



# All-in-one middleware for industrial human-robot-interaction

[arise-middleware.eu](https://arise-middleware.eu)

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Coordinator



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Consortium partners



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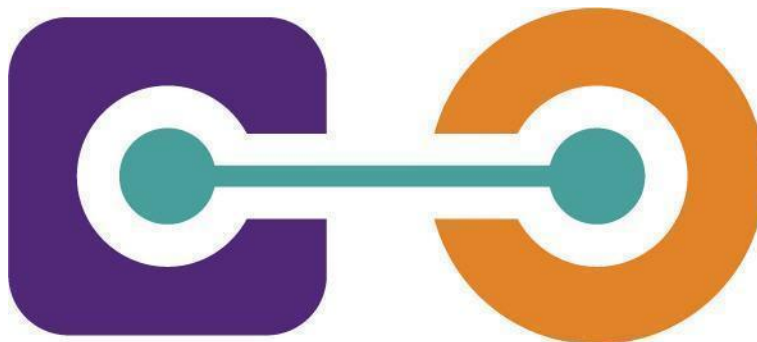
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# D3.4 ARISE's Ethics Summary Reports v1



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## Acronyms & Abbreviations

ACR.	Description
ADRA	AI, Data and Robotics
AI	Artificial Intelligence
EIR	Ethics Individual Report
FSTP	Financial Support for Third Parties
HRI	Human-Robot Interaction
SSH	Social Sciences and Humanities
TEF	Testing and Experimentation Facility

## Executive summary

This deliverable provides an overview of ethics related aspects of the ARISE project from the perspective of Demos Helsinki, the social sciences and humanities (SSH) partner of the project. The purpose of the document is to describe Demos Helsinki's approach and methodology in addressing ethics, the ethics related practices of the ARISE project, as well as the role and support of the External Ethics Committee of the project. The role of ethics in multidisciplinary projects is also discussed, and recommendations for approaching ethics in HRI projects are provided. The conclusion outlines the next steps of the ongoing work on ethics.

Demos Helsinki's approach to ethics in the ARISE project has two central dimensions: 1) increasing ethical awareness in the project and beyond, and 2) providing a toolbox involving ethics-related guidelines and tools that fit into the context of HRI. Both perspectives emphasize collaboration with the project partners and other stakeholders, continuous iteration and dialogue. The SSH research in the ARISE project is transdisciplinary in nature, applying participatory, ethnographic, and human-centric design methodologies, emphasizing sustainability and contextual understanding. Some of the concepts describing the research approach are everyday ethics, co-researching ethics and reflexivity.

This deliverable outlines the key ethics-related practices undertaken in the ARISE project, from the perspective of the SSH partner. These include the ethical considerations as part of the ARISE SSH framework, increasing ethical awareness within the ARISE project, research ethics in conducting SSH research, as well as establishing an external Ethics Committee for the ARISE project. The external Ethics Committee's role and support in the ARISE project is explained, alongside an overview of their tasks throughout the ARISE project. A summary of the findings from the first ethics review, with a focus on anticipating potential ethical challenges in the ARISE set-up before the open call phase, is provided. The findings include viewpoints to ethical concerns, recommendations, as well as current strength associated with the ARISE set-up and the eight HRI challenges and their associated use cases provided by the test and experimentation facility (TEF) partners of the project. The HRI-related challenges and their associated use cases are central for the project, as they serve as inspiration for Financial Support for Third Parties (FSTP) project applicants to design their own experiments within the scope of the ARISE open call programs.

At the end of the deliverable, an overview of the work done and plans for the future are provided, offering a comprehensive perspective on ethical aspects of the ARISE project from the SSH's partner point of view. Experiences and lessons learned from multidisciplinary collaboration on HRI topics and the role of the ethics in it are also shared. Finally, the next key tasks in the projects are outlined, including preparation related to the open call programs and the related mentoring activities, in which Demos Helsinki's role is to provide mentoring from ethics and SSH perspectives.

# 1 Introduction

## 1.1 Purpose and scope

This deliverable provides an overview of ethics related aspects of the ARISE project from the perspective of Demos Helsinki, the SSH partner of the project. The purpose of the document is to describe Demos Helsinki's approach and methodology in addressing ethics, the ethics-related practices of the ARISE project, as well as the role and support of the External Ethics Committee of the ARISE project. The discussion focuses on the role of ethics in multidisciplinary projects and recommendations for approaching ethics in HRI projects, whereas a conclusion highlights the next steps of the work.

## 1.2 Structure of this document

This deliverable describes the undertaken and planned ethics-related activities in the ARISE project from the perspective of the SSH partner. The objective of this document is to give an overview of the project's ethics-related aspects and practices. Chapter 2 describes the approach and methodology in addressing ethics. Chapter 3 describes the ethics-related practices in the project. Chapter 4 describes the role and support of the External Ethics Committee of the project. Chapter 5 is the discussion. Chapter 6 is the conclusion.

## 1.3 Intended audience

This deliverable is public. Therefore, the intended audience for this deliverable is all parties interested in ethics-related considerations and activities carried out in the ARISE project. These include, for example, the European Commission, consortium partners, researchers, practitioners and decision makers interested in the topic within scope of the ARISE project. In addition, the deliverable may be of interest to FSTP projects participating in the ARISE open call program.

## 1.4 Contributions from partners

Table 1 summarizes the main contributions from consortium partners for this deliverable:

Table 1. The main contribution from partners.

Partner	Contribution
CARTIF, INTELLIMECH, PAL Robotics, POLIMI	Reviewers of the TEF related materials used in the first ethics review by the Ethics Committee
CARTIF	Internal reviewer of the deliverable

## 2 Approach and methodology

### 2.1 From ethics awareness to practical tools

Our, Demos Helsinki, approach to ethics in the ARISE project has two central dimensions: 1) increasing ethical awareness in the project and beyond, and 2) providing a toolbox involving ethics-related guidelines and tools that fit into the context of HRI. Increasing ethical awareness involves bringing ethical questions into shared discussions and maintaining the dialogue throughout the project. Work related to guidelines and tools focuses on compiling the existing approaches, analyzing and developing them further to be usable in the context of HRI. Both perspectives emphasize collaboration with the project partners and other stakeholders, continuous iteration and dialogue.

The central part of the work is our qualitative and participatory research, which is used to gain contextual understanding about the field of HRI and its professionals' work-related practices, aspirations and needs. The goal of the research is to involve key stakeholders such as our partners and FSTP projects in the discussions and development processes, as well as to gain a deep understanding of their work-related practices and needs to provide them with meaningful recommendations related to questions surrounding ethics.

Thus far, our work on increasing ethical awareness has focused on introducing the key concepts and relevant frameworks related to ethical considerations in technological developments. These have included discussions on ethics as a concept, as well as various approaches to ethics from design to implementation. We have covered recent relevant examples such as the SIENNA<sup>1</sup> and Ethics By Design frameworks<sup>2</sup>.

