. One participant in the group shared a story on how a heavy robot that was blocking the elevator while a bleeding patient needed to get out. Thus, it was argued that robots that are to be used in these areas need to be able to be moved manually and should therefore not be too heavy. This group also discussed whether the robot in question represented a future that we as a society want to strive towards and why/why not this might be. Here, there was a clear consensus that this was indeed the case. The robot represents a working day that is both easier and more interesting for employees. Furthermore, the robot is easy to use for all kinds of people and the company has had positive experiences with people utilising it.

The group discussing the Miro-E robot (figure 17) also deliberated on the questions concerning what a strong opponent of such a robotic solution might say as well as what an unethical version of the robot might look like[23],[24]. These questions were included to get participants to think about some of the aspects of the robots at the workshops that otherwise might not have come up and they are often very well liked by participants and discussed lively as they allow people to get creative in their discussions. Here, this particular group discussed how an opponent of the robot might argue that ordinarily, people would not like to have a robot with cameras and sensors in their home and they would likely fear that the robot would hurt them - either by accident or on command. Further, to make an unethical version of the robot, it was argued that such a robot would be deliberately disobedient as well as non-compliant with GDPR regulations. Such a robot would also record the users without consent or in secret and would purposely give out wrong information.

Figure 22: Robot from Miro-E

From the discussions in the groups it was obvious that for almost all robots present at the workshop, their purpose was indeed to put the human in the centre as they were all concerned with the healthcare sector in some way or another of varying degrees. Another concern that was widely discussed was whether developers of healthcare

[23] **Ethics Question 3:** Try to imagine what a strong opponent of the robot would say. What arguments would they put forward?

[24] **Ethics Question 4:** Try to design an unethical version of the robot – what features would it have?

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robotics have a certain responsibility to assist to facilitate job assurance within the impact area of their robot. Naturally, as healthcare robotics continue to advance and become increasingly integrated into various medical settings, there is a growing apprehension regarding the potential displacement of human workers and this was a dilemma that participants found both challenging and interesting to deliberate.

Many agreed that developers have a certain responsibility to consider the broader societal consequences of their solutions and that development of these kinds of new technologies should be done in tandem with the people who will be using the solution (as well as end-users, stakeholders and decision-makers) since companies bear a certain responsibility for how their solution fit into society as well as specific work environments. It was argued that it is important for people that are going to be using the solution to receive the right training. For this, participants at the workshop mostly placed the obligation on the developers and companies, who have a responsibility towards making sure that people are trained properly to use their products.

5.3.2 Legal

Questions concerning legal matters were interesting for most groups, but also something that were somewhat difficult for some groups to discuss. The workshop invited end-users and developers (as well as stakeholders and researchers) to discuss the non-technological aspects of robotics. This selection of participants also meant that many participants felt that they were not in a position to give qualified inputs regarding this matter. Nonetheless, valuable discussions were held.

Some of the groups at the workshop discussed questions concerning what kind of liability issues that may arise when using healthcare robots and how these might be mitigated[25].

Participants were asked to consider potential future scenarios and reflect on who should be held accountable if the robot makes a mistake or causes harm (either to material/objects or people). Here, participants discussed the many difficulties that arise in this regard and that it depends very much on both the specific robot and the business structure. Another important aspect discussed was the potential malfunctions in robotic systems and how these pose a critical concern, especially in healthcare where patient safety is paramount. Identifying the cause of malfunctions—whether from improper use, insufficient training, or machine errors—is pivotal.

5.3.3 Data

Questions concerning data, cybersecurity and privacy are very important when discussing robotic technology, especially in areas such as healthcare where sensitive data about patients will often be collected. As much as innovative medical equipment and technological solutions are becoming more vital to patient care they can become the target of hackers. Therefore, the importance of security and privacy in regards to data collected within the healthcare sector is more important than ever and it is evident that

[25] **Legal Question 2**: What liability issues may arise when using healthcare robots, and how can these be mitigated? *Think about potential future scenarios e.g., reflect on who should be held accountable if the robot makes a mistake and causes harm to objects or people.*

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the healthcare sector is facing new cybersecurity risks. Amongst these new technologies are of course a wide variety of healthcare robots as well, some of which were discussed at the workshop.

Several groups discussed the question concerning what kind of data that will be collected by the robot[26]. Here, participants discussed the best ways to store data collected by the robots and how users (as well as companies) can be assured that their data is not misused or shared.

Two of the robots at the workshop shared considerable similarities – both being telepresence robots that are able to provide a sense of presence and allow individuals to virtually be in another place without physically being there, for example with the

Figure 23: Telepresence robots from IDmind and No Isolation

purpose of making sure that children, elderly and others do not feel lonely or can interact remotely with others. They resembled each other both in design and function. Within the healthcare sector these robots can be used by doctors to conduct virtual patient consultations or by caregivers to remotely monitor patients. In education, they allow students who are unable to physically attend school to participate in classes and interact with teachers and peers.

These solutions offer novel approaches for remote collaboration and presence, enabling people to interact across distances in an engaging and more immersive manner. However, it is also very important that such robots are used with a consideration for privacy and security when concerning the data that they collect. Since solutions such as these transmit data across networks, it is essential to follow best practices to ensure privacy and confidentiality for users on both ends. Groups discussed the way that their robots collect data and how they can ensure privacy and safety. Some of the main barriers and challenges discussed in this regard were how to ensure that data from livestreams is not hacked or compromised in some other way. As these robots collect various types of data related to the individuals using them, such as facial images, voice recordings, personal identifying information (e.g., name, age, gender etc.), and health-related details, ensuring trust and maintaining data privacy becomes crucial. Developers

[26] **Data Question 1:** What kind of data will be collected by the robot, how will it be used and who is responsible for it?

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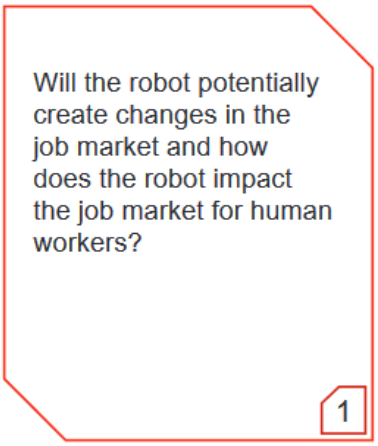
must prioritise implementing comprehensive plans to address these concerns if these technologies are to be trusted by citizens and potential patients.

5.3.4 Socio-Economics



All groups at the workshop discussed the question of how their robot might potentially create changes in the job market[27]. There was a broad consensus among the groups that while there will most certainly be an inevitable change in the job market as a result of the increasing implementation of robotics in the healthcare sector, it does not follow that workers will lose their jobs. On the contrary, there was a general agreement that the robotic solutions present at the workshop will help alleviate physically strenuous and stressful work for healthcare workers. The automation of jobs is already happening at an increasingly larger scale and is helping to reduce the workload for healthcare personnel, freeing up time for them to take care of other and more important tasks directly related to patients. Another point that was extensively discussed was the prevalent issue of severe understaffing in numerous areas of the healthcare industry. In this case, human robot collaboration can create new job opportunities for workers, meaning that they will be able to be upskilled and take on other roles. So, while the role of many workers will undoubtedly be different, the aim is to make their lives easier and relieve them from burdensome tasks.

Some of the barriers and challenges discussed in relation to this question focused on how to create a good transition of the robot into the workplace. The successful integration of new technologies will necessitate extensive training for individuals who will closely collaborate with the robots. It was emphasised that such training needs to be regularly reinforced and expanded. Moreover, it was asserted that access to information and relevant education is crucial for building trust in robots. Specifically it was argued that if workers are allowed to also be involved in the design process of the robot, they have the opportunity to express which tasks they no longer wish to perform, leading to increased acceptance of the robot. Such an approach could help alleviate the concerns that some have about robots taking their jobs.

[27] **Socio-Economics Question 1:** Will the robot potentially create changes in the job market and how does the robot impact the job market for human workers?

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5.3.5 Engagement

Engaging stakeholders, users and citizens has multiple benefits. It is especially important for robotic solutions within the healthcare sector, as they need to be broadly accepted by citizens and society in order to function properly and benefit society.

Figure 24:Robot from IDmind called ELMO

Groups discussed the question about stakeholder engagement and the difficulty of engaging the correct users and experts to test and validate the solution[28]. Many argued that getting the relevant people to validate a solution is both time and resource consuming and often comes down to funding. The group discussing the IDmind ELMO (Picture 19) found it difficult to recruit people to do testing, meaning that the robot has not yet been tested with end-users. One particular difficulty was that people working in for example care homes (where the robot is intended to be used) do not have the time nor the expertise about the technology to provide relevant feedback. Other difficulties here were concerned with expensive costs (e.g., in Europe) when it comes to testing and validating, meaning that it can be difficult for companies to cover testing periods.

The group discussing the Autonomous Units robot were one of the groups that had tested their solution and engaged end-users within a relevant area, as it had been validated at a hospital. Here they found that the solution was efficient and fast in killing bacteria at its designated environment. However, it was further argued that the barrier here was not necessarily the robot, but rather technical details in the different work environments and unclear rules in the area. The fact that many countries have different regulations makes it complicated for companies to enter into new markets with their solution. Further, it can be difficult to create a sustainable and broadly applicable solution because of multiple difficulties concerning how it communicates with different infrastructure (e.g., inability to open doors, push buttons etc.). One discussed potential solution is to promote a more concentrated scientific approach to disinfectant robots, particularly at the EU level, to avoid being guided by developments in other regions. Governments should clarify rules and give recommendations moving towards a standardised structure for disinfection robotics to avoid stalls in development, e.g., due to diverging regulations concerning antibiotic material. The group focusing on the MIRO-E solution discussed that it had not yet been tested in relevant areas but had plans to do testing in people's homes under various circumstances. Some of the barriers mentioned here, was the fact that it might be difficult to get the people to act like the robot was not there during the testing phase in order to get the best results. Discussions were had about the question of when and how to include end-users[29]. There was a broad consensus, both among the developers and the users and stakeholders, that this was a good idea and something that should

[28] **Engagement Question 1:** Has the robot and the problem it solves been validated by relevant stakeholders to secure the relevance and need for the solution?
[29] **Engagement Question 4:** During the design process of the robot, when do you think is the most suitable time to engage end users? *Reflect on what value they can bring.*

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ideally be done early in the process of new technological development, no matter what type of robot that was being developed. Such inclusion can bring additional value and different points of view and insights in relation to the development.

5.4 Conclusions of the Healthcare workshop

The co-creation workshop brought together stakeholders, researchers and end-users to discuss non-technological aspects of robotics within the field of healthcare. The discussions were framed around concrete robotic solutions that were presented by the developers and company representatives present at the workshop.

The central themes that came of the discussions of the workshop were:

Perceived safety: For instance, how people experience robots equipped with cameras and sensors in their homes and how this might lead to a sense of privacy invasion and surveillance, underscoring the importance of addressing privacy issues associated with robotic technologies.

Fears concerning job replacement: In relation to the increasing implementation of robotics in healthcare and following from the potential displacement of human workers in the healthcare sector as a result.

Changes in the job market: Related to how the implementation of robotics in the healthcare sector will likely lead to changes in the job market. These changes will not necessarily result in workers losing their jobs, but rather a transformation of their roles as well as workload reduction, and addressing workforce challenges like understaffing.

End-user and stakeholder engagement/involvement: There was a concern with the difficulties of engaging relevant users, experts and stakeholders for testing and validation, often in relation with the associated costs, and with the technical and regulatory challenges in various work environments. The importance of early end-user inclusion in the development process is emphasised as a valuable practice.

Concerns around data protection: Often in relation to the privacy and trust issues raised by the collection of various data (e.g., name, age, gender, etc.), and health-related information. It is of critical importance to address privacy and security concerns related to data collection, transmission, and storage. Ensuring trust and maintaining data privacy is considered paramount, especially when dealing with sensitive user information. Developers are urged to prioritise developing and implementing comprehensive plans to address these concerns and build trust among users and potential patients.

Communication, regulation and infrastructure: specifically concerned challenges include varying regulations in different countries, difficulties in adapting to different work environments, and obstacles in communication with existing infrastructure.

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6 Workshop 3: Agile Production, RoboHouse, Delft, The Netherlands

The third workshop was held on October 3rd in Delft, Netherlands at TU-Delfts venue called RoboHouse. Present at the event were project partners: The Danish Board of Technology (DBT), Civitta (Estonia), Norwegian University of Science and Technology (NTNU), LNE (France).

The workshop was held in connection with the fourth workshop as two separate events following each other over two days in the same location.

6.1 Organisation, Planning and Recruitment

Planning of the event started in June 2023. DBT were in charge of the logistical planning of the workshops and development of the methodology for the co-creation discussion game and prepared playbooks for all partners and created all the relevant content needed for the day, while NTNU recruited particapants.

The venue for the workshop was a place called RoboHouse in the netherlands. RoboHouse is “an industrial environment on the TU Delft Campus designed to encourage learning by doing, where innovative organisations, SMEs and talented individuals can develop and test their robotics applications in a variety of settings and contexts”[30]. RoboHouse was deliberately chosen due to its relevance to the field and to hopefully be an attractive venue for participants to attend to.

The workshop engaged a total of 26 stakeholders, end-users and robot developers, along with 7 facilitators/helpers and 1 moderator for a total of 34 people present at the workshop. The participants were divided into 5 groups of 4-7 participants. Each group had a facilitator at their table to help guide them through the workshop and take notes.

Amongst the participating robotics companies and projects were:

Group nr	Company / Project	Robotics Solution
1	DARKO project	Driving robot that should work efficiently handling objects together in work-environments with people, particularly in logistics and production.
2	Digiotouch	Robot that can automate the manual task of arc-welding in an agile production factory.
3	Industrial Robotics	Focused on making robots accessible to factories that do not necessarily mass produce but rather manufacture in smaller batches and for individuals who lack robotics or programming expertise

[30] Cited from the RoboHouse website: https://robohouse.nl/about/

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4	SINTEF	Robot that can handle loading and unloading of dynamic objects from hanging conveyors without modifying current facilities.
5	Senseglove	Wearable glove with force feedback technology that can be used for several applications within agile production such as training of robots.

Table 9: Companies/projects showcasing a robot

6.1.1 Workshop Agenda

The duration of the workshop was a full-day event and the agenda was as follows:

Time	Program	Notes
9.30 - 10.00	**Welcome and registration**	Participants register and receive name tags
10.00 - 10.10	**Welcome and introduction**	Moderator introduces R4EU and the workshop
10.10 – 10.20	**Presentation**	Presentation on the importance of discussing the non-technological aspects when developing robots from the moderator.
10.20 – 10.50	**Pitch of robots in plenary**	4 min pitch from the representative of each robot to everyone
10.50 – 11.05	**Group introduction and Q&A**	First group activity: Everyone introduces themselves. Q&A regarding the specific robot in each group.
11.05 – 12.15	**discussion game**	Second Group activity: Moderator introduces the game and the group facilitators start the game. Groups are encouraged to take a 10 min. break at some point in the game. The group facilitator will let the group know when to be back.
12.15 – 13.00	**Lunch**	
13.00 – 13.10	**Welcome back**	Introduction to upcoming session

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13.10 – 13.20	**Introduction to RoboCompass**	Presentation and live demonstration of the RoboCompass ● What is it ● Why did we make it ● What is that we want to achieve with it
13.20 – 13.25	**Introduction to brainstorm session**	The groups were asked to collaborate in groups to refine RoboCompass content. We value your input on risks and mitigations to ensure diverse perspectives. Use the posters to share existing and new insights, helping us validate and enhance our compass.
13.25 – 14.01	**RoboCompass brainstorm session** **Category 1-3.**	● For each category the group has 12 minutes. ● 5 minutes for individual discussion. 2½ for risk 2½ for mitigation. ● 7 min. for summarization and group discussion on what is missing.
14.01 – 14.11	**Break**	
14.11 – 14.35	**RoboCompass poster session** **Category 4 - 5.**	● For each category the group has 12 minutes. ● 5 minutes for individual discussion. 2½ for risk 2½ for mitigation. ● 7 min. for summarization and group discussion on what is missing.
14.35 – 14.55	**Wrap up: Final discussion round**	In groups discuss: ● What is your first impression of the tool? ● Do you have any recommendations that could help improve the RoboCompass? ● Would you feel safer if robotics companies had used such a tool? / Would you rather buy a robot from a company that has used a tool such as this?
14.55 -15.00	**Wrapping up**	The moderator waps up the day and invite the participants to stay and networking with the other participants

Table 10: Agenda for Agri-food workshop

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For our third workshop, we organised a full-day event divided into two sessions. The morning session focused on exploring various robots in the agile production field through the discussion game, while the afternoon session was dedicated to testing the latest online version of RoboCompass. We made the decision to extend the workshop because RoboCompass had reached a developmental stage where we could showcase a functioning online version. Leveraging the relevant participants already joining the co-creation workshops, we aimed to seize this opportunity to conduct thorough testing of RoboCompass and its content in an interactive workshop environment.

The session before lunch followed the same structure of the previous co-creation workshops centering around the participants interacting with the discussion game. A few updates and modifications were made to improve the agenda from the last time:

1. A new version of the discussion game was developed to match with the newest updates to the RoboCompass. This meant updating the game with new categories for the questions and updating the questions to match with the new categories. The new categories were Data, Environment, Human-experience Legal and Socio-economic. In addition to the categories from the RoboCompass we decided to also keep and include Engagement as a separate category for the discussion game.
2. In addition to new categories it was also decided to not include the concept of SRL for the workshops as the RoboCompass had made the final decision to not utilise the levels in the online assessment tool. Instead of the group assignment on SRL a more in depth presentation on the importance of discussing the non-technological aspects when developing robots was added.
3. We modified the presentation of the robots to be in plenary instead of in the groups. This meant that the companies showcasing their robot could pitch the robot to all participants instead of just the group.

The session on the RoboCompass will be described in a separate chapter 8.

Figure 25: Pictures from the workshop

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6.2 Main Outcomes from the Discussion Game

This section describes the main outcomes of the workshop. The results are presented thematically by the topics of the question cards and further thematized in the conclusion highlighting the central themes discussed in the workshop. We will not cover all the groups' discussions in detail, but provide snippets from the different discussions and provide a summary of the main themes and findings that emerged from the workshop. The open spaced setting of the venue was a driving factor in engaging participants in lively discussion that continued after the official workshop program had ended.

6.2.1 Environment

Environment is about the ecological impact of the robot during the entirety of its lifecycle. Discussing the environmental sustainability of robotics is imperative in our pursuit of responsible and innovative technology. By acknowledging and addressing the environmental impact of robots, we not only work towards reducing their negative effects but also unlock opportunities to use robotics as a force for positive change in our efforts to build a more sustainable future.

The group discussing the **SenseGlove** solution discussed the question of whether the solution contributed to the green transition and how[31]. Here, the group discussed SenseGlove use of plastic materials and packaging. Many other haptic devices come in different packaging that do not have multiple usage-opportunities. Instead, SenseGlove focuses on using materials that can easily be reused for different purposes at a later stage. For example, the plastic used could be repurposed for transportation of parts or used for other purposes such as making shopping bags for groceries. The solution uses many different parts, some are silicone, others are printed and some are PLA plastic. This also means that sustainability is something that should be looked into in relation to further and future development. For example, in relation to the fabric used for the solution as this is something that will begin to break down with regular use. If the production scale of the solution enlarges it is necessary to take a closer look at sustainability and consider whether any new difficulties arise, e.g., regards to an increased energy consumption as this might become an issue.

Figure 26: Picture of the SenseGlove

Finally, the solution prioritises waste reduction in its application domains. For instance, trials with the military have demonstrated the potential for enhanced ammunition

[31]**Environment Question 1:** Does the robot contribute to the green transition? *If yes, how? If not, evaluate the robot's purpose and assess whether any changes to the robot could further the transition?*

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planning and precision, thereby reducing wastefulness. Further, a possibility of saving money in fire extinguishing thanks to the training done with the help of the glove.

The group also discussed how the logistics around the robot impact the environment[32]. Here, it was discussed how production of parts is currently done in several countries in Europe as well as in china. Currently, there is not a lot of focus on how to have more green transportation as the need to keep costs low is a priority in the development phase. However, the latest development is that final production is done in-house. Furthermore, it was discussed that a common hurdle for companies that have have yet to reach a scale where factories would give due consideration to their requests it is challenging to establish effective communication with providers concerning the green transition.

The **SINTEF** group, discussed whether the solution had any long-term environmental impacts that extended beyond the initial use cycle[33]. Here it was discussed that there is a need to focus on the lifespan of the solution as well as looking closer at prioritising components with lower environmental footprint, although lack of information presents a challenge — specifically, the lack clarity on the environmental impact of robots compared to human workers.

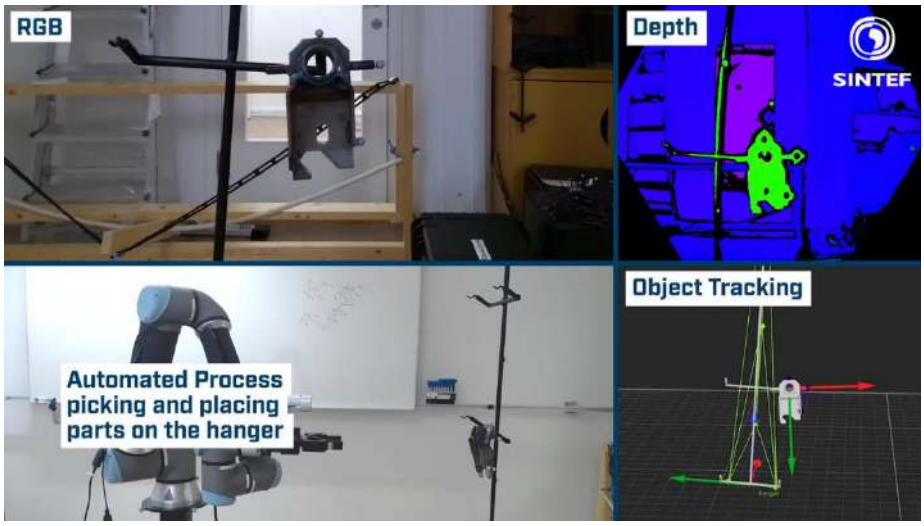

Figure 27: The SINTEF hanging conveyor robot

[32] Environment **Question 5:** How does the logistics around the robot impact the environment? *Does transporting the robot involve high energy consumption, non-recyclable materials, or habitat disruption? How can transportation impact be reduced, e.g., through alternative methods?*

[33] **Environment Question 4:** Can you identify any potential long-term environmental impacts associated with the robot that extend beyond its initial usage cycle? *For example, the use of non-recyclable or non-standard components, etc.?*

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One primary barrier that was discussed in the development of the robot is the possibility of facing energy shortages. This issue becomes particularly pertinent when a robot is fully dependent on a substantial amount of energy for its operation and is something that should be considered moving forward. Furthermore, in order to mitigate the risk associated with potential energy shortages and align with sustainable practices, it is important to develop a strategy that involves opting for a robot with the lowest environmental footprint. This not only reflects a commitment to responsible technological development but also serves as a compelling selling point for the robot.

For this specific use-case, environmental impact was not considered. This might be the case later on, if the robot is to be used for other tasks. As of now, there is an expected lifespan of approximately 10-15 years.

6.2.2 Legal

The legal aspects such as accountability of the robot, governance of the developments, and compliance to regulations during the development and the functioning of the robot are important to discuss as this can help make robots that are developed, deployed, and operated in a responsible and accountable manner.

Darko discussed the question concerning liability issues[34] and noted that due to the robots ungoing development there was still improvements to be made, to meet the current legislative needs. It was also argued that there is a need for very strong regulations within this area. Some of the barriers and challenges that were discussed were that, currently, there are too many difficult questions without proper regulatory answers. For instance, there is a need for better regulation pertaining to emotional and physical damage done by the robot. Further, there is a need for a more clear path towards authorization of the robot within specific work environments, for example that there are more clearly defined divisions of responsibilities, more standards for the implementation of robotics and impact assessments. These types of robots will be implemented into many very different and changing environments and this requires a certain set of standards that can be applied.

Figure 28: Picture of the robot from Darko

SINTEF discussed the question of when to consider legal requirements and standardisation when developing robotic solutions[35]. Here, it was argued that it is

[34] **Legal Question 1:** What liability issues might arise when using this robot, and how can they be mitigated? *Consider potential future scenarios, such as whether the robot's actions could result in property damage, harm to humans/animals, environmental damage, or harm to the robot itself.*
[35] **Legal Question 4:** At what stage in the development of the robot do you believe it's crucial to consider legal requirements and standardization?

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important to consider and discuss legal requirements early and design the robot as safe as possible as early as possible in the process. However, it was also mentioned that designing safely is an ideal that takes trial and error and therefore, it is to be expected that a solution is almost never designed 100% safe and correct the first time around. This is also why it is crucial to consider legal requirements and standardisation as early as possible as this makes it much easier. It is paramount to design with safety considerations in mind and it is usually cheaper if a solution is designed safe from the start.

However, there are several pressing issues related to this, for instance that given the complexity of the legal issue, it's virtually impossible to anticipate every mistake a person might make and therefore also very difficult to implement into robotics applications. And it was argued that although safety measures are in place, they can't address every potential circumstance.

Figure 29: The Industrial Robots Solution

The **Industrial Robots** group discussed the legal accountability of robots[36]. Here, the discussion turned to the familiar problems and barriers concerning *who* can be held accountable if a robot makes a mistake or causes harm and it once again becomes a discussion of who is responsible for the mistake— the programmer, the person who taught the robot its movements, or the person who controls it? One potential solution is to closely consider the use of CE markings[37] and take into consideration what user conditions that the company has stated. Furthermore, there is a need to account for human errors and make checklists to verify that all systems are in place. It was also argued that the robot should have an ID and the manufacturer is legally responsible unless the robot was used in the wrong way.

6.2.3 Human Experience

Human-experience is about how the use of the robot can impact the well-being and trust of the humans around it, both in professional and public settings.

[36] **Legal Question 5:** Discuss if this type of robot should be held legally accountable for their actions? Why or why not? *Were there any elements of your discussion that should be considered for the development of the robot?*

[37] https://single-market-economy.ec.europa.eu/single-market/ce-marking_en

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The **DARKO** group discussed the question of whether the robot puts the human in the centre and how[38]. Here, it was argued that the robot is indeed designed with the aim of enhancing and improving the human-robot interaction. The main outcome of this discussion was that the DARKO robot was indeed developed with the human in the centre, as it is a robotic solution that focuses on human-robot interaction and is intended to work alongside humans. Some of the barriers that were discussed were that implementing robots will come with certain costs, making a shift towards this kind of automation unattainable. Further, it was also argued that implementing such solutions comes with more ethical implications, such as what it means for workers and their families and the local community that needs to be thoroughly considered.

Both the **SINTEF** and **SenseGlove** groups discussed the question concerning what a strong opponent of a robot such as theirs might argue against it[39]. This was an interesting question for the groups to discuss, as it forced them to look at the solution in a more critical manner.

The **SINTEF** group discussed that a strong opponent might argue that their robots are removing jobs for certain people while creating new jobs for others with higher education - echoing the familiar sentiment that robots simply steal away jobs. A potential solution towards such sentiment was discussed, namely that it is important to create awareness about the fact that robots are not simply stealing jobs but that they are rearranging the premise for how some people work. Therefore, it is necessary to analyse what the robot does in order to find ways to do upscaling and training of workers and superusers of the solutions.

The **SenseGlove** group discussed that since the solution is not autonomous there is not a lot to oppose. However, a particular worry was discussed, namely that if the tension or sensation of force of the glove is lost, it could potentially be damaging/dangerous and could lead to unintended harm, particularly in scenarios like grasping objects or other humans - i.e., if the user tried to grab something and was unable to feel the correct feedback. Another worry that might be brought up could be related to the collection of data, namely that if workers for a company wear the glove and it collects data about their work that might make them or their function redundant at some future point in time. The output of this particular discussion was a consideration about what should be included in

[38] **Human Experience Question 1:** Does the robot put the human in the centre? How? *How does the robot empower users and provide them with control? Are there any aspects of the robot that may make users uncomfortable, and if so, how can these concerns be addressed?*

[39] **Human Experience Question 4:** Imagine the perspective of a strong opponent of the robot. What arguments would they present?

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the terms and agreements of the solution and that there was a particular need for governing bodies to provide specific regulations within the field.

The group also discussed whether they thought that the solution could be featured in a science-fiction scenario[40]. They agreed that this was indeed already the case and that multiple sci-fi scenarios depict these kinds of haptic feedback gloves. It was discussed that a best case scenario would be improving army operations while the worst case scenario was a somewhat more far fetched vision where the glove gained control over its user.

6.2.4 Socio-Economic

Socio-economic is about how the development, deployment and use of the robot impacts the socio-economic situation across different economic areas.

The **Industrial Robots** Group discussed what the robot might look like in 20 years and what technological advancements it might have paved the way for[41]. For this specific solution the discussion was focused on how AI will come to play a larger part in the future. It was argued that with a sufficiently large dataset available, it becomes plausible to automatically create the accurate program for the robot to use after scanning a particular component or part. In other words, having a sufficient dataset allows for the development of a program that accurately corresponds to the scanned information, eliminating the need for manual programming in certain contexts.

However, there are also challenges linked to data collection. It might be difficult to convince companies and workers that collecting their data will make robotic solutions better. Furthermore, there is the consideration related to which areas of work that should be automated and which should not as well as how to offer re-training to workers. The latter also involves serious considerations about how to integrate funding strategies for upskilling of workers and where to strategically implement automation to create value.

The **SINTEF** group discussed whether the robot's ability to carry out tasks currently done by humans could lead to social inequality[42]. Here, it was discussed that the impact of automation is evident in the displacement of low-skilled workers while high-skilled workers often remain relatively unaffected. This means that efforts should be directed toward elevating the skill levels of low-skilled workers (particularly with the SINTEF robot as it needs workers to move towards a higher skill set). It was argued that even with

[40] **Human Experience Question 7:** Could this robot be featured in a dystopian science fiction movie? Describe the potential movie plot, including the best and worst scenarios.

[41] **Socio-Economic Question 2:** Imagine the robot in 20 years. What technological advancements have the robot paved the way for and how will it impact the society we live in. *Reflect on whether there might be any negative societal impacts to consider.*

[42] **Socio-Economic Question 4:** Discuss whether the robot's ability to carry out tasks currently performed by humans could lead to increased or decreased societal inequality over time

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these considerations in mind, studies indicate that even in robotized workplaces, low-skilled workers are still employed.

Another important point was that the distinction between low and high-skill workers is also often contingent upon the local context, including the educational level within a country, so making it easier for people to move towards higher skill sets will be reliant on this factor as well.

The **SenseGlove** group discussed strategies for smooth integration of their solution into its operational environment[43]. It was argued that there is a need for guidelines and FAQs available for the users of the solution. However, one particular barrier might be that it is difficult to pre-define all of the use-cases of a solution such as this. Grabbable script and material script are utilised for interactions. This means that the robot adapts by adjusting thresholds and positions, requiring numerous settings to be configured.

6.2.5 Data

Data is one of the most crucial topics to discuss when paving the way for responsible robotics and is concerned with how the robot and associated system collect, manage and use data. Discussions about data drive innovation, promote transparency and accountability, safeguard privacy, and ultimately contribute to the development of robots that align with societal values and needs.

The **DARKO, Digiotouch** and the **SenseGlove** groups both discussed the question concerned with what kind of data (if any) their robot collects[44].

For **DARKO** it was evident that their robot is operating by collecting a lot of data. The robot uses cameras and motion capture to navigate as well as to measure the activity on the shop floor where it is operating. This also means that the robot collects vast amounts of data that needs to be stored and utilised correctly, which leads to some barriers. For instance, there is the need for an encrypted cloud infrastructure to store data and ensure security. Further, workers might be cautious around the robot because of its extensive data collection and there needs to be clear guidelines on how data collected by the robot is handled as having such guidelines is paramount in order to foster trust.

The **SenseGlove** solution does not collect any data as such. The solution is able to record data on forced feedback that can be recorded for the user. It is planned in the future to begin looking into how to utilise data, perhaps to use in relation to machine learning later on.

For **Digiotouch** it was about making existing robots more measurable. This requires insights into data collected by the robots in order to uncover hidden insights. Connecting

[43] **Socio-Economic Q6:** What strategies should robot developers consider to ensure smooth integration of their robots into their intended operational environments?

[44] **Data Question 1:** What kind of data (if any) does the robot collect and who is responsible for the collection? *For example, does the robot collect data about images/voice, medical, biometric, geolocation, etc.?*

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existing data points can be used to infer missing data sources and explore areas such as limitations in production speed, potentially linked to human factors.

6.2.6 Engagement

Engaging all the relevant stakeholders of a specific solution can often help to make it better suited for smooth integration into its intended work environment.

Digiotouch engaged in the discussion about the benefits of including relevant stakeholders[45]. Here it was argued that Involving the wider public allows developers to address concerns, demystify misconceptions, and create a positive perception of robotics. This, in turn, contributes to wider acceptance and adoption. The trust that is built in this way is crucial for the successful integration of robotics into daily life, as it assures the public that their concerns and expectations are taken into account.

The **SINTEF** group discussed the most suitable time to engage the end-users of the product[46]. Here, it was argued that it is important to engage the end-users as early as possible, either from day one, or from when the first prototype of the robot is ready. This means that when doing the risk assessment of a new robotic solution, it's crucial to consult with individuals who previously performed the tasks that are now handled by the robot. Barriers towards this might be that the factory floor might not be particularly interested in engaging, as they are aware that they might lose their jobs and they might not believe that the robot is able to perform the tasks. This means that it is crucial to be open and engage with end-users early and continuously, as it was argued that they are more likely to assist if it is demonstrated to them that their perspectives and knowledge are valued. In short, inform end-users early in the process and actively involve them in the overall procedure.

The **SenseGlove** group discussed how their solution is accessible to various users[47]. Here, it was evident that one of the potential barriers that might be connected with the solution is that, since it is a glove that the user puts on their hand, there might be issues related to size. The soft glove allows for minor changes in size. However, too large gloves will be unable to give the correct and relevant feedback, it is however difficult for the company to produce the product in many sizes at the moment.

[45] **Engagement Question 2**: What benefits could robot developers gain by engaging the wider public (e.g., citizens) in the development of their technologies? Consider what potential risks and missed opportunities robots face if they do not match with the expectations and values of the greater public.

[46] **Engagement Question 4:** During the design process of the robot, when do you think is the most suitable time to engage end users? *Reflect on what value they can bring.*

[47] Engagement **Question 6**: How is the robot accessible to various users? Have people with disabilities been considered? If no, discuss whether this should be done in the future.

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The **DARKO** group discussed whether the robot has been validated by relevant stakeholders[48]. Here, the main outcomes were that as a research project, DARKO has the opportunity to pave the way for potential business cases. One way to do this is to validate the solution via collaborative processes with partners that are focused on different challenges that there might be for the adoption of the solution.

6.3 Conclusions of the Agile Production Workshop

The co-creation workshop brought together stakeholders, researchers and end-users to discuss non-technological aspects of robotics within the field of Agile Production. The discussions were framed around concrete robotic solutions that were presented by the developers and company representatives present at the workshop.

The central themes that came of the discussions of the workshop were:

Sustainable Material Use: For instance in relation to the potential for repurposing plastic and other materials that not only focuses on immediate sustainability but also paves the way for future development and focus on responsible technological development.

Minimising Waste in Application Areas and Short-Term and Long-Term Environmental Effects: Concerning how solutions can reduce waste within their respective domains, for example as a result of increased automation. Further, as commitments towards waste reduction to increase efficiency, cost-effectiveness, and create an environmentally responsible practice. Moreover, the need to scrutinise the lifespan of the robots and prioritise components with lower environmental footprint, as well as acknowledging the challenge posed by the lack of comprehensive information on the environmental impact of robots versus human workers.

The need for legal regulation, standardisation and authorisation: Related to the need for enhanced legal frameworks that can navigate the complexities of robot-human interactions and ensure responsible and accountable deployment of robotics.The diverse and dynamic nature of the environments where robots will be implemented calls for the establishing of standards as this is imperative for their effective and safe implementation.

Incorporate legal requirements and standardisation elements into the development process: In consideration of the fact that it is virtually impossible to achieve 100% safety in the initial design of a robotic solution, focus was on the critical importance of addressing legal requirements and standardisation early in the development of robotic solutions as this can help to ensure safer and more efficient robotic solutions.