As for ethics-related tools, it is noteworthy that the tools we talk about do not include technical solutions to ethical concerns. Rather, tools in this context are focused on frameworks and guidelines. Examples of these practical tools could be: embedded ethics (embedding education to STEM studies), ethically aligned approach (specific high-level principles, such as transparency or fairness), and value sensitive design (defining ethical values throughout the entire technological design process)<sup>3</sup>.

### 2.1 Co-researching ethics

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<sup>1</sup> SIENNA framework. Available at: <https://doi.org/10.5281/zenodo.7266848>

<sup>2</sup> Ethics-by-design framework. Available at:

[https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-by-design-and-et-hics-of-use-approaches-for-artificial-intelligence\\_he\\_en.pdf](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-by-design-and-et-hics-of-use-approaches-for-artificial-intelligence_he_en.pdf)

<sup>3</sup> Bleher, H., & Braun, M. (2023). Reflections on putting AI ethics into practice: how three AI ethics approaches conceptualize theory and practice. *Science and Engineering Ethics*, 29(3), 21. <https://doi.org/10.1007/s11948-023-00443-3>

Our SSH research is transdisciplinary and involves experts from various fields such as social psychology, political science as well as sustainability and design research, combining viewpoints from human-robot interaction, science and technology studies (STS), and design. Methodologically, our research is grounded on qualitative participatory, ethnographic, and human-centric design research, emphasizing sustainability and contextual understanding.

A central feature of our approach is that we co-research ethics. In practice, this means a strong collaboration with both internal and external project experts to investigate the ethics-related questions. Within our project, we collaborate with project partners in researching relevant ethics-related questions and possible ways to address them. We are also responsible for establishing and being the main contact point of the Ethics Committee for the ARISE project, consisting of 3 external ethics experts. Outside the project, we seek to collaborate and exchange knowledge with professionals and practitioners who are interested in these topics.

The idea of co-researching ethics is strongly embedded in our qualitative research. A central concept in our approach is everyday ethics, which has been applied, for instance, in the field of anthropology<sup>4,5</sup>. In our study, everyday ethics reflects the idea of weaving ethical questions into specific context and the daily lives of people. Hence, our focus is on co-researching ethics with our research participants in their own contexts and from their situated perspectives. This approach was considered to be suitable for our work, because it enables us to produce outcomes that benefit all parties. The approach is reflexive in nature, where a special attention is placed on the researchers' critical examination of their own possible biases and impacts of the research methods utilized<sup>6</sup>. Our goal is to ensure inclusive, respectful and equitable collaboration as well as transparency throughout the research process.

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<sup>4</sup> Banks, S., Armstrong, A., Carter, K., Graham, H., Hayward, P., Henry, A., ... & Strachan, A. (2016). Everyday ethics in community-based participatory research. In *Knowledge Mobilisation and Social Sciences* (pp. 97-111). Routledge. <https://doi.org/10.1080/21582041.2013.769618>

<sup>5</sup> Pols, J. (2024). Making things specific: towards an anthropology of everyday ethics in healthcare. *Medicine, Health Care and Philosophy*, 1-11. <https://doi.org/10.1007/s11019-024-10204-z>

<sup>6</sup> Reid, A. M., Brown, J. M., Smith, J. M., Cope, A. C., & Jamieson, S. (2018). Ethical dilemmas and reflexivity in qualitative research. *Perspectives on medical education*, 7, 69-75. <https://link.springer.com/article/10.1007/S40037-018-0412-2>

## 3 Ethics-related practices in the ARISE project

### 3.1 Ethical considerations as part of the ARISE SSH framework

The ethical considerations are a central part of the Open ARISE SSH Framework for human-centered and ethical HRI. The framework is one of the key tools in the ARISE project, and provides a systematic approach to embed ethical, social and legal considerations into HRI. Demos Helsinki leads the development of the framework through an iterative process. The first release of the framework is December 2024. The second version will be published at the end of 2025, and the final version of the framework is published at the end of the project, in June 2027.

The framework consists of several elements which are relevant to ethics. These include the ARISE HRI ethical principles, the ARISE ethics impact assessment, as well as the collection of HRI-related, relevant industry standards and European regulation. The ARISE ethical principles provide the starting point for the framework and include principles outlined in the Ethics By Design framework, namely respect for human agency; privacy, personal data protection and data governance; fairness; individual, social, and environmental well-being; transparency; accountability and oversight. As for the ethical assessment, we focus on relevant existing approaches, such as the SIENNA framework, which is a six-step process for ethical considerations in technological innovations including robotics. Furthermore, we discuss the role of the external Ethics Committee in making ethical assessments and producing ethical requirements. We also outline the typically encountered ethics-related questions in artificial intelligence (AI) systems, as well as give examples of relevant use cases and their associated ethical concerns and questions. Regarding industry standards and European regulation, the framework includes a collection of relevant approaches, such as the AI Act<sup>7</sup>, GDPR<sup>8</sup>, ePrivacy directive<sup>9</sup>, Ethics guidelines for Trustworthy AI<sup>10</sup>, the Assessment List for Trustworthy Artificial Intelligence (ALTAI)<sup>11</sup>, as well as standards such as IEEE 7000 series<sup>12</sup>, and ISO/IEC JTC 1/SC 42 (AI standards)<sup>13</sup>. Altogether, the framework serves as an open toolbox for various audiences, providing a wide range of relevant and applicable materials for enhancing human-centric and ethical HRI.

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<sup>7</sup> The AI Act. Available at: <http://data.europa.eu/eli/reg/2024/1689/oj>

<sup>8</sup> GDPR. Available at: <http://data.europa.eu/eli/reg/2016/679/oj>

<sup>9</sup> ePrivacy directive. Available at: <https://eur-lex.europa.eu/eli/dir/2002/58/oj>

<sup>10</sup> Ethics guidelines for Trustworthy AI. Available at: <https://data.europa.eu/doi/10.2759/346720>

<sup>11</sup> The Assessment List for Trustworthy Artificial Intelligence. Available at: <https://digital-strategy.ec.europa.eu/en/library/assessment-list-trustworthy-artificial-intelligence-altai-self-assessment>

<sup>12</sup> IEEE 7000 series. Available at: <https://standards.ieee.org/initiatives/autonomous-intelligence-systems/>

<sup>13</sup> ISO/IEC JTC 1/SC 42 (AI standards). Available at: <https://www.iso.org/committee/6794475.html>

## 3.2 Increasing ethical awareness within the ARISE project

In the ARISE project, we strive for increasing ethical awareness within the project consortium through continuous discussions and involvement. This does not only strengthen the collaboration between project partners but also all the partners' know-how in SSH and ethical considerations. This way, we seek to strengthen the capabilities of the key players in the field, leaving a long-term impact on the European robotics community. To this end, the joint ethics-related discussions in the ARISE project have taken place in consortium meetings, in WP3 bi-weekly online meetings, as well as during our on-site visits at TEF partners.

In addition to the kick-off-meeting in January 2024, two general assemblies have been held during 2024, the first in June and the second in October. Alongside their extensive agendas, these meetings served as important platforms for presenting and discussing ethics-related topics. In these meetings, we have presented our work on ethics-related literature review and mapping for the use of the SSH framework. These included, for example, introductions to SIENNA framework, Ethics By Design framework including its six ethical principles, Ethics guidelines for Trustworthy AI by the High-Level Expert Group on Artificial Intelligence (AI HELG), and the Assessment List for Trustworthy Artificial Intelligence (ALTAI).