Accountability and liability for robots in Agile production: Related to the complexity of determining responsibility in the case of errors or harm caused by robots.

[48] **Engagement Question 1:** Has the robot and the problem it solves been validated by relevant stakeholders to secure the relevance and need for the solution?

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Critical Assessment of Robotics in Agile Production: related to critical self-assessment and hypothetical future scenarios as a way of reflecting on the responsible development and deployment of robotic technologies.

Evolution of Technology and AI capabilities: Specifically, with focus on challenges tied to data collection, such as the barriers of getting companies and workers to contribute their data for the betterment of robotic solutions. Moreover, ethical considerations, such as determining the areas of work that should undergo automation as well as the need for retraining/upskilling programs, and the strategic implementation of automation to maximise value creation.

Social Inequality and accessibility: Related to a discourse on how increased automation can potentially increase social inequality and create environments that allow for the upskilling of workers in specific contexts as well as displacement of low-skilled workers. Further, how to best make solutions that are widely available to many different user types.

Data collection and privacy: Central to the discussions were data related issues concerning the extensive data collection capabilities of robotic solutions and the utilisation of cameras and motion capture that underscore the need for a robust and encrypted cloud infrastructure to ensure the secure storage and utilisation.

Ongoing and Transparent Engagement of Relevant Stakeholders: Concerning how to develop the best possible solutions that are validated with the relevant stakeholders in order to gather inputs as well as informing and actively engaging end-users, stakeholders and other relevant entities in the process from early on.

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7 Workshop 4: Inspection and Maintenance, RoboHouse, Delft, The Netherlands

The fourth workshop was held on october 4th in Delft, Netherlands at TU-Delfts venue called RoboHouse. Present at the event were project partners: The Danish Board of Technology (DBT), Civitta (Estonia), Norwegian University of Science and Technology (NTNU), and LNE (France).

The workshop was held in connection with the third workshop as two separate events following each other over two days in the same location.

7.1 Organisation, Planning and Recruitment

Planning of the event started in June 2023 at the same time as the planning of the third workshop previously described. DBT were in charge of the logistical planning of the workshops and development of the methodology for the co-creation discussion game and prepared playbooks for all partners and created all the relevant content needed for the day, while CIVITTA recruited particapants.

The workshop engaged a total of 18 stakeholders, end-users and robot developers, along with 7 facilitators/helpers and 1 moderator for a total of 26 people present at the workshop. The participants were divided into 4 groups of 4-7 participants. Each group had a facilitator at their table to help guide them through the workshop and take notes.

Amongst the participating robotics companies and projects were:

Group nr	Company / Project	Robotics Solution
1	SINTEF	Snake-like robots that can contribute to efficient inspection and maintenance of critical services to citizens and the society. E.g., keep road tunnels open, ensure that wind turbines can produce energy, etc.
2	Panza Robotics	Quadruped robot that can carry out routine tasks, such as area surveillance, condition monitoring of heat, toxicity, chemicals, or predictive maintenance.
3	Orbiba Robotics	Working on technology for robots that can enhance precision agriculture.
4	Panza Robotics	Same robot as in group 2

Table 11:Companies/projects who showcased a robot

Recruiting participants for the last workshop on inspection and maintenance proved to be very challenging. Only two different companies SINTEF and Panza Robotics expressed interest in using their robots as cases for the discussion game. Orbiba Robotics were originally planned to attend the workshop the day before on agile production, but it was decided to move them to the second workshop to compensate for

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the low number of robots. Additionally we invited an extra representative from Panza Robotics to fill up a fourth group.

Despite the limited number of companies willing to present their robots, we managed to secure an adequate number of registered participants, ensuring that the workshop environment remained conducive for generating valuable outcomes. Consequently, we decided to proceed with the originally planned workshop and seize the opportunity to engage in extensive, in-depth discussions with the participants.

7.1.1 Workshop Agenda

The duration of the workshop was a full-day event and the agenda was as follows:

Time	Program	Notes
9.30 - 10.00	**Welcome and registration**	Participants register and receive name tags
10.00 - 10.10	**Welcome and introduction**	Moderator introduces R4EU and the workshop
10.10 – 10.20	**Presentation**	Presentation on the importance of discussing the non-technological aspects when developing robots from the moderator.
10.20 – 10.50	**Pitch of robots in plenary**	4 min pitch from the representative of each robot to everyone
10.50 – 11.05	**Group introduction and Q&A**	First group activity: Everyone introduces themselves. Q&A regarding the specific robot in each group.
11.05 – 12.15	**discussion game**	Second Group activity: Moderator introduces the game and the group facilitators start the game. Groups are encouraged to take a 10 min. break at some point in the game. The group facilitator will let the group know when to be back.
12.15 – 13.00	**Lunch**	
13.00 – 13.10	**Welcome back**	Introduction to upcoming session

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13.10 – 13.20	**Introduction to RoboCompass**	Presentation and live demonstration of the RoboCompass ● What is it ● Why did we make it ● What is that we want to achieve with it
13.20 – 13.25	**Introduction to brainstorm session**	The groups were asked to collaborate in groups to refine RoboCompass content. We value your input on risks and mitigations to ensure diverse perspectives. Use the posters to share existing and new insights, helping us validate and enhance our compass.
13.25 – 14.01	**RoboCompass brainstorm session** **Category 1-3.**	● For each category the group has 12 minutes. ● 5 minutes for individual discussion. 2½ for risk 2½ for mitigation. ● 7 min. for summarization and group discussion on what is missing.
14.01 – 14.11	**Break**	
14.11 – 14.35	**RoboCompass poster session** **Category 4 - 5.**	● For each category the group has 12 minutes. ● 5 minutes for individual discussion. 2½ for risk 2½ for mitigation. ● 7 min. for summarization and group discussion on what is missing.
14.35 – 14.55	**Wrap up: Final discussion round**	In groups discuss: ● What is your first impression of the tool? ● Do you have any recommendations that could help improve the RoboCompass? ● Would you feel safer if robotics companies had used such a tool? / Would you rather buy a robot from a company that has used a tool such as this?
14.55 -15.00	**Wrapping up**	The moderator waps up the day and invite the participants to stay and networking with the other participants

Table 12: Agenda for the workshop on I&M

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The workshop was initially structured to follow the same program as the previous day. However, since some participants had already attended the workshop the day before and there were many participants who did not show up, we opted to make a few adjustments to the session focused on the RoboCompass. This was done to avoid any sense of repetition for those participants who had attended the previous day.

As a result, new participants followed the original program, while we created two separate groups for those who had participated in the workshop the previous day. These returning participants engaged in group activities that looked deeper into the RoboCompass discussion, addressing some of the unresolved matters from the prior day.

Figure 30: Pictures from the I&M workshop

7.2 Main Outcomes

This section describes the main outcomes of the workshop. The results are presented thematically by the topics of the question cards and further thematized in the conclusion highlighting the central themes discussed in the workshop. We will not cover all the groups' discussions in detail, but provide snippets from the different discussions and provide a summary of the main themes and findings that emerged from the workshop. Participants eagerly engaged in discussions and as there were many participants that attended both days of the workshop, their discussions regarding RoboCompass was

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greatly expanded in this workshop. Once again, the venue fit the theme and made participants want to stay for informal networking and discussions.

7.2.1 Environment

Environment is about the ecological impact of the robot during the entirety of its lifecycle. Discussing the environmental sustainability of robotics is imperative in our pursuit of responsible and innovative technology. By acknowledging and addressing the environmental impact of robots, we not only work towards reducing their negative effects but also unlock opportunities to use robotics as a force for positive change in our efforts to build a more sustainable future.

The **Panza Robotics** groups discussed how their robot contributes to the green transition[49]. Here, it was argued that the robot itself is helping the green transition as it is electric and designed with green considerations in mind. Furthermore, the work that the robot will be doing is helping to reduce physical travel of workers to work sites as the robot will be taking over these types of jobs. In the future, AI solutions might be implemented to help analyse how to make the robot even greener. One specific barrier discussed was that there are various use-cases that can be challenging, e.g., if the robot is used within the oil-industry. To help further the green transition, it was suggested that robots such as these could receive funding from Europe or subsidies.

Figure 31: Artaban by Panza Robotics

SINTEF discussed that their solution indirectly serves a sustainable purpose, but it was not primarily designed with a sustainability focus. In essence, it offers the advantage of eliminating the need for boat trips to windmill farms; however, the materials, such as batteries, are produced using conventional methods, lacking a dedicated sustainable approach. One of the main barriers here is that it is costly and without a clear end-user in mind it is too early to optimise for it. Two solutions that were discussed were, first: to consider this when scaling the robot and incorporate it into subsequent iteration and second: look into secondhand components and robotics.

[49] **Environment Question 1:** Does the robot contribute to the green transition? *If yes, how? If not, evaluate the robot's purpose and assess whether any changes to the robot could further the transition?*

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The **Orbiba Robotics** group discussed whether there were any potential long-term environmental impacts associated with the robot[50]. One barrier was the use of batteries and the end-of-life-cycle of the solution. Given the current developmental stage of the solution as a prototype, there was a consensus regarding the necessity of prioritising partnerships with a strong commitment to environmental sustainability and the incorporation of more eco-friendly components. Further, there is a need to focus on lean software in order to limit consumption.

7.2.2 Legal

The legal aspects such as accountability of the robot, governance of the developments, and compliance to regulations during the development and the functioning of the robot are important to discuss as this can help make robots that are developed, deployed, and operated in a responsible and accountable manner.

Legal considerations about liability were discussed in the **Panza Robotics** group[51]. Here it was argued that questions regarding liability had been considered, but that it is difficult because there is a lack of standards in place concerning damage done by these types of robots. With regard to the Panza Robotics solutions, this is especially important because of the strength of the robot and the amount of torque that it is able to produce. In case of person or property damage, it was discussed that it is still unclear who is liable. Some of the solutions that were suggested towards these barriers was to increase the use of AI to make the robot more aware and reduce risk when near humans while also adding a physical emergency stop button. Further, there was once again a call from more clear guidelines regarding legal matters such as liability as well as clear legal agreements between the companies developing the robot and the customer.

In the **Orbiba Robotics** group focus was on how legal guidelines are different depending on countries, meaning that liability might differentiate - for example if the robot ends up damaging crops or if data from the solution is somehow leaked. Some solutions towards barriers such as these is to check on current legislation and make clear guidelines that come with the robot when sold to end-users, for example stating that developers can not be held accountable for how an end-user might use the robot in ways that it is not intended for.

[50] **Environment Question 4:** Can you identify any potential long-term environmental impacts associated with the robot that extend beyond its initial usage cycle? *For example, the use of non-recyclable or non-standard components, etc.?*

[51] **Legal Question 1:** What liability issues might arise when using this robot, and how can they be mitigated? *Consider potential future scenarios, such as whether the robot's actions could result in property damage, harm to humans/animals, environmental damage, or harm to the robot itself.*

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For **SINTEF** the robot is typically deployed in environments that are challenging for humans to access, minimising the risk of harm to individuals. However, the primary concern may involve potential damage to property, such as causing a leak in a remote and difficult-to-reach pipe. Since the robot is controlled by an operator, the only liability will be if there is a robot malfunction. Here, it was discussed that it is important not to rely on too much automation of the robotic system's movements and grant the controller complete control over individual components and further, implement integrated safety mechanisms that prevent the robot from moving over areas where it could potentially fall.

Figure 32: The robot from SINTEF

7.2.3 Human Experience

Human-experience is about how the use of the robot can impact the well-being and trust of the humans around it, both in professional and public settings.

The **Panza Robotics, SINTEF and Orbiba Robotics** groups all discussed the question regarding if and how the robot puts the human in the centre[52].

For the **Panza Robotics** solution, it was argued that the way the robot places the human in the centre, is that it is operated by a human using a controller. However, it is intended that in the future the robot will operate autonomously. It was argued that anonymous operation of the solution is preferred by most customers as this can minimise the use of human resources and free up workers for other and more meaningful tasks, thereby placing the human in the centre by doing the jobs that they don't want to do. The intent is to create a solution that removes humans from dangerous situations (e.g, firemen). Some barriers that were discussed was that there might be situations where human workers find it difficult to create and ensure trust in the robot.

SINTEF discussed that, for instance, in the context of windmills, workers typically need to transport heavy toolboxes (up to 30kg) to the top. However, when using a robot, this load is significantly reduced. The robots can also be controlled remotely, so it could be possible to leave the robot inside the windmill and control it from a distance. This increases not only the safety, but it also saves a lot of costs going to the windmill, meaning that the operators can do more jobs. One barrier was that the robot can cause discomfort for the controller due to the unusualness of its snakelike body, making it challenging for the controller to always know the robot's exact location, especially when it is positioned behind them. Solutions towards such barriers could be to experiment with

[52] **Human Experience Question 1:** Does the robot put the human in the centre? How? *How does the robot empower users and provide them with control? Are there any aspects of the robot that may make users uncomfortable, and if so, how can these concerns be addressed?*

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different camera mounting points and virtual mapping as well as providing proper training and guidance.

For **Orbiba Robotics**, the robot is developed as an aid to workers. This also means that one barrier towards adoption is that the solution requires technical knowledge to operate, meaning that farmers will need a certain level of technical know-how to use the solution. One way to overcome this barrier could be to develop a user-friendly app that could assist with overcoming some of the technological barriers towards implementation.

Regarding the question of whether the **Panza Robotics** solution represents a future that people would want to strive towards[53]. Here, the answer was that it *does* because it aims to relieve humans from doing dirty, dangerous and demeaning jobs - however it is not intended to be used in military applications. However, even though the robot strives towards helping humans and relieving them from unwanted jobs, there is always the risk that someone will utilise the solution in unethical ways.

Does the robot represent a future that you want to strive towards? Why/why not?

How can the values of the company be reflected in the final product (for example, gender, race, species equality etc.)? How would you achieve this?

2

7.2.4 Socio-Economic

Socio-economic is about how the development, deployment and use of the robot impacts the socio-economic situation across different economic areas.

The **Panza Robotics** groups discussed the question about how the robot might alter the job market and how it will affect human workers[54]. Here, it was argued that it is unlikely that the robot will replace human workers or lead to a reduction in the number of jobs. Rather, it alters the job market by replacing difficult or dangerous jobs, thereby enhancing the work experience and operating in synergy with human workers. One barrier that was discussed here was whether workers would be able to be adequately upskilled for their new tasks. The robot clears up time for humans to do other tasks and robots are often better suited for these kinds of assignments than humans.

Some of the solutions discussed were that in order to facilitate this transition, there is a need for educational initiatives targeted at workers, aiming to equip them with the necessary skills in robotics that are needed as a result of the changes in their work life. A broader strategy involves incorporating robotics into educational systems, necessitating a political blueprint that outlines the ethical, social, and economic implications of widespread robotic integration. Further, it was highlighted that there is a

[53] **Human Experience Question 2:** Does the robot represent a future that you want to strive towards? Why/why not?*How can the values of the company be reflected in the final product (for example, gender, race, species equality etc.)? How would you achieve this?*

[54] **Socio-Economic Q1:** Will the robot potentially alter the labor market, and how will it affect human workers? *Are these changes positive or negative? What measures would you propose to mitigate the negatives and enhance the positives?*

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need to focus on how the education systems can proactively prepare for the future, ensuring that individuals are well-prepared for the changing demands of the workforce influenced by robotics and automation.

The **SINTEF** group discussed that their solution will definitely have an impact. Performing tasks remotely enhances overall job productivity by saving time on transportation, although this may lead to a reduction in the number of available jobs. However, on a positive note, this approach opens opportunities for a broader range of individuals to engage in these tasks and offers a less physically demanding alternative for the workforce. One proposed solution was to focus on educational programs designed to facilitate the training of controllers, especially when dealing with the snake-like robotics, which presents unique challenges in control compared to conventional robotic systems.

7.2.5 Data

Data is one of the most crucial topics to discuss when paving the way for responsible robotics and is concerned with how the robot and associated system collect, manage and use data. Discussions about data drive innovation, promote transparency and accountability, safeguard privacy, and ultimately contribute to the development of robots that align with societal values and needs.

The **Panza Robotics** groups discussed what kind of data the robot collects and who has the responsibility for any collected data[55]. The robot has several cameras (facing front, side and back) that are used for navigation and mapping of the terrain that the robot is operating in. At the moment data is only stored locally on the robot itself and not shared. Even so, some interesting barriers were discussed and it was evident that ensuring data security is imperative, and the methods for achieving this, particularly in terms of access to locally stored data, need to be well-defined. For instance, if the robot is at a considerable distance, there is a potential vulnerability for data compromise, which necessitates precautions against theft. A further concern related to data interception or data was that since the robot is able to share data through WiFi and bluetooth, it prompted the worry of scenarios where drones might fly over the workplace of the robot in an attempt to steal data.

The **Orbiba Robotics** solution collects a multitude of data such as; Visual data, temperature data, GPS, Ph-level, moisture etc. This data is stored in clouds and locally. To secure data, cybersecurity protocols are implemented. Further, Orbiba aims at continuous maintenance and quality control of sensors — as well as making sure to use reliable commercial sensors.

For **SINTEF** data is collected via sensors that are placed on the robot. This means that the collection of data is different and ultimately decided by the users of the robot as they can place a wide variety of sensors on the solution. There is an opportunity to provide software and ready made analysis but as it is a platform solution it is not as extensive.

[55]**Data Question 1:** What kind of data (if any) does the robot collect and who is responsible for the collection? *For example, does the robot collect data about images/voice, medical, biometric, geolocation, etc.?*

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One proposed solution was to focus on software solutions that don't rely on larger servers for storing data. **SINTEF** further discussed if the robot uses AI now or in the future[56] and sensors, microphones or cameras[57]. Regarding the former it was argued that AI could potentially be employed to automate the robot's movements or to interpret the data it collects, but in the majority of cases, it will not have a substantial impact on the functionality of the robot and full automation is still only possible too far into the future for this type of robot. Currently, the robot is fully controlled by an operator, and AI will not within the nearest future be developed enough to fully automate all the necessary parameters. Regarding the sensors, microphones or cameras, the robot will be able to work a multitude of sensors, but as the robot will not be used alongside people, this was not considered a problem.

Concerning what challenges related to data that there might be concerning human-robot collaboration[58] the **Panza Robotics** group's discussion turned on how humans might feel in the vicinity of a robot that uses cameras to collect data. One proposed solution to this problem was to divide the data into different categories, such as data that is non-essential for the operation of the robot (e.g., faces or other personal information that might be collected) might for example be blurred out. This could potentially help increase trust in the robot and broader acceptance of the robot in a work environment.