Another central venue for ethics-related discussions has been the recurring WP3 bi-weekly meetings. In the first WP3 online meeting in spring 2024, an introductory lecture on ethics was given, focusing on the academic literature as well as the SIENNA framework as a relevant practical example of approaching ethics in the context of technological innovation. In the fall of 2024, our series of meetings was initiated by asking the partners about their hopes and expectations for future meetings and whether they had any feedback on the work carried out by us, the SSH partner. Miro online tool was used for collecting feedback and suggestions anonymously, which was followed by an open discussion on the points raised on the online platform.

During October and November, three interactive ethics-themed workshops were conducted in connection with our bi-weekly meetings. These short sessions focused on forming shared ground and language for discussing ethics in the later stages of the project. First, we focused on the participants' current thoughts by asking for their initial reactions to the words "collaborative robots" and "ethics". Then the discussion centered around the six ethical principles of the Ethics By Design framework. During the three interactive sessions, we explored the meanings and examples for all six principles by encouraging our partners to share practical examples related to each principle from the perspective of their work in the ARISE project. Examples outside of the project were also included. Mentimeter was used as an interactive online tool to collect the answers and facilitate the discussion. Due to a relatively small number of participants in the first session, the Menti responses were supplemented with anonymous online survey responses collected from partners via email. Figures 1 and 2 illustrate the responses regarding first reactions to collaborative robots and ethics. The specific questions were 1) "The first 3 adjectives that comes to your mind when thinking of collaborative robots" and 2) "The first 3 adjectives that comes to your mind when thinking of

ethics". For the first question, we received 29 responses in total and for the second question we received 26 responses in total. Participation in this joint activity was voluntary.



Figure 1. Participants' first reactions to collaborative robots.



Figure 2. Participants' first reactions to ethics.

The third central arena for ethics-related discussions have been the on-site visits to TEF partners during the fall 2024. We visited all four TEF partners; PAL Robotics, CARTIF, INTELLIMECH and POLIMI, for 3-4 days each, in October and November 2024. During the visits we conducted an ethnographic field study focusing on the following research questions: 1) how the work related to HRI is practically carried out, 2) how the work is perceived by employees, and 3) what kinds of perspectives related to human-centeredness and ethics are associated with the work. The practical goals of the visits were to gain a situated and

contextualized understanding of TEF's work, engage in deeper discussions on ethics, human-centricity, and co-development, and collaboratively build, refine, and test guidelines and tools within the ARISE SSH framework. Through our visits and practical understanding, we sought to ensure that the guidelines, tools, specifications and recommendations we include in the ARISE SSH framework are relevant, understandable and fit for purpose.

During the visits, the ethics-related aspects were present in multiple ways. In addition to learning about our partners' thinking and practices in their everyday work through interviews and participatory observation, we held a workshop on ethics, human-centricity and co-development at each of the testing facilities. In the workshops, we first explored the interests and values that the participants associated with their own work, as well as the step-by-step process for robot development. We then introduced the group with the six ethical principles of the Ethics By Design framework and mapped how these principles could be addressed as part of the existing work processes. The workshop enabled us to collaboratively explore how ethics were involved in the participant's current work practices, as well as ideate ways to do it in the future.

### 3.3 Research ethics in conducting SSH research

While HRI professionals' work practices and experiences are not a particularly sensitive research topic, ethical considerations arise through the research process, from planning to data storage and reporting. The whole SSH research team is committed to follow good scientific practices throughout the process and strive for high ethical standards to protect participants from any harm stemming from participation. Our research approach is highly participatory and puts emphasis on equity.

At first, before the on-site visits, we held a joint planning call with each of the TEFs in August and September to collaboratively decide on practicalities and contents of the visits. All TEF partners received written information about the research and the study objectives, their participation's voluntary nature and the opportunity to withdraw from the study if they desired. Research permits were co-produced and signed by all involved parties at the beginning of each visit. Participants of workshops and individual interviews signed an informed-consent form to participate and received a privacy policy report. After the visits, the research group has carefully handled and stored the datasets to safeguard participants' privacy and anonymity. All information received in the context of this project is treated as confidential. The research findings are shared with the research participants and then with wider audiences in a format that ensures individual respondents cannot be identified. The results are reported accurately and comprehensively using respectful language. In addition to the ARISE project's deliverables, our goal is to report our findings in academic publications.

### 3.4 External Ethics Committee in the ARISE project

We as the SSH partner of the project are responsible for establishing the Ethics Committee for the ARISE project. We have recruited three experts for the committee during fall 2024. In the Ethics Committee of the ARISE, all three experts participate in conducting ethical assessments, and one of them also serves as the chair of the committee, being responsible for the final decision-making. All the three experts have demonstrable expertise in doing ethics assessments and have previous experience in carrying out ethics review tasks in the context of open call programs and FSTP projects. In addition, the composition of the committee is geographically distributed, and we have paid attention to gender balance.

The rationale for having the external experts involved in the project is multifold. The external experts enhance the ethical oversight of the project, helping to ensure that it is conducted responsibly and has a strong ethical foundation. The experts possess specialized expertise in the ethics-related issues concerning technological innovations, which, on one hand supports our efforts in identifying specific niche challenges, and, on the other hand, brings diverse viewpoints that contribute to a comprehensive overall perspective. The experts are already involved at the beginning of the project, evaluating its foundations, which helps mitigate risks in later stages, as well as provide the ARISE project directions to move forward. Particularly in the FSTP projects phase, the external experts provide support in regulatory compliance by doing an ethical assessment for all the pilots, including outlining necessary recommendations and ethical requirements for each of them to be addressed. Towards the end of the project, the experts conduct a comprehensive evaluation of the ethics-related procedures of the project, providing the entire consortium with valuable documentation of the processes and external viewpoints to the actions undertaken. Overall, the committee supports the project in ethical matters and Demos Helsinki's role is to be the main contact point between the experts and the consortium. We facilitate this process by, among other things, managing schedules and providing the necessary materials for ethical assessments.

## 4 External Ethics Committee's role and support in the ARISE project

### 4.1 Overview of the ethics review tasks of the Ethics Committee

The Ethics Committee will conduct an ethics review procedure at the start of the research, during the testing facility phase, and at the end of the ARISE project.

To this end, the experts have conducted the first ethics review at the start of the research, in November 2024. The first ethics review was to anticipate any ethical challenges in the ARISE set-up before the open call phase. The first ethics review was conducted independently by the experts based on a document describing the key elements of the ARISE project, TEFs set-ups and the associated HRI challenges, using a template provided by Demos Helsinki. The summary of the findings is included in this deliverable in the next section 4.2 Summary of the findings from the first ethics review.

The experts will conduct the second and third ethics reviews during the testing facility phase within two open call programmes, the first running in 2025-2026 and the second in 2026-2027. The experts will review each FSTP finalists project independently and produce an Ethics Individual Report (EIR) for each of them. Then, the preliminary joint reports from the individual EIRs are combined, and Demos Helsinki calls the experts for an online consensus meeting to discuss the results, reach consensus and finalize the documents. In case of disagreement, the Chair of the Committee is responsible for the final decision-making. The joint reports will include the ethical recommendations and the deliverables that the project beneficiaries have to share with the Ethics Committee in the next phases of the assessment. The contents of the joint reports will be included into the individual mentoring plans for FSTP projects and the ARISE project's deliverable D3.5 ARISE's Ethics Summary Reports v2.

The Ethics Committee evaluates each project selected for funding for compliance with the Horizon Europe standards on ethics and according to the Ethics Appraisal rules set up by the European Commission in the standard Ethics assessments conducted in all Horizon Europe calls and programmes. The Ethics Committee is responsible for 1) evaluating the accomplishment of ethical requirements of third-party beneficiaries; 2) monitoring the ethical concerns of the sponsored projects; 3) offering plausible solutions and contributing to the resolution of conflicts that may arise; 4) raising awareness throughout the ARISE project of potentially emerging ethical issues regarding privacy/confidentiality of personal data, as well as tracking/observing issues related to the implementation.

In both open call programmes, the ethical review is conducted in three stages: initial, interim and final assessment. The initial assessment is conducted based on the selected FSTP finalists' full proposals involving their ethical self-assessment to outline the potential ethical challenges

and requirements separately for each project. The interim and final assessments are based on the deliverables from the FSTP projects. The interim assessment is to check ethical deliverables or requests in the initial assessment and approval of such deliverables, if any, or additional comments to them. The final assessment is to check the implementation of additional comments or requirements established in the previous phase, if any, and at validating final approval. After the final assessment, the Ethical Assessment Approval minutes are elaborated and agreed by the Ethical Expert Committee to close the Ethical Assessment procedure in the open call programme.

The experts will conduct the fourth ethics review at the end of the ARISE project, in spring 2027. The fourth ethics review is to assess the ethics reviews undertaken in the project. The fourth ethics review is conducted independently by the experts based on a document describing the ethics review procedures of the ARISE project, using a template provided by Demos Helsinki. The summary of the findings will be included in the deliverable D3.5 ARISE's Ethics Summary Reports v2. Figure 3. Illustrates the estimated timeline of the process and the report due dates.

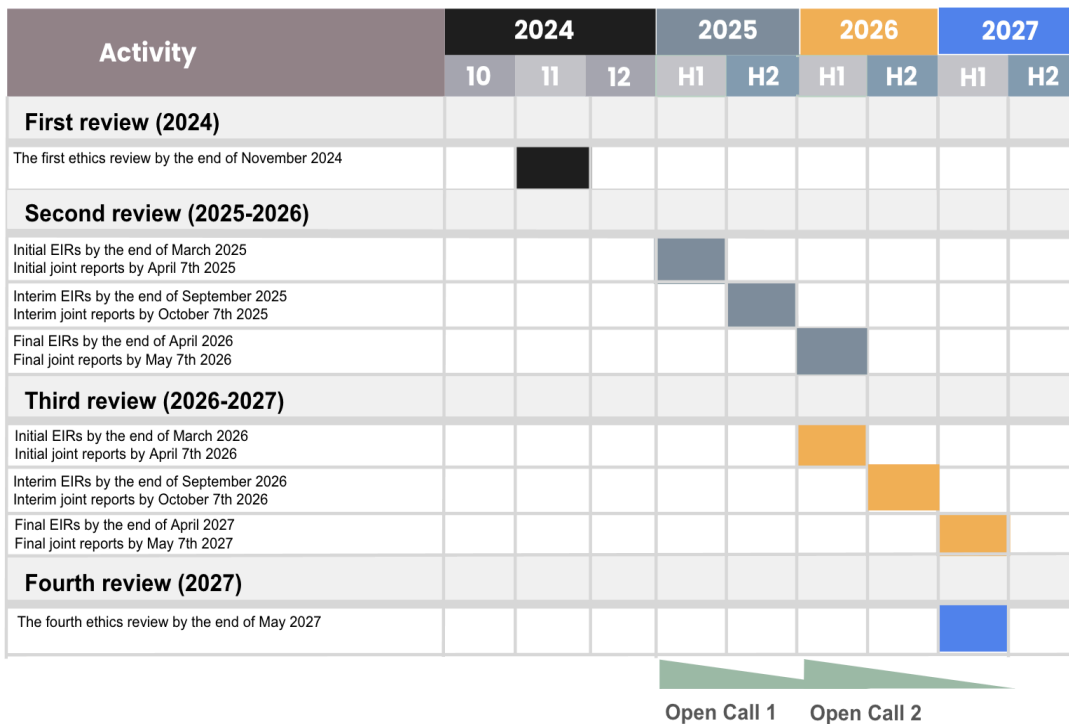


Figure 3. The estimated timeline of the ethics review process and report due dates.

## 4.2 Summary of the findings from the first ethics review

The first ethics review was to anticipate any ethical challenges in the ARISE set-up before the open call phase. The first ethics review was conducted independently by three experts (Santtu

Lehtinen, Emad Yaghmaei and Agnieszka Sprońska) based on a document describing the key elements of the ARISE project, TEFs set-ups and the associated HRI challenges, using a template provided by Demos Helsinki. The assessment template included the following six questions:

1. Please describe the general nature of the ARISE project, its key elements and TEFs.
2. Please describe the possible ethical concerns that can be anticipated from the perspective of each of the four TEFs and the HRI challenges they present.
3. Please describe your recommendations for addressing the ethical concerns mentioned above from the perspective of each of the four TEFs and the HRI challenges they present.
4. Please describe the possible ethical concerns that have already been addressed in the descriptions of the TEFs and their associated HRI challenges. If possible, highlight at least one strength for each of the TEFs.
5. In the ARISE project, the HRI challenges presented by the TEFs serve as inspiration for FSPT projects in the upcoming two open call programmes (2025-2026 and 2026-2017). In addition to technical mentoring, the ARISE consortium will provide the FSTP projects guidance on ethical considerations. Please describe the type of key ethical questions you anticipate arising during the project that are relevant to FSTP projects ethics mentoring.
6. Your other remarks and recommendations

After receiving the reviews, a summary of key findings was compiled to provide an accessible overview of the types of ethical concerns, recommendations, strengths, and viewpoints reported by the experts. The original ethics review reports have been shared with the consortium members, and Demos Helsinki has called the TEF partners to discuss the findings in detail. The summary of key findings from the first ethics reviews is provided below. The original review reports are available in Annex 1.