7.2.6 Engagement

Engaging all the relevant stakeholders of a specific solution can often help to make it better suited for smooth integration into its intended work environment.

Whether or not the robot had been validated by relevant stakeholders was something that was eagerly discussed by the **Panza Robotics** groups[59]. The solution has been validated and tested at construction sites, as this was something that customers specifically asked for. The Robot was also part of a previous task in the Robotics4EU project where citizens gave feedback on a variety of parameters[60]. Here, citizens gave feedback on questions such as how safe they would feel working close to the robot and how much they liked the design and what uses citizens might think of for the robot.

[56] **Data Question 2:** Does the robot use AI, or will it use AI in the future? If yes, reflect on the impact of AI in the future. *E.g., How can transparency and explainability of the AI algorithms be ensured? How can bias and fairness in the AI algorithms be addressed? How can the AI algorithms adapt to changing conditions in the environment?*

[57] **Data Question 3:** Does the robot use any microphones, cameras or other types of sensors that collects and stores data?*If yes, reflect on whether the robot unintentionally collects data about people which are not necessarily needed for the function of the robot?*

[58] **Data Question 5:** What challenges could hinder robot-human collaboration in terms of data protection/GDPR, and how can they be resolved? *Additionally, what do you think is the most pressing issue in this regard?*

[59] **Engagement Question 1:** Has the robot and the problem it solves been validated by relevant stakeholders to secure the relevance and need for the solution?

[60] Read the report here: https://www.robotics4eu.eu/wp-content/uploads/2023/04/Panza-Robotics_final.pdf

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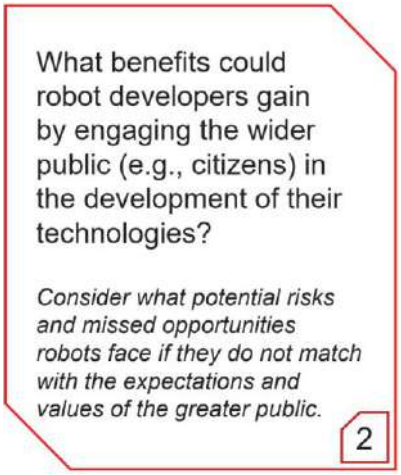
Further, it was argued that the robot provides an important European alternative that removes some of the reliance of the American or Chinese market and that the need for such a solution has been validated with the customers.

Orbiba discussed issues with securing stakeholders and securing the necessary connections as barriers towards implementation of their solution. To overcome such barriers it was discussed that it is necessary to continuously involve more partners such as farmers, commercial partners (e.g., supermarkets) and other relevant companies such as NGOs or government organisations.



For **SINTEF**, engagement was something that they are actively focusing on. They have implemented this approach successfully in search and rescue or disaster-stricken areas. Additionally, they have initiated exploratory efforts in offshore windmill parks, although this has not yet been validated in a working environment. However, it is difficult to find use-cases as this also requires funding to scale the solution. One surprising barrier is the financing structures used in the field of inspection and maintenance. It is a sector that is used to working with people, charged by the hour, which does not make sense in terms of using robotics. Changing the pricing structure has been challenging. Notably, in the case of Norway, it posed the most significant obstacle, whereas when dealing with India, it was less of a hindrance. Solutions to this might be to engage in discussions about how to change these structures. Further questions on engagement were discussed namely, what benefits there might be to engaging the wider public[61] and whether the solution had been tested in real-life scenarios[62]. Regarding the former, the robot does not often interact with people. However, including the wider public could help to the discovery of use cases or to get additional people interested in the area. However, the barrier towards this is the cost of doing actual testing with citizens (for instance, because of the cost of moving the robot from place to place). Regarding the latter, the solution has been tested in disaster-zones and is planned to be tested at offshore wind farms. Specifically, a barrier towards testing is that it is difficult to gain access to test in real-life environments - especially if the solution has not been proven before. One solution to this might be to explore the possibility of conducting tests in a simulated real-life environment, for instance in broken windmill parts.

[61] **Engagement Question 2:** What benefits could robot developers gain by engaging the wider public (e.g., citizens) in the development of their technologies? *Consider what potential risks and missed opportunities robots face if they do not match with the expectations and values of the greater public.*

[62] **Engagement Question 3:** In which real-life environments has the robot been tested or plan to be tested? *Discuss the areas/environments most important for testing and identify what challenges there might be in a real use-case.*

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7.3 Conclusions of the Inspection and Maintenance Workshop

The co-creation workshop brought together stakeholders, researchers and end-users to discuss non-technological aspects of robotics within the field of Inspection and Maintenance. The discussions were framed around concrete robotic solutions that were presented by the developers and company representatives present at the workshop.

The central themes that came of the discussions of the workshop were:

Involvement in the green transition and change in work: Related to the ways in which companies and projects design and construct their solutions. For instance, by designing and incorporating electric-driven solutions that help contribute towards a greener future. Reduce travel as a result of increased automation, minimising the physical need for workers to be at job sites - this could be further enhanced by the increased use of AI which can increase effectivity.

Commitment to sustainable practices and partners: Related to component use (such as batteries) that are often produced using conventional methods and have a considerable environmental impact and the need for using more eco-friendly components. Further, the need for partnerships that have environmental commitments.

Need for standardisation and clear guidelines: Considering the absence of standards for damage caused by these types of robots as well as the crucial importance of addressing liability issues, particularly given the strength and torque capabilities of many robots in the inspection and maintenance field. The need for clear guidelines concerning liability issues and explicit legal agreements between developers and customers. Focus on increasing safety by the use of AI to enhance systems awareness of their surroundings thereby reducing risk when in close proximity to humans, as well as physical stop buttons placed on the robots.

Regulatory differences between countries: Related to challenges of varying legal guidelines in different countries, potentially leading to differentiated liability and a need for addressing these challenges through proactive measures.

Positive Changes in the job market: Related to how solutions might alleviate people from doing dangerous and difficult jobs. Such as the potential for increased implementation in tasks like transporting heavy toolboxes reduces the physical strain on workers and the positive changes brought about due to autonomous operation that minimises human resource usage and free workers for more meaningful tasks as well as contributes to the removal of humans from dangerous situations. The need for trust in these situations is paramount, for instance via improved communication or user interfaces and proper training and guidance of operators.

Need for technical knowledge in certain areas: Highlighted as a significant barrier to adoption, because some solutions necessitates a certain level of technical knowledge for effective operation. Relevant to the importance of making the robotic solution more accessible to a broader user base, particularly those with limited technical expertise.

Fear of job loss and upskilling/education: Specifically with regard to the importance of addressing challenges, such as upskilling, to ensure a smooth transition in the

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evolving job market influenced by robotic development. Focus on proactive solutions to challenges for human workers brought about by automation. The need for educational initiatives that can give workers the necessary robotics skills required due to changes in their work environment and advocate for a broader strategy involving the integration of robotics into educational systems.

Data collection and privacy: Focus on how to ensure well-defined methods to secure locally stored data, including precautions against theft as well as promoting transparency, accountability, and safeguarding privacy. The need to seriously consider the challenges related to human-robot collaboration, particularly focusing on how humans might feel in the vicinity of a camera-equipped robot.

Financial Structures as barriers for implementation and testing of the solution: For instance in regards to the difficulty in finding funding to scale the solutions and test them with relevant stakeholders. Overcoming financial barriers and exploring innovative testing approaches are crucial for the successful implementation of robotic solutions.

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8 Extra session on the RoboCompass at workshops 3 and 4.

In this chapter we will give a description of the RoboCompass session from the two last workshops.

The afternoon-session was divided into first a general introduction to the RoboCompass presented by LNE and then two workshop exercises performed in groups.

8.1 First Exercise - Brainstorm

The purpose of the first session was to generate as many new insights as possible in order to both to validate existing content (checklists, and categories) as well as to receive new ideas. In the first session we wanted to get input to the content of the compass. As the tool's content was not yet finalised, we wanted to seek input from diverse perspectives on essential risks within the different categories of the RoboCompass and any suggested mitigations.The aim of this exercise was to incorporate diverse perspectives into the development of the compass, using the results to validate existing content and update it with new inputs that might have been overlooked. To do this a brainstorming exercise was prepared using special designed posters as the worksurface for each group (See figure below).

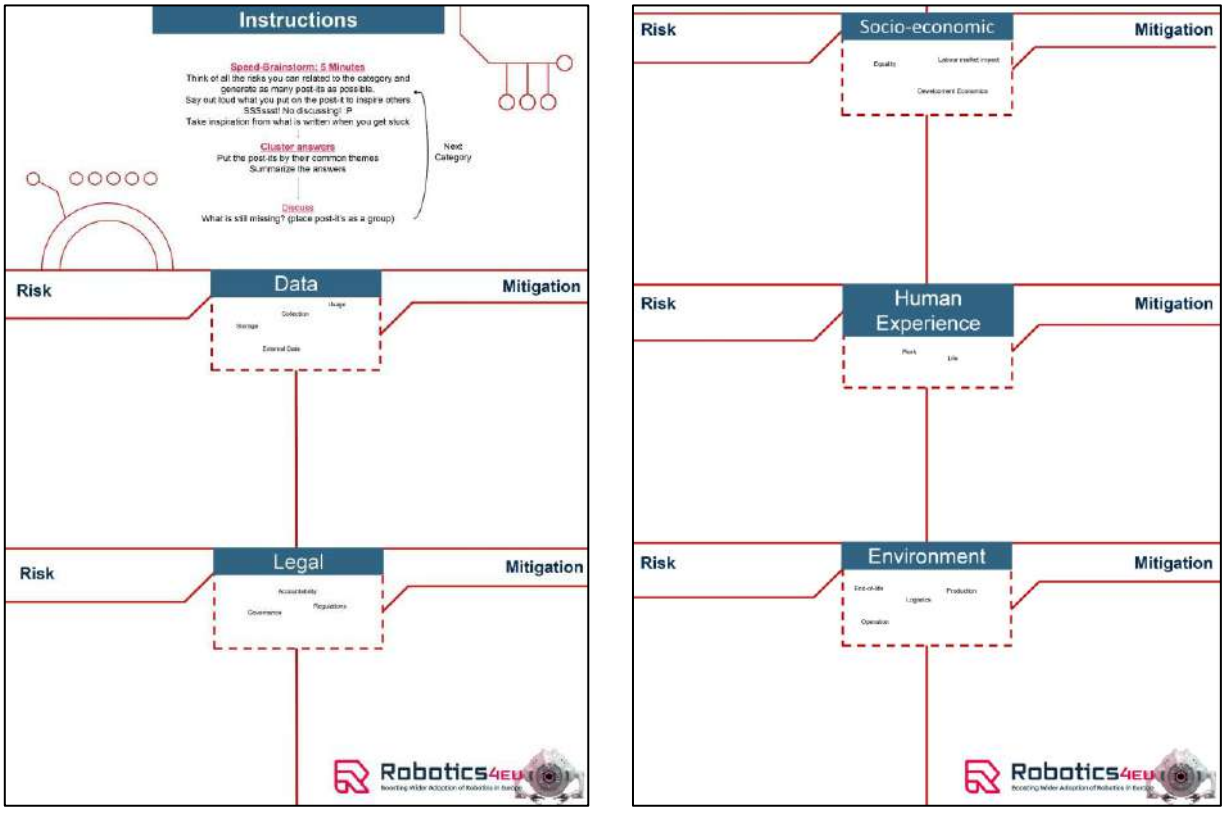

Figure 33: The posters for the robocompass session were printed in a large format for particapnts to use them as a worksurface to arrange post-it notes on

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The instructions were as follows:

1. For the next session you will be in groups for the next 70 minutes to collaborate on giving us input for what content we should have in the RoboCompass.
2. What we want you to do now, is to use the posters on your table as a blank sheet to give input on. You should add all the inputs you have also the ones you might know are already in the compass and of course also new ones. This way we can both validate what we might already know and we can see if we have missed anything.
3. You take one category at a time. First you spend 5 minutes on your own and write as many post-its as you can on all the risks you can think of and mitigation steps to overcome the risks. Once you have written a note, say it out loud and put it on the poster. You say it out loud to inspire the others not to start a discussion.
4. After you have spent 5 minutes of individual time you spend 7 minutes clustering the answers and discussing if anything is missing in the category you would like to add.
5. After 12 minutes you move on to the next category.

Figure 34: Picture from one of the groups clustering the post-it notes

The results from the brainstorm session were noted down and digitised by the facilitators. These results were then passed on to the developers of the RoboCompass who have been responsible for handling the data in a useful way for their development process of the RoboCompass. We will therefore not go into the full details with the results of the brainstorm in this report. However to give an example of some of the results one of the templates with the post it notes for the topics of Data can be seen below:

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Data	
Risk	**Mitigation**
USER LEVEL Data being sent to other actors User is unaware of what data is being collected Lack of privacy, no protection of personal information Lack of data transparency and understanding of data Being open to data manipulation by global companies and political bodies User has no way to delete their own data Essential data not guaranteed storage for sufficient time **DATA USE** Lack of transparency in data collection method making it unusable Using the wrong data or incomplete data Getting obsessed with data and gathering data for the sake of it Data biases Misuse of data Dependence on previous data (tunnel vision) Too much data - incomprehensible, large volumes of data **DATA MANAGEMENT LEVEL** Data management - how to organise? External data dependencies in hardware and software Data storage Data hacking How the data is no longer of value.	Ethics committees Local data storage. System penetration testing. Data management plans. Good documentation and technical testing in the company. Standardization of communication protocols

Table 13: Outtake from an overview of the post-it notes on Data from group 3 in the agile production workshop.

8.2 Second Exercise - General feedback on the RoboCompass

For the second group exercise we wanted the participants to broaden and open up the discussion on the RoboCompass. We wanted the participants to give their general thoughts, feedback and suggestions for further improvements. To frame the discussions the groups were asked to spend 20 minutes discussion the following questions:

1. What is your first impression of the RoboCompass?
2. Do you have any recommendations that could help improve the RoboCompass?
3. Would you feel safer if robotics companies had used such a tool? / Would you rather buy a robot from a company that has used a tool such as this?

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The summary from the discussion were:

First Impression of RoboCompass: Participants generally had mixed feelings about the RoboCompass. Some found it to be a good initiative but very general, suggesting that its real value lies in the recommendations it provides. The tool was criticised for being too flashy, with suggestions that a simple spreadsheet or PDF document would be more valuable for internal use. However, multiple participants also found that the visual look of the tool was pleasing and looked easy to use. There were also comments on the scoring system, with a preference for a scale such as poor, ok, good, perfect rather than a numerical scale from 0-100 %. Overall, the consensus was that the tool is a guide to reflective thinking and risk awareness rather than a decisive scoring mechanism.

Recommendations for Improvement: Several recommendations for improving RoboCompass were noted. Participants expressed a desire for a mutual third party, possibly a governing lab, to certify companies, indicating a spectrum of certification levels. Benchmarking companies based on risk prioritisation rather than percentage mitigation was suggested. It was also proposed that the tool could evolve into a benchmarking tool for companies to assess themselves over time. Additionally, participants stressed the importance of avoiding bias and involving all market players to prevent companies from all adopting the same recommendations. Lastly, a sector specific approach was recommended to create additional learnings and content.

Adoption by Robotics Companies: Concerns were raised about the effectiveness of self-assessment alone and the need for a mutual third party behind the tool. Some participants expressed scepticism about the willingness of big companies to adopt such a tool, emphasising the importance of forcing them to use it. It was suggested that the tool could be beneficial for small companies, providing a reality check and guiding responsible design. Making companies care about the tool was discussed, including potential strategies such as building it as a community tool for sharing good practices and making it a standard accepted by consumers and investors. The comparison was drawn with FDA approval in the medical industry, highlighting the trust associated with safety certification.

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9 Reflecting on the Challenges, Limitations and Feedback.

Challenges Regarding Recruitment and Sector Specific Differences

Overall, recruitment of relevant participants to the workshops proved to involve several difficulties. For all workshops a last-minute dropout percentage was expected. This meant that for the workshops we aimed at recruiting more participants than the amount that we expected to show up on the day. However despite being aware of the usual dropout percentage it was a recurring challenge especially for the last two workshops on agile production and inspection & maintiance. To mitigate this challenge different methods for recruitment were invoked throughout the planning of the events to reach as many participants as possible.

Despite the many different approaches to outreach, it became obvious during the planning and execution of the workshops that there were noticeable differences in interest from both robotic companies and projects as well as end-users, stakeholders, researchers and other participants depending on the theme of the workshop.

For the workshop on **agrifood** recruitment was done via the event that the workshop was a part of. This meant that there was somewhat less control over the participating companies and no control whatsoever concerning other participants. However, as the event was agri-food specific, we found that we had a relevant selection of participants present at the workshop.

The workshop focused on **healthcare** was the easiest to recruit companies and participants for. We suspect that this is because of the many projects that are concerned with automatisation and robotics within healthcare as well as a general interest by multiple relevant stakeholders and for this workshop we ended up having to place potential participants on a waiting list because we reached maximum capacity.

The workshops on **agile production and inspection & maintenance** were vastly more difficult to recruit for than the other sectors, and many different approaches were used in the process, such as official/personal emails, personal contact (via LinkedIn, ERF, FARI etc.) and networking. However, even with increased effort by multiple partners in the consortium, reaching the desired number of companies and end-users was difficult. It was found that many companies within these sectors are busy and thus pressed for time and/or resources and find it difficult to attend workshops such as ours. We suspect that the timing of our workshops may have played a role in the low response rate. The months leading up to the workshops coincided with the vacation period for many professionals, leading to reduced availability for engagement. Additionally, the first month following the summer period is typically a busy period for many companies, making it challenging for them to prioritise workshop participation. Some have responded to our invitation with eagerness to participate, but with too much pressure to meet market demands to do so. We have unfortunately also had many who did not respond.

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Despite the difficulties in attracting participants we can conclude that overall, the workshops achieved positive results. For all workshops enough people attended to create an inspiring environment gathering participants with many different perspectives which is one of the main ideas behind doing co-creation. In the end the workshops provided insightful and valuable output both for the project and for the participants who attended.