### **1. The general nature of the ARISE project, its key elements and TEFs**

The EU-funded ARISE project aims to advance HRI in industrial settings through its AgileHRI concept, which emphasizes human-centric and sustainable approaches in line with Industry 5.0 principles. ARISE has four key objectives: 1) to increase the efficiency and cost-effectiveness of HRI solutions; 2) to develop open-source modules that advance HRI beyond state-of-the-art; 3) to demonstrate the importance of openness and agility in HRI solutions; and 4) to ensure lasting impact by engaging a critical mass of stakeholders in the AI, Data and Robotics, ADRA ecosystem<sup>14</sup>. To achieve these objectives, ARISE relies on two primary tools: 1) the ARISE all-in-one middleware and 2) the ARISE SSH framework for human-centered and ethical HRI. The project is structured around four TEFs focused on industrial HRI. These facilities showcase how the ARISE tools can help users address their business challenges through human-centric AI and robotics automation solutions. The project addresses eight specific HRI-related challenges, each paired with a corresponding use case. These use cases provide detailed industrial scenarios and objectives to address the challenges.

<sup>14</sup> ADRA ecosystem. Available at: <https://adra-e.eu/>

TEF1, which is hosted by CARTIF, consists of two challenges: 1) dismantling and assembly of high-value products, and 2) complex product picking in industrial warehouses. TEF2, which is hosted by INT and JOiINT LAB, consists of two challenges: 3) flexible collaborative robots, and 4) smart programming. TEF3, which is hosted by PAL Robotics, consists of two challenges: 5) enhancing robot functionality through multimodal HRI interactions, and 6) developing robotic systems able to autonomously perform fetch and carry tasks in healthcare environments. TEF4, which is hosted by POLIMI, consists of two challenges: 7) leveraging HRI to improve the efficiency of workers in high precision flexible tasks, and 8) leveraging HRI for improving ergonomics in high precision tasks.

## 2. The possible ethical concerns

### General:

The project raises several direct and indirect ethical concerns, direct ones relating to the activities performed by the project consortium and indirect ones relating to the activities performed by FSTP projects. Direct effects include the processing of personal data (mainly non-sensitive business data) for the purposes of the open calls processes, service delivery and project coordination. The project also faces risks related to the health and safety of personnel involved in the operation and maintenance of testing facilities and equipment, including autonomous robots and hazardous materials. Additionally, the development of AI technologies with the ARISE middleware introduces challenges such as ensuring human oversight, technical robustness, privacy, transparency, fairness, societal well-being and accountability.

Indirect effects stem from third party activities supported by the project, which are less predictable at this stage. These include potential involvement of vulnerable groups (e.g., older adults or patients) in HRI testing, processing of sensitive data (e.g., face, body posture, voice, gaze tracking) as well as profiling for users' recognition and their behaviour assessment. Additional concerns include safety risks associated with the experimental use of robotics and hazardous elements, and environmental sustainability issues, such as energy efficiency and material waste. The application and testing of AI technologies, including ARISE's middleware and other solutions, further amplify these concerns. Cybersecurity, in particular, is critical across both direct and indirect activities due to the personal data processing and AI integration. The scope and impact of these ethical issues will vary depending on the specific experiments and developments undertaken by ARISE and its supported projects.

### TEF1

Challenge 1 of the ARISE project focuses on developing an industrial HRI solution for dismantling and assembling high-value products, emphasizing automation, efficiency, worker safety and productivity. Ethical concerns arise around privacy, inclusivity, safety, job displacement and environmental sustainability. The solution requires secure handling of personal data collected via cameras, sensors, and augmented reality tools like MR HoloLens glasses, with informed consent and compliance with GDPR. Inclusivity must be considered to ensure accessibility for diverse workers, and the recruitment criteria for participants, as well as the potential compensations for participating, must be clearly defined. Robust health and

safety protocols are needed to mitigate risks in hazardous environments. To address job displacement from automation, upskilling and reskilling initiatives are necessary. Sustainability and dual-use risks must be considered to minimize environmental impact and prevent misuse. Ethical considerations extend to AI technologies, requiring transparency, fairness and accountability to ensure trust and compliance across all activities under the project.

Challenge 2 of the ARISE project focuses on developing a HRI solution for product picking in industrial warehouses to enhance efficiency, ensure worker safety and handle the variability of products and purchase orders. Key ethical concerns include worker safety, as collaborative robots operate in close proximity to humans, requiring robust fail-safe mechanisms and adherence to safety protocols. Privacy and data security are critical due to the collection of personal and operational data via cameras and microphones, necessitating GDPR compliance and data minimization practices. Inclusivity is essential, ensuring the system accommodates diverse workers with varying abilities and communication styles. The recruitment criteria for participants must also be clearly defined. Strategies for upskilling and reskilling workers address potential job displacement due to automation. Additionally, the system must prioritize energy efficiency to minimize environmental impact and include safeguards against misuse and unethical applications. Continuous engagement and ethical oversight are integral to the successful deployment of this HRI solution.

#### **TEF2**

Challenge 3 of the ARISE project addresses the need for flexible HRI solutions in dynamic manufacturing environments to accommodate increasing demand variety while improving work quality and ergonomics. Key ethical concerns include privacy and data security, as data from sensors and cameras monitor worker movements and ergonomic postures, necessitating GDPR compliance and data minimization. Inclusivity ensures systems are adaptable to diverse workforce, preventing exclusion or inequity. Safety and reliability are paramount, with fail-safe mechanisms required to minimize risks in high-stakes environments. Concerns about job displacement highlight the need for upskilling and reskilling strategies to help workers transition to new roles. Environmental sustainability and potential misuse of flexible robotic technologies must also be addressed, with safeguards in place to prevent unethical applications and minimize resource consumption. Continuous ethical oversight is essential to ensure trust, safety and fairness in deploying flexible collaborative robots.

Challenge 4 of the ARISE project focuses on developing intuitive interfaces for HRI systems, enabling operators without coding skills to easily reprogram robots for different tasks. Key ethical concerns include worker safety, requiring robust fail-safe mechanisms and real-time monitoring to prevent accidents during collaborative tasks. Inclusivity is essential to ensure the interfaces accommodate diverse technical skills and abilities. Privacy and data security concerns arise from sensors and monitoring tools used in the system, necessitating GDPR compliance, data minimization and informed consent. Addressing job replacement through upskilling and reskilling opportunities is critical to support workforce transitions. Accountability frameworks must clarify responsibilities for errors or failures, while the system's design should align with sustainable practices to minimize environmental impact. Safeguards must also prevent misuse or unethical applications of adaptable robotic technologies. Worker

engagement and training are vital to foster trust and mitigate potential social and psychological impacts.

### **TEF3**

Challenge 5 of the ARISE project aims to enhance robot functionality through advanced multimodal HRI, integrating communication methods such as gestures, verbal cues, and visual signals to improve collaboration. Ethical concerns include privacy risks due to extensive data collection from cameras, microphones, and sensors for tracking and personalized profiling, requiring strict adherence to GDPR and robust data security measures. Inclusivity is crucial, ensuring the system accommodates diverse user skills, physical conditions, and cultural or linguistic backgrounds to prevent bias or exclusion. Psychological and social impacts, such as feelings of alienation, dehumanization, discomfort or overreliance on robots, must be mitigated through continuous monitoring and engagement strategies. Safety and reliability are essential, with fail-safe mechanisms needed to prevent misinterpretation of commands or system failures. Additionally, job displacement concerns necessitate upskilling opportunities, while environmental sustainability and safeguards against misuse must be prioritized to align with ethical and operational goals.

Challenge 6 of the ARISE project focuses on developing autonomous robotic systems for fetch-and-carry tasks in healthcare settings, aiming to enhance efficiency and allow medical staff to prioritize patient care. Ethical concerns include privacy risks due to extensive collection of sensitive data, such as facial, body, and voice recognition, necessitating GDPR compliance, data minimization and transparent use. Inclusivity is critical, requiring systems to accommodate diverse linguistic, physical and cognitive capabilities while avoiding biases. Safety and reliability are paramount, ensuring robots can navigate dynamic healthcare environments without disrupting workflows or causing harm. Psychological and social impacts, including perceptions of job replacement, emphasize the importance of upskilling programs and clear communication about the complementary role of robots. Environmental sustainability and safeguards against misuse must also be addressed to ensure ethical and responsible deployment.

### **TEF4**

Challenge 7 of the ARISE project focuses on deploying HRI to improve the efficiency of workers in high-precision, flexible tasks by preparing workspaces and reducing setup time. Key ethical concerns include safety and reliability, requiring robust measures to prevent errors and malfunctions that could harm operators or damage materials. The potential for job displacement and deskilling of workers emphasizes the need for upskilling programs to ensure smooth collaboration between humans and robots. Privacy and data protection are critical, particularly concerning the collection and use of real-time data to optimize interactions. Inclusivity and accessibility must be prioritized to accommodate diverse operators, while monitoring systems should address potential biases and social impacts. Environmental sustainability and safeguards against the misuse of high-precision robotic systems must also be considered to ensure responsible deployment.

Challenge 8 of the ARISE project focuses on deploying HRI systems to enhance operator ergonomics in high-precision tasks by allowing cobots to adjust workpiece positioning based on individual comfort and stress levels. Key ethical concerns include privacy risks associated with extensive data collection through cameras and microphones, such as biometric data (e.g., body dimensions, speech patterns) and stress indicators, necessitating GDPR compliance, data minimization and informed consent. Inclusivity and accessibility are vital to ensure diverse user needs, including cultural and physical differences, are met to prevent bias. Safety and reliability are critical, with fail-safe mechanisms and rigorous testing required to avoid operational errors that could harm operators or cause inefficiencies. The potential for job displacement and deskilling raises the need for upskilling and reskilling programs. Environmental sustainability and safeguards against misuse of the systems must also be addressed to ensure ethical and responsible deployment.

### 3. Recommendations for addressing the ethical concerns

#### General:

The ARISE project is advised to prioritize self-assessment for AI technologies developed within its framework, such as the all-in-one-middleware, to ensure compliance with Ethics By Design principles in alignment with the EU AI Act, Ethics Guidelines for Trustworthy AI of the Independent High Level Expert Group on AI (HLEG), and related frameworks. Centralized policies are recommended to address ethical concerns across all TEFs and challenges, emphasizing uniform recruitment and informed consent procedures, particularly for vulnerable groups, and robust personal data processing and protection measures in compliance with GDPR. These include informed consent protocols, technical safeguards, anonymization techniques, and data subject rights. Additionally, health and safety policies must be established for experimentation within TEF facilities. A structured monitoring procedure is also necessary to evaluate and ensure ethics compliance across all FSTP-funded projects, including clear requirements and guidance for addressing related ethical issues.

#### TEF1

Addressing the ethical concerns associated with Challenge 1 involves focusing on several critical areas. These include enhancing workforce skills, mitigating risks of job displacement, and safeguarding privacy through informed consent and adherence to robust data security measures aligned with GDPR and AI-specific regulations. Inclusive design principles are emphasized to accommodate diversity in accents and abilities. This includes explanations of how non-standard accents are recognized in the Voice Command Recognition, and how workers with visual impairments, whether far-sighted or near-sighted, if any, are expected to use the MR HoloLens glasses. Protocols for safe physical interaction must be developed, including a detailed specification on fail-safe mechanisms. Potential risks to health and safety of human workers must also be assessed, with measures outlined to mitigate these risks. The importance of environmentally sustainable practices, prevention of dual-use or misuse and establishing clear accountability for system failures is also highlighted. Detailed attention is directed toward personal data processing policies, anonymization, and compliance with international data transfer standards. A strong focus is placed on integrating Ethics By Design principles for AI systems in line with European standards, compliance with the AI Act and

frameworks for trustworthy AI, with centralized ethics monitoring recommended to ensure uniformity across initiatives.

Addressing the ethical concerns associated with Challenge 2 involves a focus on mitigating risks to human workers, ensuring data security, and establishing accountability. Emphasis is placed on equipping workers with skills for effective collaboration with robots, addressing potential job displacement, and safeguarding privacy through informed consent and adherence to GDPR. Considerations for inclusive design prioritize diversity, accessibility, and bias reduction in AI systems. Health and safety protocols are expected to comply with relevant regulations, incorporating fail-safe mechanisms and throughout risk assessments. Attention is drawn to sustainable practices, ethical data management and clear accountability for system performance. For automation and AI, adherence to Ethics By Design principles and alignment with the AI Act frameworks for trustworthy AI are key priorities.

### **TEF2**

Addressing the ethical concerns related to Challenge 3 involved safeguarding human workers, promoting inclusivity and protecting personal data. Emphasis is placed on equipping workers with skills for effective robot collaboration and mitigating risks related to job replacement. Privacy concerns tied to voice recognition and camera systems necessitate clear data usage policies, informed consent and compliance with GDPR. Inclusive design must account for diverse physical and linguistic characteristics, particularly in systems for real-time monitoring. Health and safety protocols, including comprehensive risk assessment and fail-safe mechanisms, are expected to meet legal standards. Sustainability practices and strategies to prevent dual-use and misuse of technology are prioritized. Continuous impact assessment and user feedback loops are crucial for refining system functionalities. For automation, AI, and personal data management, adherence to data protection laws, anonymization protocols, and secure international data transfers are essential. Special attention is placed on meeting the AI Act requirements and following trustworthy AI guidelines.

Addressing the ethical concerns related to Challenge 4 involved safeguarding workers, ensuring inclusivity and addressing data security and health risks. Focus is placed on equipping workers with the skills needed for effective collaboration with robots and mitigating job replacement risks. Privacy concerns related to voice recognition and camera systems require measures for informed consent, GDPR compliance, and robust data protection during collection, processing and any third-party use. Accountability measures define system liability, while inclusive design prioritizes diverse physical and linguistic characteristics, including "follow-me" functionalities. Health and safety protocols must align with regulations, with fail-safe mechanisms included. Emphasis is placed on sustainability, continuous impact assessment and integrating user feedback to refine systems. Ethical frameworks, such as the AI Act and trustworthy AI guidelines, guide automation and AI practices, with specific attention to smart programming and ensuring safe experimentation.