Limitations of Analysing Workshop Results

The results are presented thematically by the topics of the question cards and further thematized in the conclusion highlighting the central themes discussed at each of the workshops. As each group had its own discussion going in different directions from the other groups, it has not been possible to write a comprehensive detailed description from each table. Instead we have in the chapters of the main outcomes chosen to focus on outtakes from the conversations that brought forth interesting perspectives and examples that were noted down by the groups and their facilitators. This can be seen as a limitation to getting the full picture of the interconnected narrative of all discussions of the workshop. We can see this as one of the challenges and limitations to the workshop-format where parallel conversations are happening throughout. This makes it difficult to cross compare and write a connected full piece showing all the results. However the workshop format also comes with many benefits such as an interactive and inspiring environment for open discussion and networking.

Reflecting on the Workshop Feedback and Further Developing the Discussion Game.

Many participants provided positive feedback on the workshops that helped make the following workshops better. This feedback was received via feedback postcards that were filled out at the workshops as well as in emails received from participants. Some of the feedback we received were:

> *"I think the topics and the questions provided were well-thought of. They helped see the bigger picture"*
>
> *"The boardgame was really productive, our team discussed 6 cards, and from my point of view, we learned many interesting facts. Overall idea is great!"*
>
> *"In general, I find this game very interesting, useful and important. Thank you. I enjoyed it"*
>
> *"Overall, it's a very useful and convenient idea to discuss projects along with listening [to] all the stakeholders' opinions at a table. I believe the game is quite encouraging to participate in the discussion"*

As a result of the workshop there has been a considerable interest from participants to continue using the discussion game. As of now, the plan is to create an open-access version of the game that can be downloaded and used by companies, projects and people concerned with robotic technology to deliberate on the non-technological aspects. The open-access discussion game is meant to inspire and engage people involved in robotics as well as researchers, stakeholders and end-users.

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10 Conclusion

In this report, the findings from the four co-creation workshops carried out as part of the WP4 engagement activities of the Robotics4EU project have been presented along with the overall planning, process and methodology of the activities. Furthermore, the main findings and themes of each of the four workshops have been presented.

The workshops focused on giving feedback on robotics solutions for better integration into their respective areas of operation; Healthcare, Agrifood, Agile Production and Inspection & Maintenance through a co-creation approach. This was done by bringing together companies, projects, researchers, end-users and stakeholders to deliberate on concrete robot solutions presented at each of the workshops. To help faciliate the workshops a discusion game was developed to motivate the participants into having engaging discussions in a more fun, creative and interactive setting. The workshops presented valuable insights into the multifaceted challenges and opportunities presented by robotic technologies and the overarching themes that emerged from these discussions underscore the complexity and interconnectivity of various issues that demand careful consideration in the ongoing development and deployment of robotics. The main conclusions of the workshops are presented below:

Safety and human-centric approaches are key to developing responsible robotics. All workshops highlighted the importance of safety in robotics, particularly through a human-centric design approach. This was especially important for robotics in the healthcare sector, but also for the other sectors. Furthermore, enhancing user control, improving human-robot interactions, and ensuring human operators have control over robot behaviour were recurrent themes at all workshops. The emphasis on user-friendly interfaces and direct control, highlights the need to prioritise safety and user acceptance in the development process.

Data protection, cybersecurity and privacy are paramount. Common for all workshops was the need for addressing the many concerns related to data protection, especially in relation to storage, handling, and sharing of data, which emerged as critical themes at all workshops. Further, clear guidelines to ensure secure data storage and utilisation were highlighted as means for fostering trust. A lot of focus was also placed on the need for encryption and transparency in data handling. The themes concerning data were especially important due to the evolution of technology and the increasing AI capabilities.

Legal and regulatory frameworks are needed. Common for all workshops was that they addressed the need for enhanced legal frameworks, standardisation, and clear guidelines to navigate the complexities of robot-human interactions in some form or other. Further, examining and incorporating the necessary legal requirements and standardisations early in the development process was stressed to ensure safer and more efficient robotic solutions.

Job market and socio economic changes require focus. The transformation of the job market was highlighted at all workshops — both with focus on the positive and the negative impacts. A lot of focus was on how robotics can provide positive changes such

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as alleviating workers from dangerous, cumbersome and monotonous tasks and creating opportunities for a more meaningful work life. However, the fear of job loss is something that looms over all sectors that are facing increased robotic implementation, which also means that proactive solutions, including upskilling initiatives and education should be considered. The fear of job displacement and loss was also highlighted at the workshops as something that can potentially act as a barrier towards implementation. Furthermore, socio-economic factors must be considered to address social inequality and accessibility thereby aiming at creating solutions that are widely available to various user types as well as mitigating the potential displacement of low-skilled workers and facilitating upskilling in specific contexts.

Engagement as a means for increased trust and acceptance. As the aim of the workshops was to bring together relevant stakeholders and end-users in deliberation on robotics, a lot of focus was given to the topic of engagement. Here, stakeholder and citizen engagement were identified as crucial for broader acceptance of robotic solutions. Here, the broad consensus was that active involvement not only contributes to commercial success but also plays a pivotal role in fostering a more widespread acceptance of the technology.

Sustainability and environmental concerns. Even though sustainability was something that was widely discussed at all workshops, the workshops on agile production and inspection and maintenance included a specific category of questions that placed focus on the environmental impacts. Here, considerations ranging from material use and waste reduction to the long-term environmental effects of robotic applications, were highlighted. To create responsible robotics, it is important to commit to sustainable practices, and focus on establishing partnerships with focus on environmental commitments.

In essence. The workshops provided an overview of some of the many opportunities that are increasingly presenting themselves via the rapid advancements of robotic technology. The workshops also focused on actual and potential barriers towards the wider implementation of the technology and ways to overcome these. The use of the discussion game helped to establish a relaxed atmosphere, and gave participants a central focus area from which they could start their deliberations.

Thank You!

On behalf of the Robotics4EU consortium we would like to extend our deepest gratitude to all who participated in the workshops. We know that it can be difficult to take time out of busy schedules to travel to physical meetings and we would like to extend a special thanks to all that participated with a robotic solution and agreed to present and discuss your work.

We would also like to thank all consortium partners and external facilitators that helped with the organisation, planning and facilitation. We could not have done any of this without your help.

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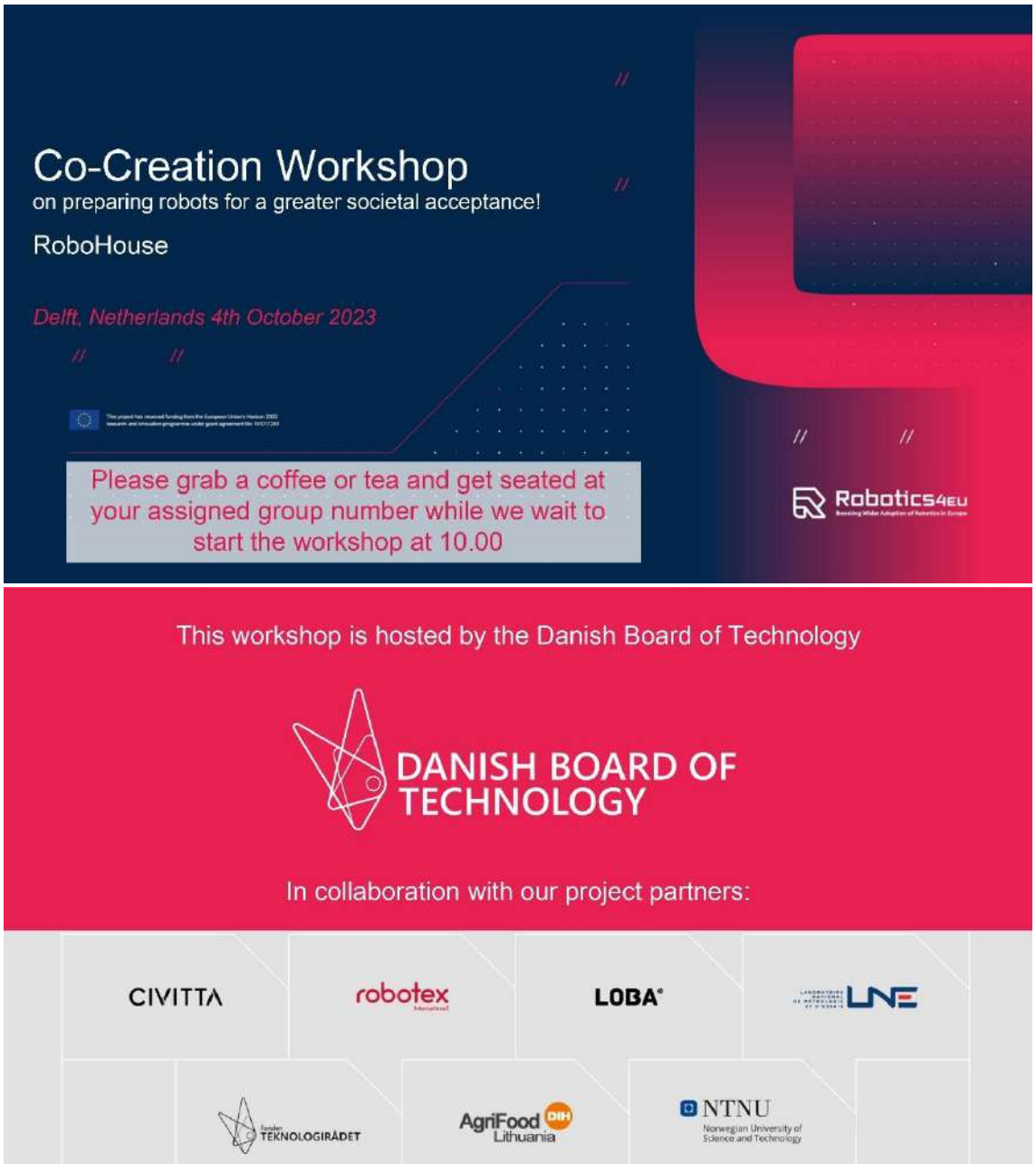
12 Appendix

12.1 Appendix 1: Presentation from one of the workshops



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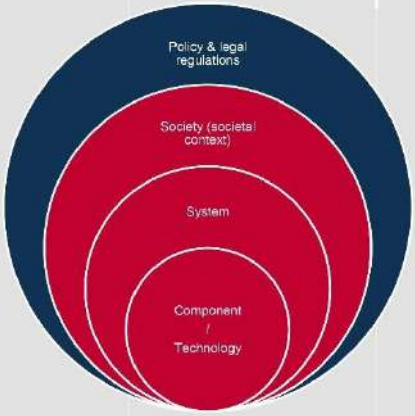
You are (almost) never just designing/developing a component

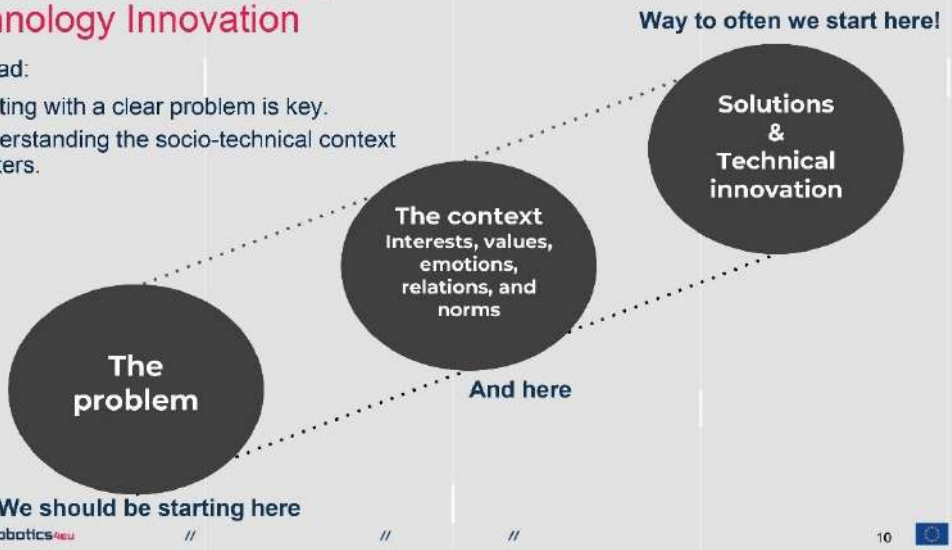
- The component almost always has to fit into a system which has to be implemented into a context (society).
- Therefore, we have to make sure that the technology we develop aligns with the needs and expectations of those who are affected in the societal context.
- Engaging a wide range of actors can be beneficial to understand the context by uncovering interests, values, needs, relations, and norms.



The Solution-Centric Approach in Technology Innovation

Instead:

- Starting with a clear problem is key.
- Understanding the socio-technical context matters.



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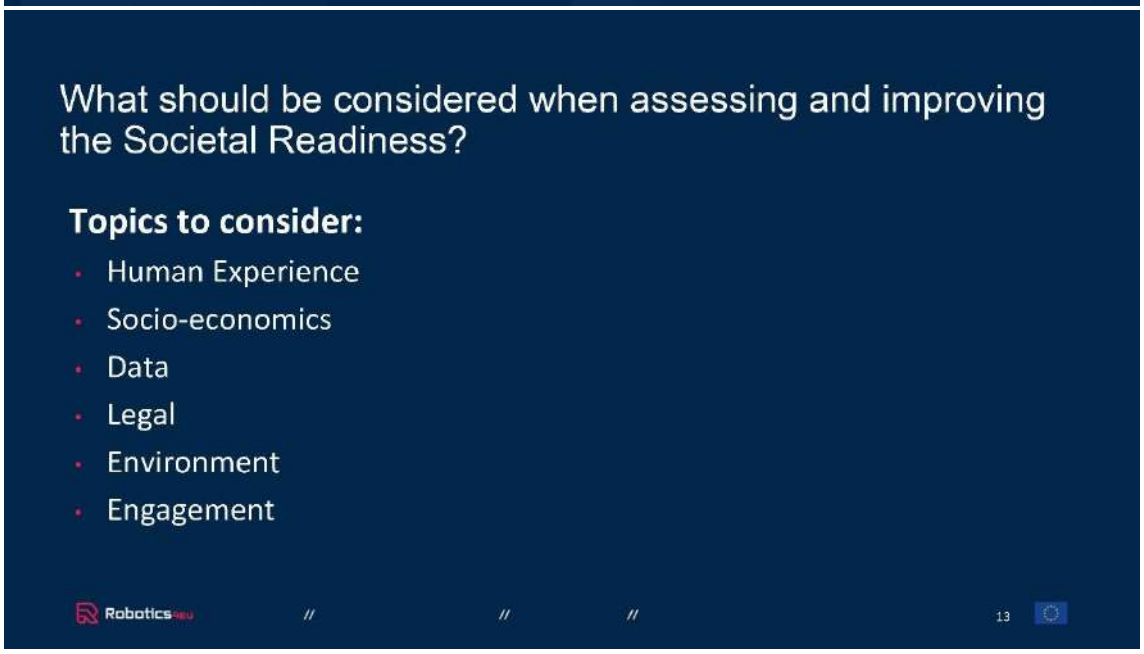

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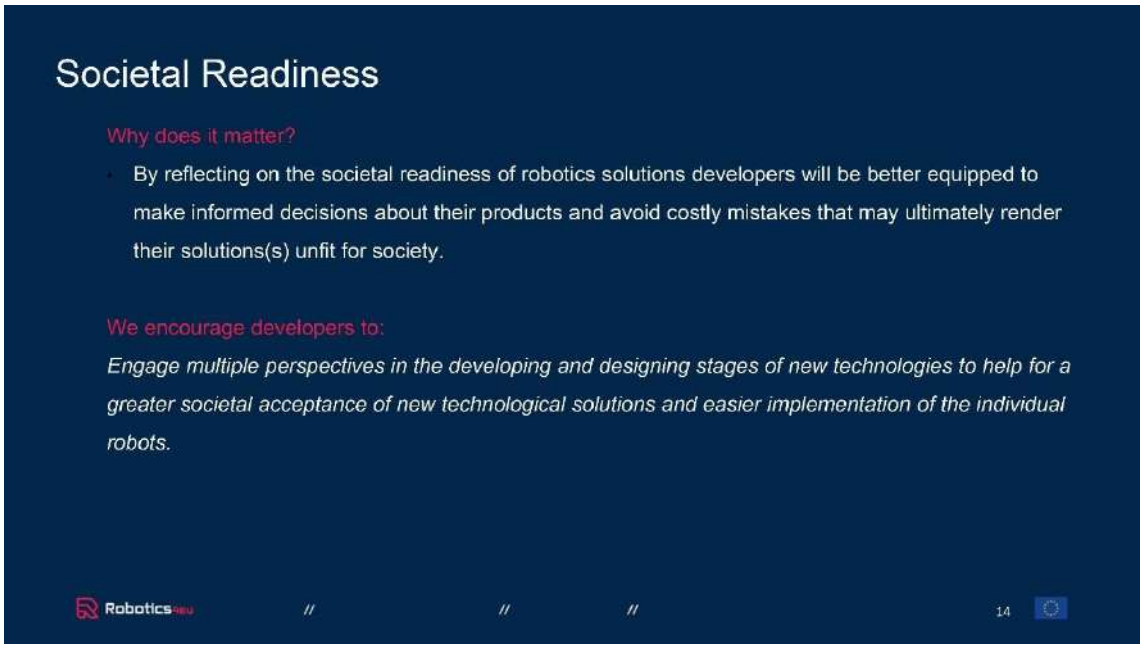

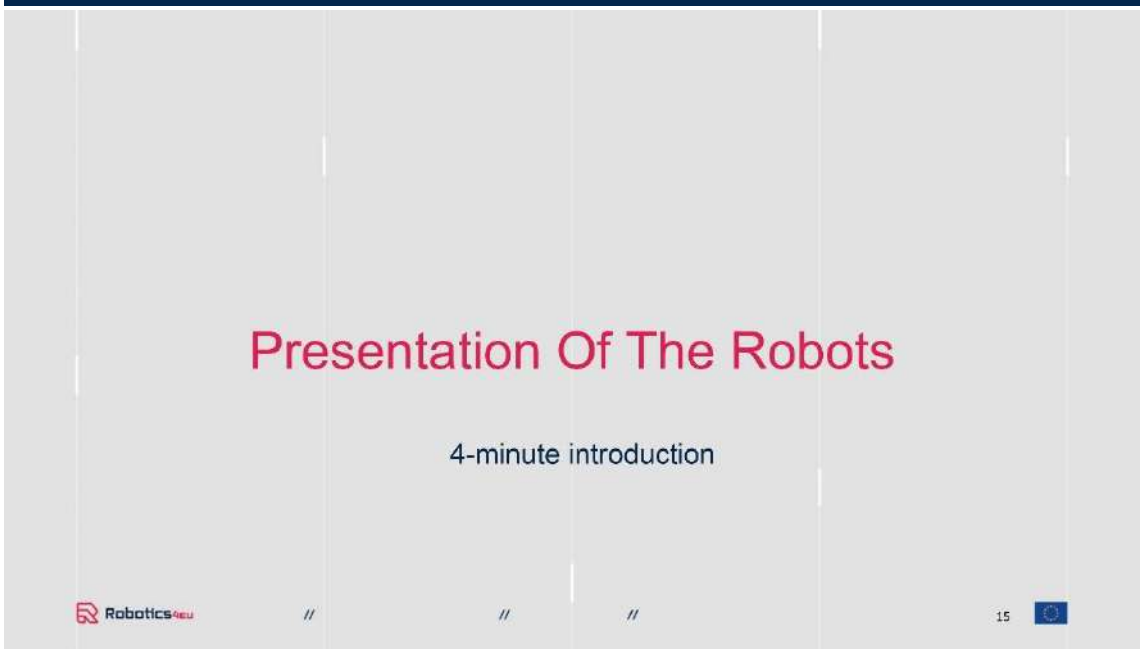

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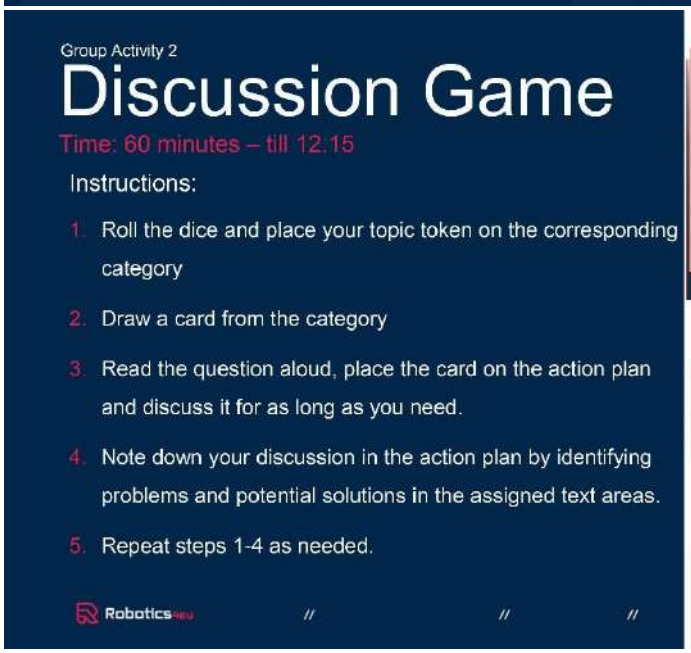

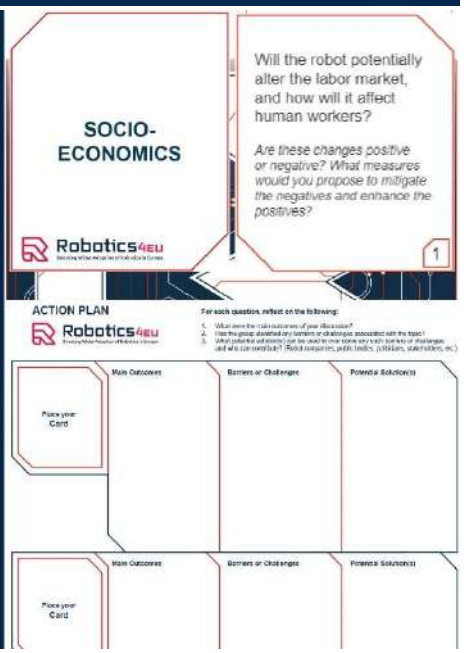

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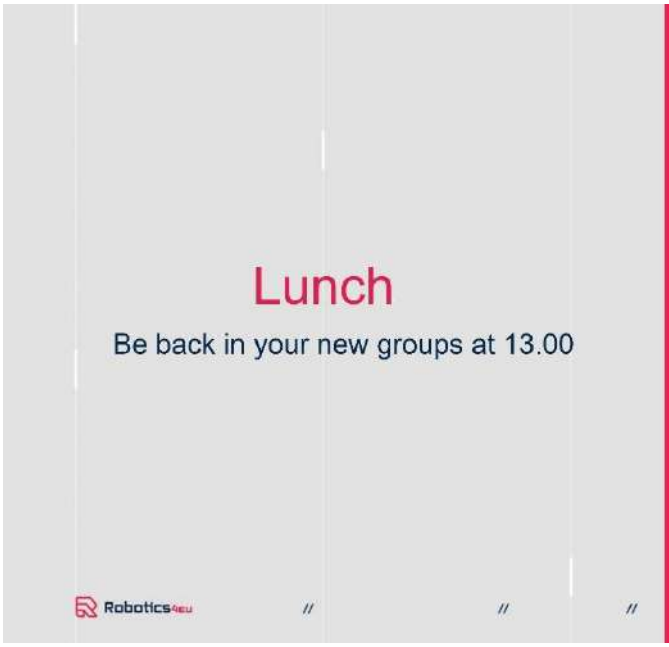

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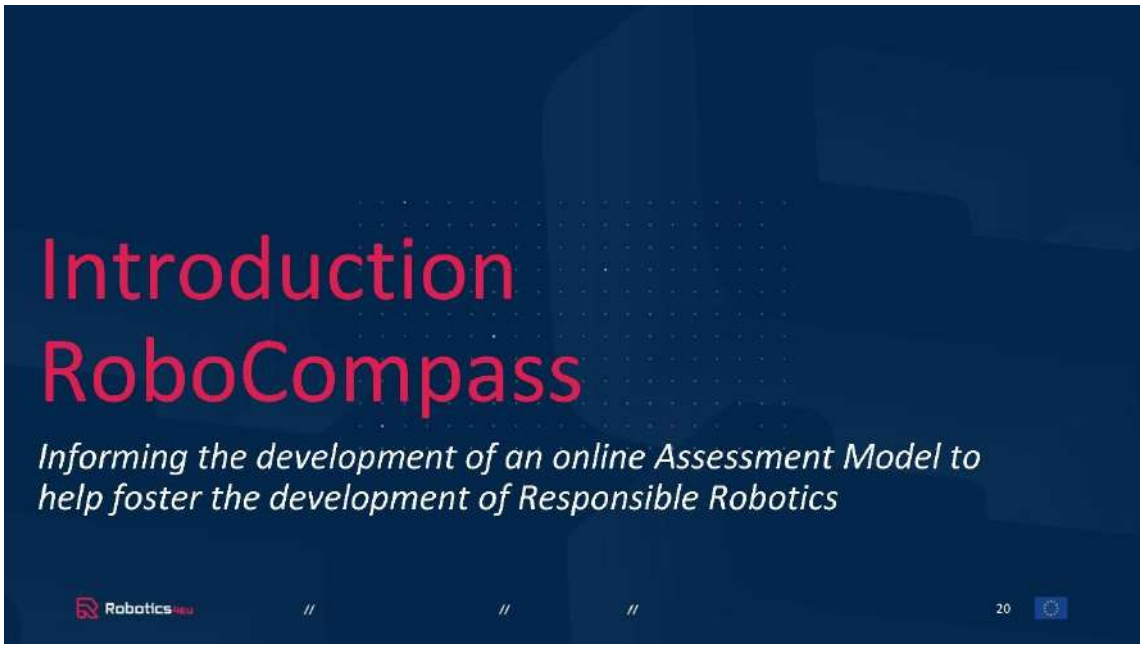
Introduction
RoboCompass
Informing the development of an online Assessment Model to help foster the development of Responsible Robotics
Robotics4EU
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Introduction to the Responsible Robotics Compass
03/10/2023 – Anne Kalouguine
Robotics4EU

A tool for robot manufacturers

- Is my robot sustainable?
- Will it be accepted by society?
- How can I make it more friendly?
- What resources can I use to improve my sustainability?

Environment

Socio-economics

Legal

Data

Human experience

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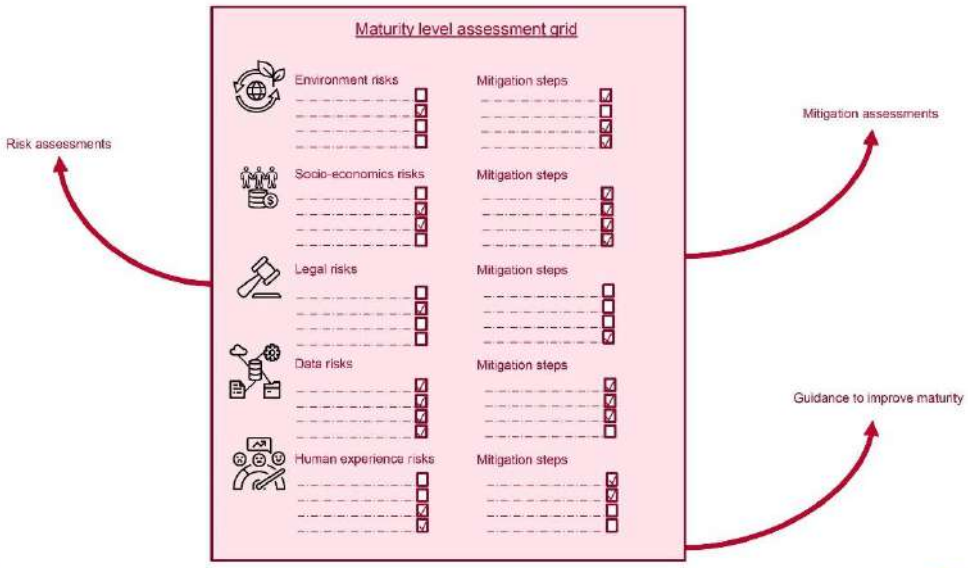
DATA	
Collection	What data is collected by the robot and surrounding system?
Storage	How is the collected data stored?
Usage	How is the collected data used? How are bias risks addressed?
External Data	If any external data is used, what is its origin and how is it handled?

LEGAL	
Acountability	Can legal accountability be established for the actions of the robot?
Governance	How are the technologies around the development of the robot governed (intellectual property, open source)?
Regulatory Readiness	Is the robot system ready to comply to existing and future regulations?

SOCIO-ECONOMIC	
Development economics	How do the robot production and deployment impact the global economic situation?
Equality	What impact can the robot have on the equality, at the workplace and beyond?
Labour market impact	How do the robot production and deployment impact the local labour market?

ENVIRONMENTAL	
Production	What is the environmental impact of the production of the robot and how can it be reduced?
Logistics	What is the environmental impact of the transportation and logistic chain of the robot and how can it be reduced?
Operation	What is the environmental impact of the operation of the robot and how can it be reduced?
Maintenance and End-of-life	What is the environmental impact of the end-of-life of the robot and how can it be reduced?

HUMAN EXPERIENCE	
Work	What is the impact of the robot on people working on its development or using the robot at work?
Life	What is the impact of the robot on people encountering it in other situations or influenced by its deployment?



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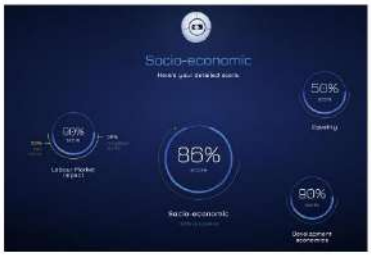
Scoring

- Risk and mitigation scores for each sub-category
- Score compiled from each risk/mitigation pair
- Category and global score compiled as a weighted sums



Timeline

- 2020-2022 Development of requirements and questions
- 2023 Development of first website version, testing
- Currently: Testing with robot manufacturers
- October 2023: new version of website and public release

The tool is already live and available at
https://robocompass.robotics4eu.eu/

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Group Activity 3 – 60 min. + 10 min break:
Help us Refine and validate the content of RoboCompass

One category at a time – Five rounds of 12 minutes

- **Speed-Brainstorm** — 5 min
  - Think of all the risks you can related to the category and generate as many post-its as possible.
  - Say out loud what you put on the post-it to inspire others
  - SSSssst! No discussing!
  - Take inspiration from what is written when you get stuck
- **Cluster answers** — 7 min
  - Put the post-its by their common themes
  - Summarize the answers
- **Discuss**
  - What is still missing? (place post-it's as a group)
- **Next Category**

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RoboCompass Session:

1. Spend **10 min**. looking the tool on the computer and try it out! Get acquainted with it and ask questions. Share your honest opinions!
2. Use **5 Min.** to review the questions in each category and talk about your opinions on the question and their framing.

1. Considering that the European Commission is focused on assessment frameworks (such as RoboCompass) that can be applied to multiple areas, what do you think is needed to make it work? Additionally, how can we make companies care about the non-technological aspects of robotics?
2. From your point of view, are the categories included in the tool relevant?
3. Can you think of situations where this kind of assessment would not work – discuss *why*.

Break

Be back at:

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Group Activity 3 – 60 min. + 10 min break:
Help us Refine and validate the content of RoboCompass

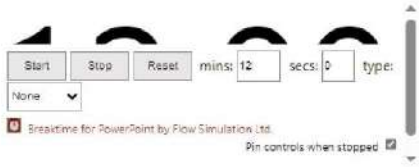
One category at a time – Five rounds of 12 minutes

- **Speed-Brainstorm**
  - Think of all the risks you can related to the category and generate as many post-its as possible.
  - Say out loud what you put on the post-it to inspire others
  - SSSssst! No discussing!
  - Take inspiration from what is written when you get stuck

5 min

- **Cluster answers**
  - Put the post-its by their common themes
  - Summarize the answers
- **Discuss**
  - What is still missing? (place post-it's as a group)
- **Next Category**

7 min



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Group Activity 4 – 15 min. in groups
Zoom Out:
Open Discussion On The Concept Of RoboCompass

- The group discusses and reflects on the following questions:
  1. What is your first impression of the tool?
  2. Do you have any recommendations that could help improve the RoboCompass?
  3. Would you feel safer if robotics companies had used such a tool? / Would you rather buy a robot from a company that has used a tool such as this?
- Facilitator writes notes from the discussion

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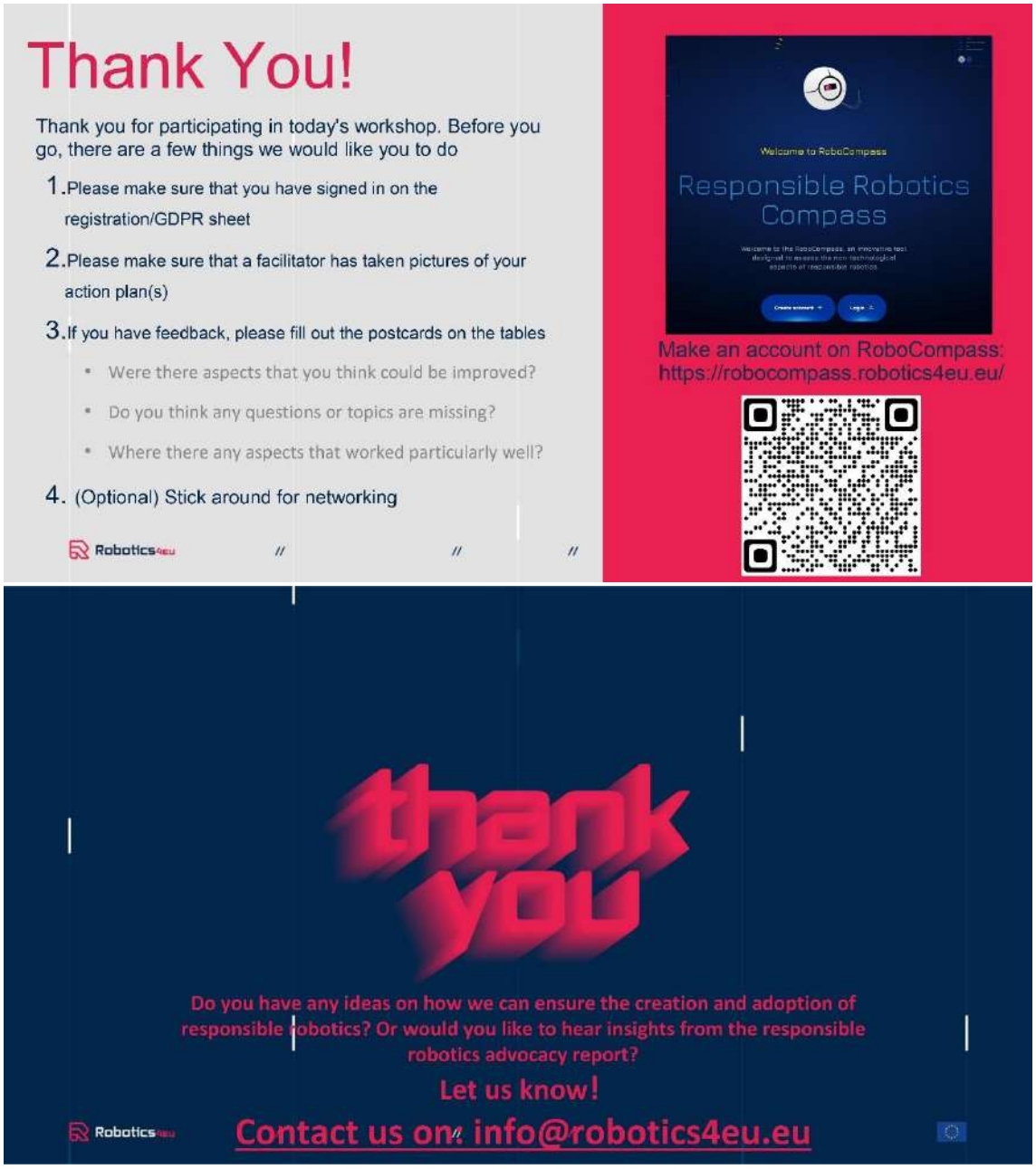

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12.2 Appendix 2: First version of Discussion Game