### **TEF3**

Addressing the ethical concerns related to Challenge 5 about user safety, inclusivity and data security involves prioritizing the development of skills for effective collaboration with robots,

mitigating job displacement, and ensuring informed consent during data collection. Privacy challenges linked to speech recognition and camera systems require strict GDPR compliance and measures to prevent unauthorized data access. Inclusivity considerations must reflect diverse user features, such as accents, physical conditions and expressions, with transparent documentation facilitating understanding of system outputs. Safety protocols need to adhere to legal standards, mitigating health risks and defining accountability for failures. Environmental impacts and dual-use or misuse of technology must be addressed, with feedback loops and impact assessments enhancing system refinement. Special attention is needed for safeguarding vulnerable participants groups and ensuring personal data protection, while alignment with relevant legislation supports the ethical management of these concerns.

Addressing ethical concerns related to Challenge 6 involves prioritizing skill development for effective HRI collaboration, mitigating risks of job replacement, and ensuring informed consent, particularly for vulnerable groups. Privacy considerations associated with voice command recognition and data collection require strict GDPR compliance, secure data handling and clear protocols for processing sensitive information. Inclusivity measures must account for diverse physical, linguistic, and cognitive abilities, with transparency in system operations fostering trust. Health and safety measures must adhere to regulatory standards and incorporate fail-safe mechanisms. Sustainability practices and prevention of dual-use or misuse are critical, alongside integrating user feedback for ongoing refinement and conducting regular audits to identify and address biases. Alignment with ethical AI principles, European guidelines, and the AI Act ensures responsible deployment, particularly in healthcare environments.

#### **TEF4**

Addressing ethical concerns related to Challenge 7 involves focusing on strategies to enhance workforce skills, mitigate job displacement risks, and ensure informed consent for all participants. Privacy considerations tied to unauthorized data collection and system transparency necessitates compliance with GDPR, data minimization practices, and robust security measures. Inclusive design principles must account for linguistic, physical and cognitive diversity to reduce biases and enhance accessibility. Clear accountability measures are essential for managing system failures, while health and safety protocols must meet legal standards and include fail-safe mechanisms. Emphasis is placed on sustainability practices and preventing the dual-use or misuse of technology. Continuous improvement is supported through user feedback integration and regular impact assessments. Adherence to ethical AI principles and alignment with European standards, including the AI Act and trustworthy AI frameworks, ensures responsible and ethical implementation.

Addressing ethical concerns related to Challenge 8 involves enhancing workforce skills for effective collaboration with robots and reducing risks of job displacement. Privacy issues, particularly related to speech command detection and data collection, require strict adherence to GDPR and the implementation of robust security protocols. Inclusive design considerations must encompass linguistic, physical and cognitive diversity to ensure accessibility for a wide range of users. Health and safety protocols must comply with regulations, incorporate fail-safe mechanisms, and prioritize user well-being. Clear

accountability frameworks are essential for managing system performance and addressing failures. Sustainability practices, along with measures to prevent dual-use and misuse of technology, are prioritized. Informed consent is necessary, especially during sensitive data processing, with adherence to legal requirements guiding recruitment and participation. Compliance with ethical principles, European standards, and the AI Act is essential, supported by regular audits to uphold fairness, privacy and safety.

#### **4. The possible ethical concerns that have already been addressed**

Ethical strengths and challenges of proposed HRI systems across TEFs reflect a strong emphasis on safety, inclusivity and human-centric design. Features like safety buttons, user-friendly interfaces and adaptive systems address diverse worker needs. TEF1 focuses on operator safety and system reliability, TEF2 highlights collaboration among diverse stakeholders and ergonomic monitoring, TEF3 prioritizes user-centered design in healthcare and TEF4 emphasizes improved working conditions and ergonomic solutions. However, broader ethical concerns, including data privacy, autonomy, and the implications of efficiency-focused designs, present recurring gaps. While the ARISE consortium shows awareness of these issues, the practical implementation of ethical measures in future projects remains unclear. Participatory design and ethical oversight are highlighted as critical to ensuring alignment with ethical standards and fostering stakeholder trust.

#### **5. The type of key ethical questions you anticipate arising during the project that are relevant to FSTP projects ethics mentoring.**

Awareness of fundamental ethical requirements in EU-funded projects, particularly those involving human participants, AI technologies and personal data collection remains critical. Key ethical principles, including human agency, privacy, fairness, non-discrimination, transparency and accountability, require careful consideration. For projects focused on HRI and AI, trustworthiness and Ethics By Design approaches are essential to uphold autonomy, dignity, and freedom while fostering social, individual and environmental well-being. Guidance on essential ethical practices, encompassing recruitment, informed consent, data protection and health and safety policies, supports robust compliance and alignment across initiatives with the ARISE project framework.

#### **6. Other remarks and recommendations**

It may be advisable for the project to complement its direct mentoring services with training sessions and/or webinars focused on the SSH framework for human-centered and ethical HRI development within the project, as well as the ethical dimensions of the experiments performed.

## 5 Discussion

### 5.1 Many roles of ethics in multidisciplinary project work

In multidisciplinary projects, there are multiple ways to approach ethics. In the ARISE project, we have chosen to focus on two critical dimensions, that is, increasing the ethical awareness within the project as well as providing a toolbox involving ethics-related guidelines and tools that fit into the context of HRI. Our approach to addressing ethics is highly participatory, meaning that we seek to collaborate with various stakeholders. Our qualitative research also embeds this idea: Using participatory, ethnographic and human-centric design methodologies, we seek to investigate ethics-related questions together with professionals and practitioners in- and outside from the ARISE project. We aim to deeply understand the nature of the HRI related work, its practices and the embedded aspirations, needs and values in order to provide meaningful support, recommendations and tools to embed ethical considerations into technological developments. Through continuous discussions, iterations and dialogue, we seek to collaborate with and support our technical partners in ethics-related questions to spark their interest toward ethical thinking and equip them with up-to-date knowledge around the topic. The ARISE project has also established an Ethical Committee of three external experts, who will provide support throughout the project via four comprehensive ethics review tasks. Finally, our ARISE SSH framework, of which first versions will be released in December 2024, is an open toolbox including relevant materials and recommendations for embedding ethical considerations into technological development. Our framework will not only address ethical questions, but also social and legal dimensions to HRI to create a more comprehensive understanding of the topic. This way, we seek to position our work also in a broader socio-political context.

### 5.2 Recommendations for approaching ethics in HRI projects

Based on our own experiences of working in a multidisciplinary project related to HRI and technological innovation, we next offer some practical recommendations and tips on how to approach ethics in HRI projects similar to ARISE. It is good to keep in mind that the project is in its early stages, and thus many of our own learnings are yet to come and the current ones to be updated. However, we believe that sharing our ideas at this stage might be helpful to others, including our partners and FSTP projects, with whom we will continue iterating these topics. The recommendations are thematically grouped, with an eye on different phases of a project.

#### Problem definition and baseline

- Examine the problem at hand from the perspective of different stakeholders, i.e., what is the challenge we are addressing.
- Examine the baseline level of interest and knowledge regarding ethics-related topics.
- Understand the technology in question and its maturity level.

#### Shared language and conceptual understanding

- Discuss and define the central concepts that are used in joint discussion.
- Define the focus of the work, e.g., ethical analysis.
- Use plain language that is understandable to all, avoid jargon.