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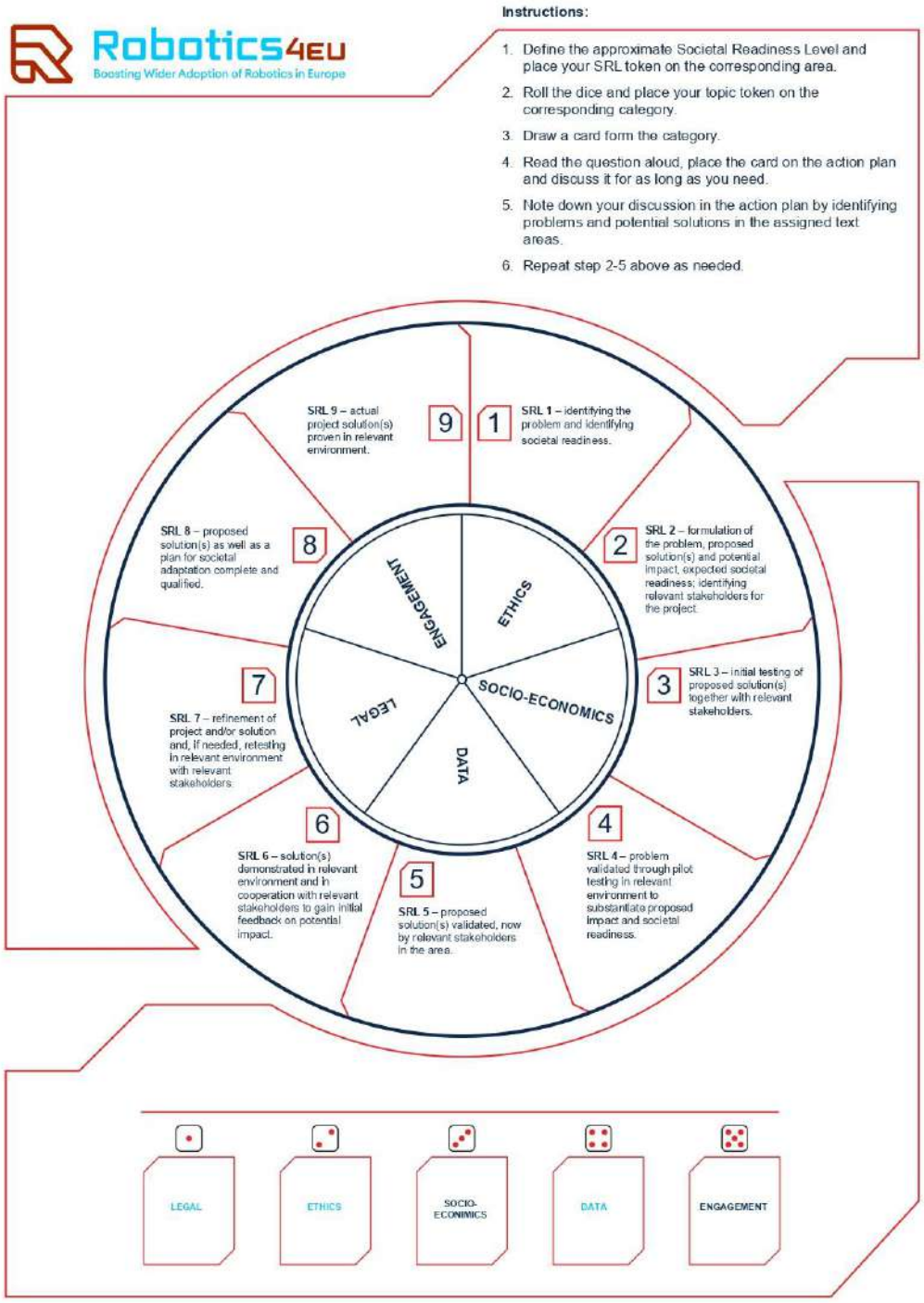

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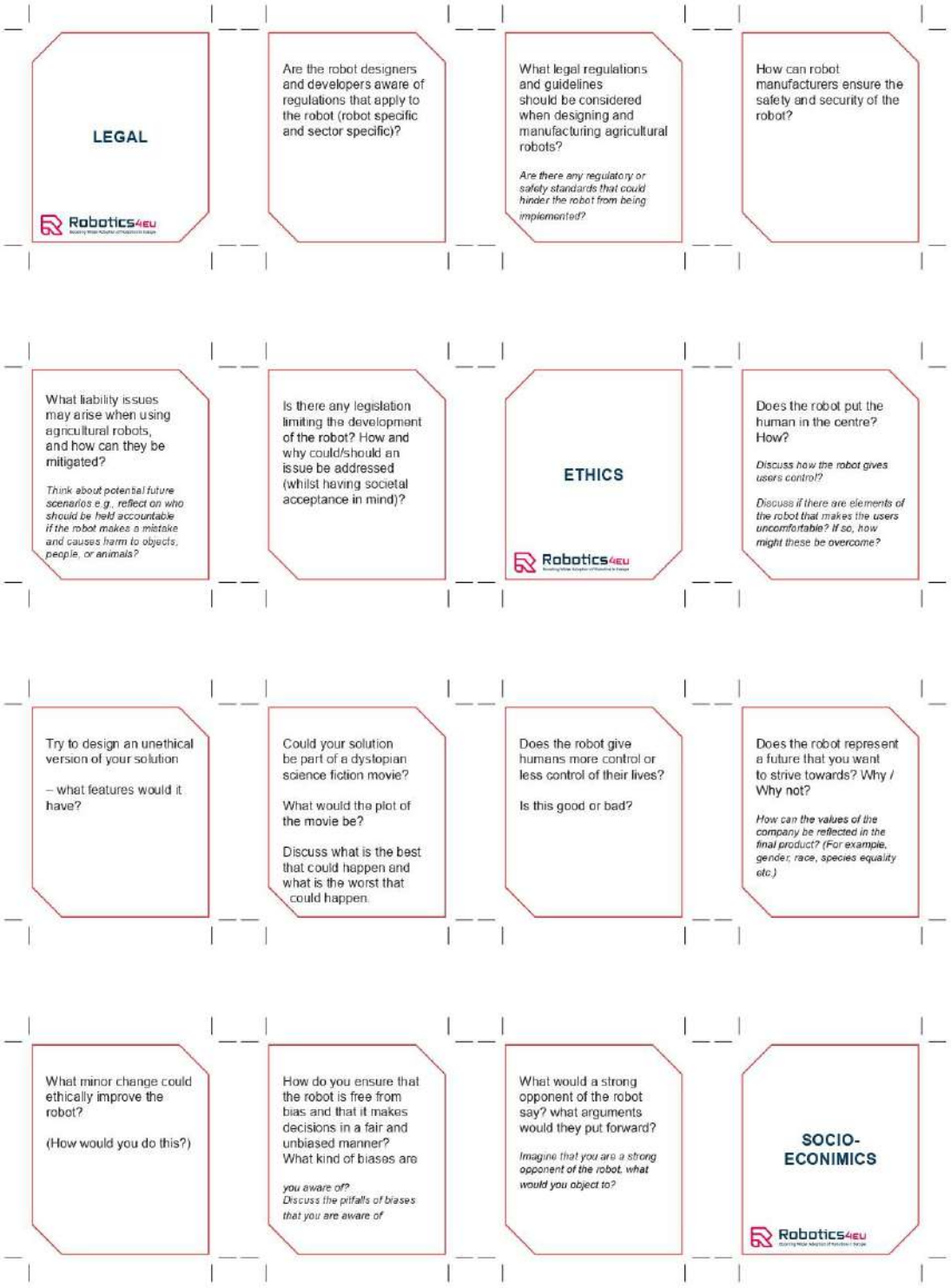

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Will the robot potentially create changes in the job market and how does the robot impact the job market for human workers?

Could the workers be offered internal training to work in collaboration with the robot or to find a more qualified job.

If the robot will be able to perform jobs currently done by humans, do you think this with time can result in more or less inequality between rich and poor in society?

Imagine the robot in 20 years. What technological advancements have the robot paved the way for and how will it impact the society we live in.

Reflect on whether there might be any negative societal impacts to consider.

From a socio-economic perspective, reflect on how the robot can improve society.

For example, will the robot improve any aspects of the work for the humans? Or how does the robot improve efficiency, productivity, and quality?

How can these factors be beneficial in ensuring a wider acceptance of the robot.

Are there any barriers towards the implementation of this solution in society?

Do the potential users see any barriers that the developers have not thought about?

What measures can the company developing the robot take to ensure trust in the robot?

Both among its users and among citizens.

How does the robot contribute to sustainable practices?

For example, are there any steps the developers could take to improve the impact the robot might have on society?

What measures can the robot developers take to ensure that the robot fits into the environment it should be implemented in?

Do the users have any recommendations or considerations that should be taken into account?

Will the robot have an impact on the cost of goods or services for regular citizens?

If yes, how?

Will the robot have any impact on small farms and rural communities?

If yes, how?

Will the robot impact the local environment and biodiversity?

If yes, how?

DATA

Robotics4EU

What kind of data will be collected by the robot, and how will it be used?

Is there any type of data that the users would not want the robot to obtain?

If yes, why?

Does the robot use any microphones, cameras or other types of sensors that collects and stores data?

If yes, reflect on whether the robot unintentionally collects data about people which are not necessarily needed for the function of the robot.

Does the robot manufacturer have an implemented strategy to let users know what type of data is collected?

Discuss how users prefer to be informed about data collection.

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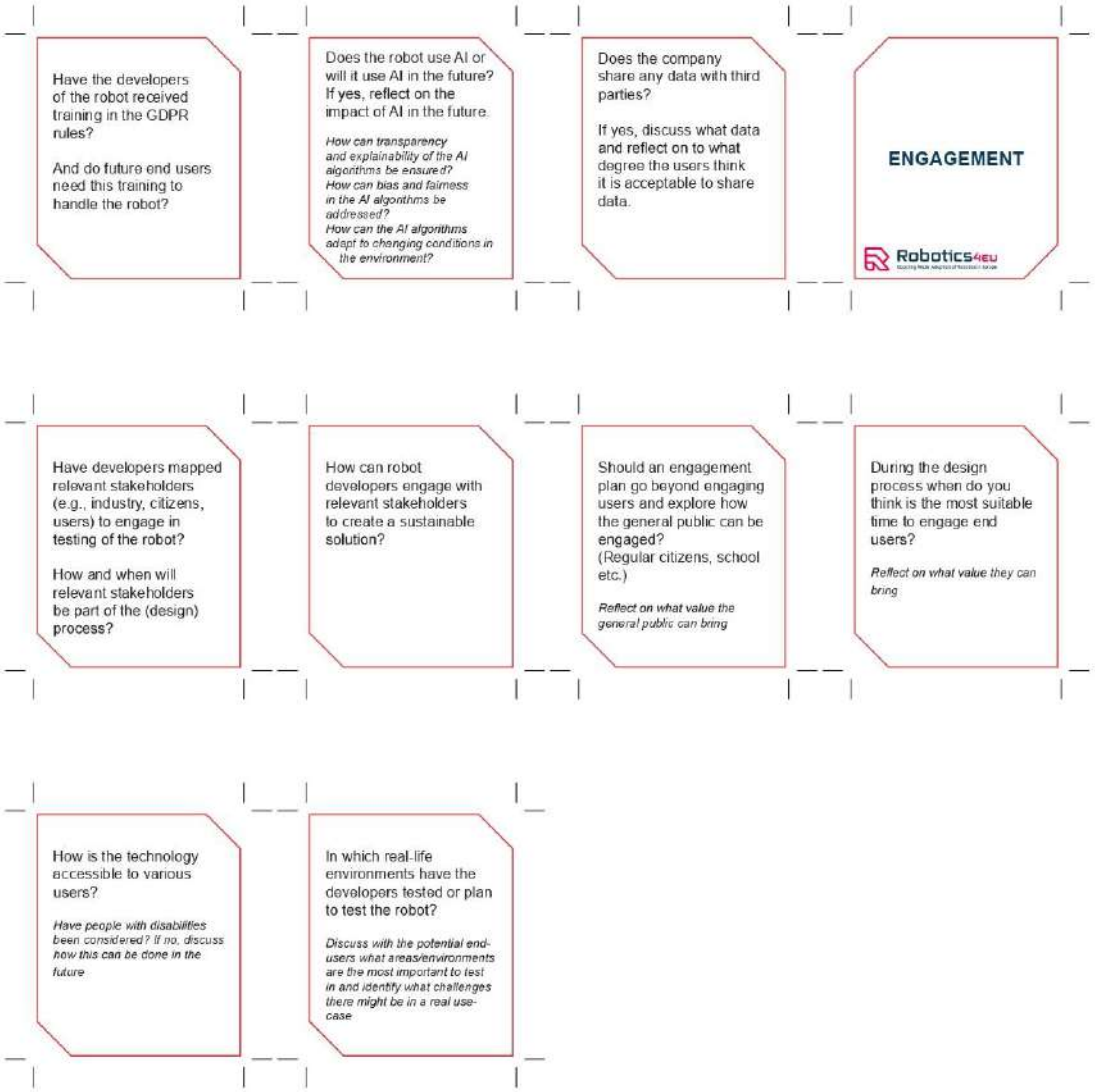

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12.3 Appendix 3: Second version of Design Game

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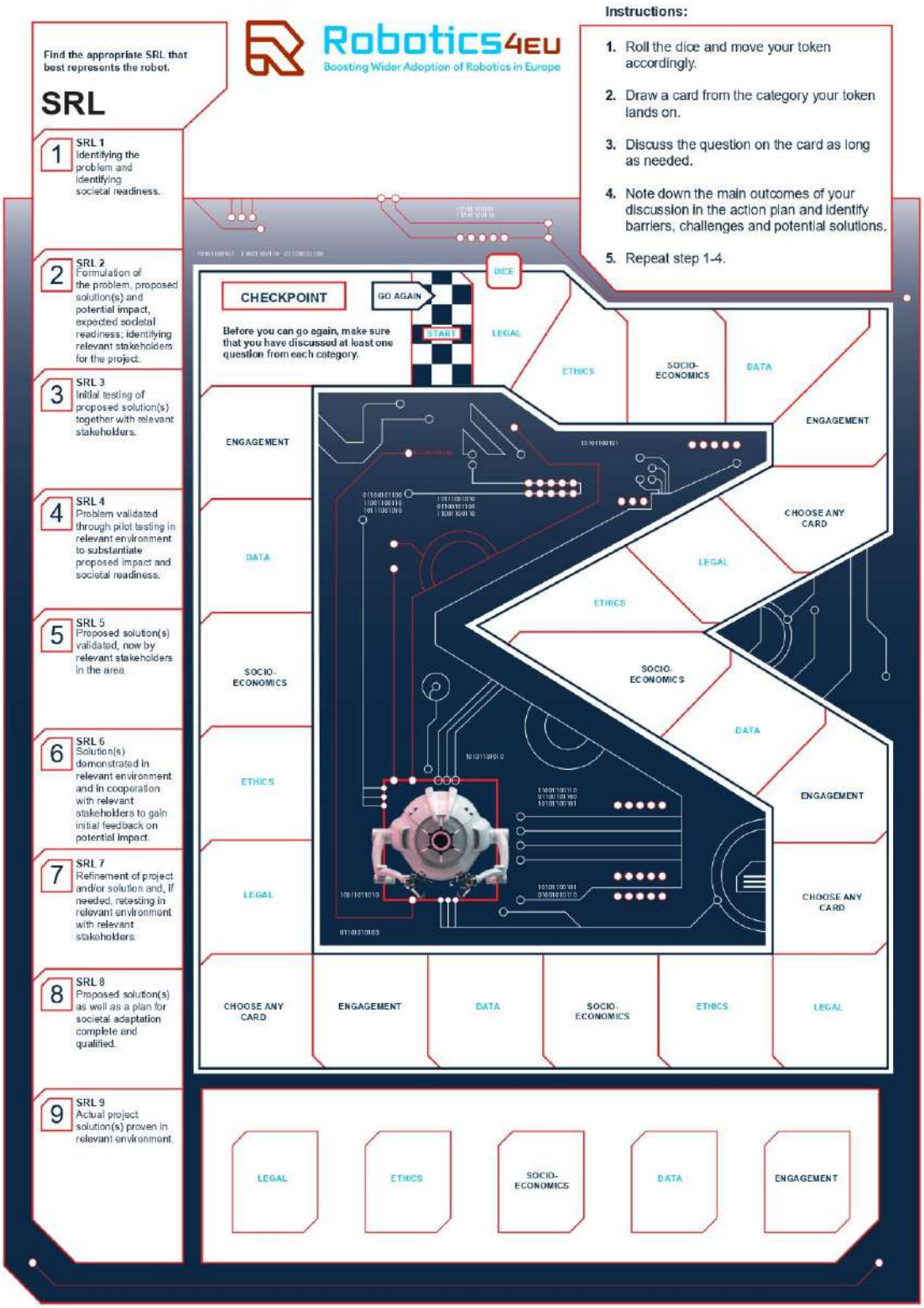

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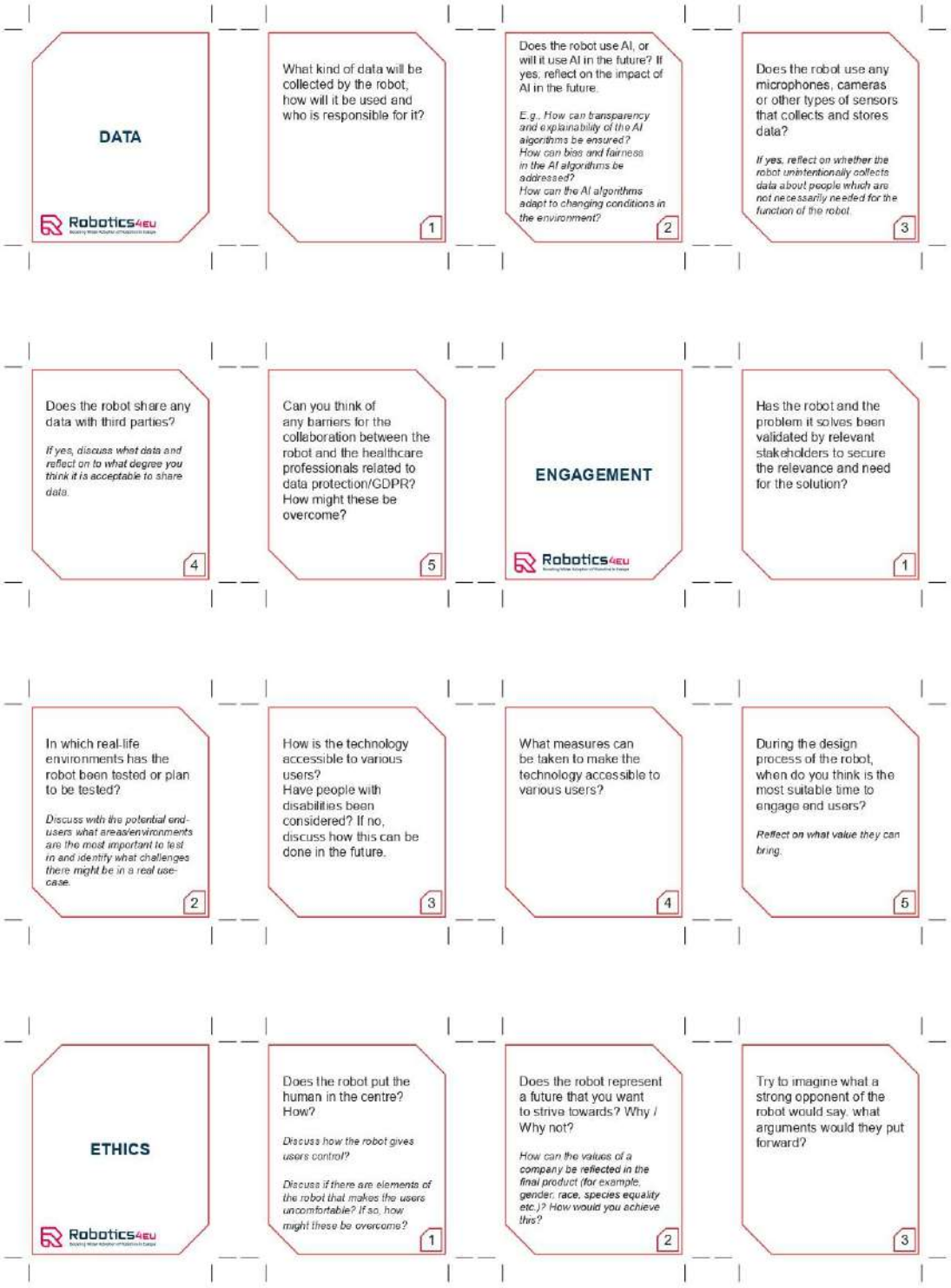

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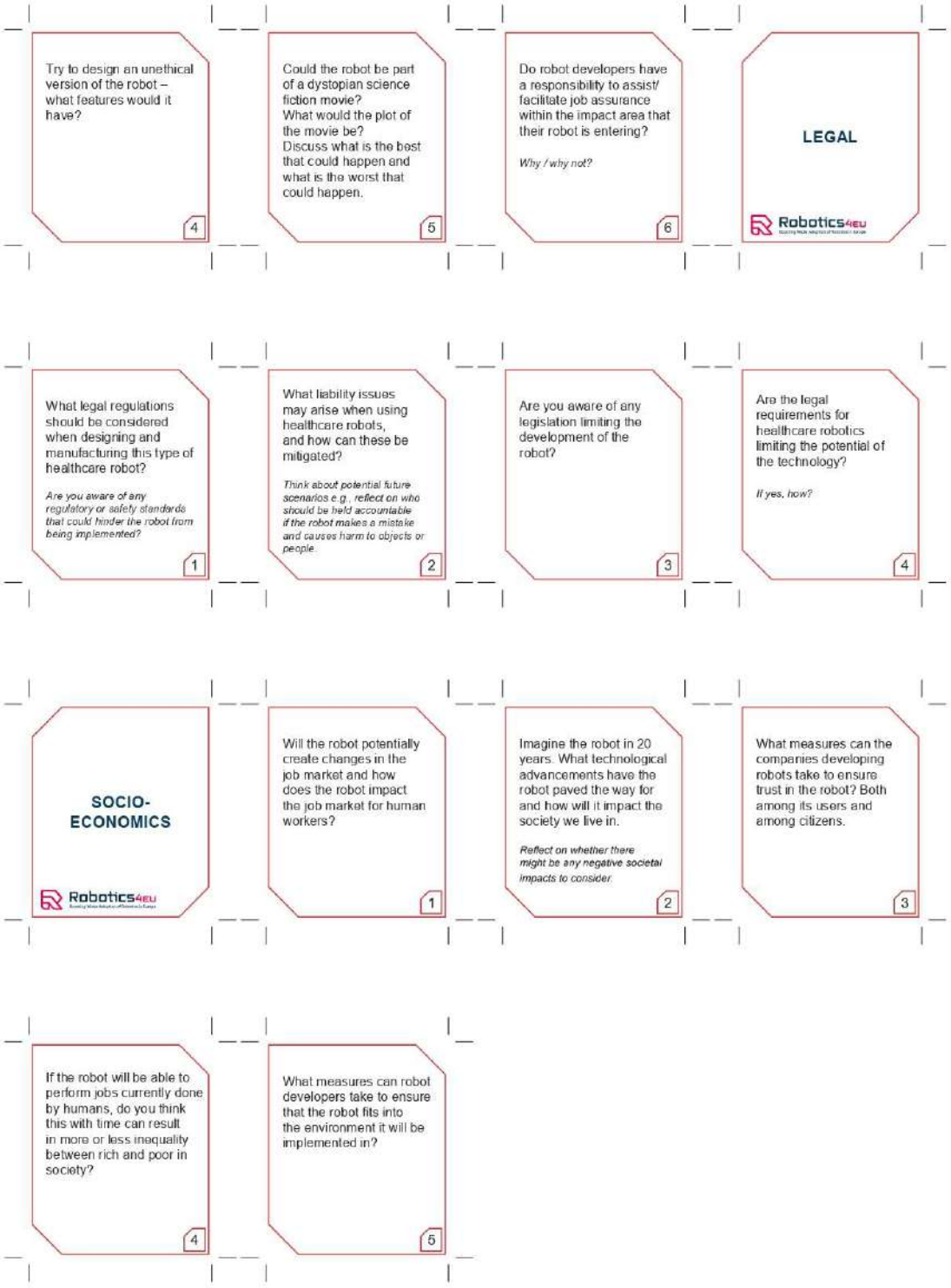

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ACTION PLAN

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For each question, reflect on the following:

1. What were the main outcomes of your discussion?
2. Has the group identified any barriers or challenges associated with the topic?
3. What potential solution(s) can be used to over come any such barriers or challenges and who can contribute? (Robot companies, public bodies, politicians, stakeholders, etc.)

Place your Card	Main Outcomes	Barriers or Challenges	Potential Solution(s)
Place your Card	Main Outcomes	Barriers or Challenges	Potential Solution(s)
Place your Card	Main Outcomes	Barriers or Challenges	Potential Solution(s)

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12.4 Appendix 4: Materials for recruitment

Template for email invitation

Dear (Name),

I hope this email finds you well. My name is [Your Name], and I am reaching out to you on behalf of [Insert your own organization or the project Robotics4EU] regarding the opportunity to participate in one of our upcoming workshops.

The workshop will be a co-creation event where robot developers and end-users will collaborate to explore the potential opportunities and implications of robotics solutions within agile production. At the workshop we will choose 10 aspiring robotics solutions within Agile Production to focus the discussion on and therefore we are contacting [Insert name of company].

We have been following your work in the field of robotics and are particularly interested in [Insert specific details about their work that you find interesting or impressive]. We believe that your participation in this workshop could add great value to the discussions and outcomes and at the same time be a great opportunity to test the societal aspects of your robot with potential end-users and stakeholders.

We hope you can join us, as it promises to be some engaging and thought-provoking discussions. You can register here: https://deltagelse.nemtilmeld.dk/18/

Purpose of the workshop:

The workshop is part of the European funded project Robotics4EU which aims to ensure a more widespread adoption of robots by addressing user need and societal acceptance. The workshop aims to bring experts from multiple disciplines together to discuss how robots can be implemented in agile production, while still ensuring ethical and responsible outcomes.

When joining the Co-creation workshop, you'll get the opportunity to examine important aspects of your robotic application from a societal perspective and a chance to discuss your robotic solutions with potential future end users or stakeholders of your solution.

During the workshop, participants will in groups use a discussion tool developed by the Danish Board of Technology to engage in discussions on how to prepare the robots for society by discussing a set of reflexive questions within the five topics of: Data, Legal, Socio-economic, Environment and Human experience

Expectations for your participation:

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We are looking for 10 aspiring robotics solutions within the agile production sector to display their robot either physically or in a video presentation to a small group of end-users at your group table. As a robot representative we expect you to shortly pitch the purpose and capabilities of your robot. For the majority of the workshop you will be engaging in discussions with potential end users and stakeholders to examine the non-technological aspects of your robot and how it can potentially impact society. You will be guided through the whole day by our facilitators and won't need to prepare anything else than the short robot presentation.

When and How:

The workshop will be held at at RoboHouse in Delft, Netherlands on the 3rd of October.
The workshop is **free to attend** and it will be possible to receive reimbursement on your **travel and accommodation** by the Robotics4EU project. There is a maximum of 450€ for reimbursement per participant. If you want to receive reimbursement please indicate this in your registration and we will send you more information.
Food and beverages will be provided, and there will be plenty of opportunities to network and collaborate with fellow participants.
Please follow this link to register for the workshop: Registration to workshop
Thank you for considering this invitation. We hope that you are as excited about this opportunity as we are and look forward to hearing from you soon. We hope to see you in Delft on the 3rd of October.

Kind regards,
(Name), consortium member of Robotics4 EU.

For more information on the project go to the R4EU website.

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Example of Registration Page

Co-creation workshop on robotics in agile production at RoboHouse in Delft, Netherlands on the 3rd of October.

Robotics4EU
// www.robotics4eu.eu
// info@robotics4eu.eu

Robotics4EU

Co-Creation Workshop on the societal aspects of Robotics in Agile Production *Inviting Robot Developers and End-Users*

We are excited to invite you to participate in our upcoming co-creation workshop on robotics in agile production **at RoboHouse in Delft, Netherlands on the 3rd of October.**

About the event

Robots are revolutionizing society and the use of robotic solutions in agile production has enormous potential to transform our lives for the better – but only if they are accepted and trusted by society.

The co-creation workshop seeks to bring together robot developers and manufactures with end-users and stakeholders to discuss the societal aspects of specific robotics solutions and co-create ideas for improvements. The workshop is part of the European funded project Robotics4EU which aims to ensure a more widespread adoption of robots by addressing user need and societal acceptance.

During the workshop, we will divide all participants into approximately ten different groups to focus their discussion on one specific robot at each table.

Each group will consist of 4-7 people:

- 1-2 representatives from the company/project developing or manufacturing the robot
- 3 or more participants who are potential end-users or stakeholders of the robot.
- A facilitator

After an introduction, the groups will use a discussion tool developed by the Danish Board of Technology to engage in discussions on how to prepare the robots for society.

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Example of Registration Page

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- A facilitator

After an introduction, the groups will use a discussion tool developed by the Danish Board of Technology to engage in discussions on how to prepare the robots for society.

Agenda*

9:30
Registration and welcome coffee

10:00 - 12:30
First workshop session
- Pitch of the robots
- Groups will be using an interactive discussion game to explore different themes within the topics: Data, Legal, Socio-economic, Environment and Human experience.

12:15 - 13:00
Lunch

13:00 - 15:00
Second workshop session
- Testing Robotics4EU's online assesement tool.

In addition to the planned workshop program there will be plenty of opportunities to network and collaborate with fellow participants.
**Small adjustments to the final agenda might happen as we apporach the event.*

Pratical information

The event is **free** and food and beverages will be provided on the day.

Venue:
We are happy to collaborate with RoboHouse for this event. Robohouse is located

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Example of Registration Page

in Delft and is part of the the flourishing robotics community around Delft University of Technology

Julianalaan 67
2628 BC Delft
The Netherlands

Reimbursement on travel and accommodation:
If you are traveling from outside the delft region, it will be possible to receive reimbursement on travel and accommodation to attend the workshops (Up till 450 euros, upon agreement). If you are interested in recieving reimbursement please indicate this in the registration and we will send you detialed information to your email once registrered. *Please be aware that we will have periods over the summer where there will be a longer waiting time for this information as we are on summer holiday in july.*

Who is this event for?

The co-creation workshop seeks to bring together robot developers and manufacturers with end-users and stakeholders to discuss the societal aspects of specific robotics solutions and co-create ideas for improvements.

If you identify yourself within one of these categories, we encourage you to join us at the co-creation workshop.

- **Robot Developers:** If you are involved in developing, designing, or manufacturing robotic solutions within the domain of agile production, this workshop provides a platform for you to showcase your work and receive valuable feedback from potential end-users and stakeholders. At the workshop we will be choosing up to 10 robotics solutions as cases for the discussions ***if you would like to represent a robot at the workshop, please indicate this in your registration*** under the question about your relation to the topic or reach out to us on mems@tekno.dk .
- **End-Users:** If you are a potential end-user of robotics solutions or a stakeholder in the field of agile production, this event offers an opportunity to engage with robot developers and manufacturers, voice your needs and concerns, and contribute to the discussion on societal aspects of robotics.
- **Buyers and Stakeholders:** If you are responsible for procurement decisions or have a vested interest in the adoption and impact of robotics in agile production, attending this workshop will give you and opportunity to discuss the challenges and opportunities in this domain.
- **Experts and Researchers:** If you are an expert or researcher in the field of the non-technichal aspects of robotics and/or agile production, your insights and expertise can contribute to the discussions and co-creation of ideas during the workshop.

By signing up you agree to recieve information about the upcoming workshop via email. The Danish Board of Technology will store information about your name, email, dietary restrictions and organisation for logistical planning of the event. You will only recieve news regarding the Robotics4EU project.

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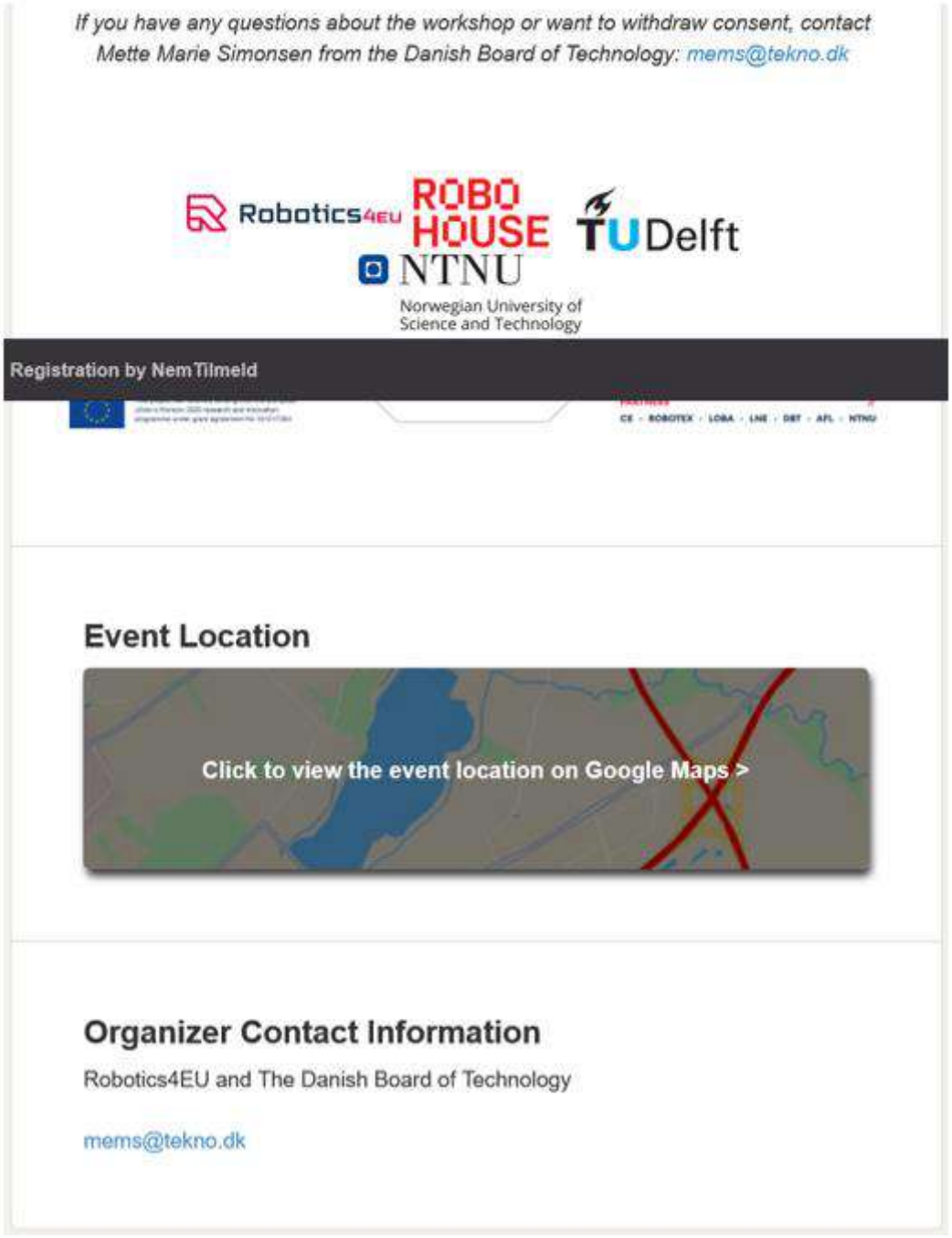
Example of Registration Page



SoMe / Promotional Material

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017283

Co-Creation Workshop on Robotics in Agile Production

Inviting Robot Developers and End-Users

We are excited to invite you to participate in our upcoming co-creation workshop on robotics in agile production **in Delft, the Netherlands the 3rd of October 2023.**

Robots are revolutionizing society and the use of robotic solutions in agile production has enormous potential to transform our lives for the better – but only if they are accepted and trusted by society.

The workshop invites robot developers and manufacturers to collaboratively explore the non-technological and societal aspects of robotic solutions with end-users and stakeholders. At the workshop it will be possible to assess the societal readiness of new robotic solutions and gather honest feedback on how to improve acceptance and trust from potential customers and partners.

Are you a robot developer or a potential end-user and do you want to participate?

Register for the workshop here: Registration to workshop

The workshop is free, and it is possible to receive reimbursement on travel and accommodation (upon agreement) to attend the workshops.

Food and beverages will be provided, and there will be plenty of opportunities to network and collaborate with fellow participants.

We hope that you can join us.

For any questions, please contact Mette Simonsen on mems@tekno.dk

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