#### Means for collaboration, dialogue and feedback

- Understand others' ways of working and preferred tools for communication.
- Use meaningful tools for interaction, collaboration and co-creation, supporting the task and sought outcomes.
- Provide means for exchanging feedback throughout collaboration.

#### User, stakeholders and society

- Understand who is impacted by technological innovation, directly and indirectly.
- Pay attention to who is considered as primary and secondary user, and on whose decisions are those based on.
- Consider whose perspective is left out from the analysis, and why.
- Consider the potential societal implications of the technological solution.

#### Conflicting values and viewpoints and ethical trade-offs

- Be mindful of various stakeholders when promoting ethical principles.
- When promoting a certain ethical principle, consider how it connects and interacts with other ethical principles.
- Discuss the ways to identify, manage and address the possible ethical trade-offs.

#### Be mindful of context-sensitivity of ethics

- Be mindful of the possible contexts and use purposes the solution might be implemented to.
- Explore the specific user needs, existing practices, policies and guidelines of that context.
- Pay attention to how to introduce the technical solution to a specific context, i.e., to who you are talking to and from what perspective.

#### Monitor and document the process and iterate when necessary

- Make a plan for impact assessment of the project.
- Include steps in the process where you can review the results achieved in various phases in order to make necessary changes.
- Document the process properly so you or someone else can revisit it later.

## 6 Conclusion

During the first year of the ARISE project, we as the SSH partner of the project have established goals and structures for our ethics-related work. We have described our goal to foster collaboration in both research and other work related to ethical considerations. We approach ethics as a part of a broader societal context, which also encompasses various social and legal viewpoints to be considered. Our SSH framework, which is reported in a separated deliverable, brings together key perspectives on these matters, serving as an open collection of relevant materials for the HRI domain. In this deliverable, we have aimed to outline our starting points and objectives, particularly concerning our work on ethics. We have described how we have approached the topic in practice so far. Key elements of our work include raising ethical awareness within the project and engaging in mapping, analyzing and developing the existing ethical guidelines and tools to fit in for use in the context of HRI. We have also established an external Ethics Committee for the ARISE project to support the consortium on ethical considerations, particularly through their four comprehensive ethics review tasks.

Important next steps in our work include reviewing the Ethics Committee's first review reports in detail with all TEF partners, facilitating the Ethics Committee's next assessment tasks, as well as preparing ourselves for the FSTP project mentoring phase of the project. Furthermore, we will continue to refine our SSH framework throughout the project, allowing us to update it with the newest information. Our collaboration with project partners continues through recurring meetings and focused discussions on selected topics. We are open to collaboration with stakeholders interested in the topic, who share our vision for promoting more sustainable, human-centric and ethical technological innovations, work environments, as well as the future overall.

# ANNEX 1

## Original first ethics review reports by the ARISE ethics committee members.

**Reviewer:** Santtu Lehtinen

**1. Please describe the general nature of the ARISE project, its key elements and the testing and experimentation facilities (TEFs).**

ARISE (*Agile, human-centric, and Real-time enabled open Source technologies advancing industrial HRI in Europe*) -project focuses on the multidisciplinary implementation and deployment of AgileHRI in various industrial settings.

The key objective of ARISE is to implement Industry 5.0 principles and processes in Europe through the human-centric deployment of solutions that will enable the "seamless collaboration between humans and robots on complex tasks". More specifically, these industrial HRI approaches and solutions are deployed in four testing and experimentation facilities (TEFs) and over 25 workplaces across Europe.

ARISE has four major objectives: 1.) to increase the efficiency and cost-effectiveness of HRI solutions; 2.) to develop open-source modules that will advance HRI beyond State-of-the-Art; 3.) to demonstrate the importance of openness and agility in HRI solutions; and 4.) to ensure sustainable impact by engaging a critical mass of stakeholders in ADRA ecosystem.

The key tools for achieving these objectives are 1.) the ARISE all-in-one middleware and 2.) the ARISE social sciences and humanities (SSH) framework for human-centered and ethical HRI. ARISE-project consists of four TEFs on industrial HRI, which aim to showcase how these tools can enable users to address their business problems by using human-centric AI and robotics automation solutions. There are 8 specific challenges addressed within the project, which are accompanied by specific use-cases. Each challenge has a corresponding use-case that provides specific industrial scenarios and objectives. The TEFs include:

TEF1, which is hosted by CARTIF, consists of two challenges: 1) dismantling and assembly of high-value products, and 2) complex product picking in industrial warehouses.

TEF2, which is hosted by INT and JOiiNT LAB, consists of two challenges: flexible collaborative robots, and 4) smart programming.

TEF3, which is hosted by PAL Robotics, consists of two challenges: 5) enhancing robot functionality through multimodal HRI interactions, and 6) developing robotic systems able to autonomously perform fetch and carry tasks in healthcare environments.

TEF4, which is hosted by POLIMI, consists of two challenges: 7) leveraging HRI to improve the efficiency of workers in high precision flexible tasks, and 8) leveraging HRI for improving ergonomics in high precision tasks.

**2. Please describe the possible ethical concerns that can be anticipated from the perspective of each of the four TEFs and the HRI challenges they present.**

**TEF1**

Overall, in TEF1, there is a focus to adapt the robot behavior to the operator, which requires certain algorithms. How this is done in practice, raises questions about tracking and monitoring vis-à-vis the operator by the system and its related machine learning components. Relevant requirements related to personal data and AI apply. Similarly, the interaction between operators and robots is enabled by extended reality and natural language processing technologies. This also raises potential ethical questions on how these features operate and which types of data they require from the human participants. Relevant personal data and AI requirements apply.

**Challenge 1: Dismantling and assembly of high-value products**

Challenge 1 involves the dismantling and the assembly of high-value products by developing an industrial HRI solution involving collaborative work between robots and human workers. The aim is to automate tasks, enhance efficiency and to mitigate risks in order to improve productivity and work safety. The main ethical concerns of Challenge 1 are related to the collaborative work and interaction between robots and humans. This involves potential issues related to **Job Displacement, Health and safety**, as well as **Personal Data** and **Human participation**, and **AI**.

In terms of Human participants, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all persons taking part in activities funded under ARISE. The recruitment criteria of participants should also be made clear with a view towards a diversity of persons involved.

In terms of potentially automating certain functions, the potential ethical issue is related to the potential of workers being displaced from their jobs. The participants/employees must be provided with the opportunities for training and upskilling.

In terms of Health and Safety, the potential beneficiaries must ensure that all relevant national legislation are being met in the collaborative activities between humans and robots funded under ARISE. In addition, the beneficiaries should contextualize any general guidelines to their own activities in order to create a safe environment.

In terms of Personal Data and AI, the Challenge raises questions on how the mixed reality, artificial vision, and voice command technologies as well as cameras and AR glasses will utilize personal data collection from the participants involved in the activities funded under ARISE. It is mentioned that “MR HoloLens glasses offer real-time visual information and track user interactions for an immersive user experience” and that “the PC oversees the interaction between the robot and the human worker”. These features raise ethical issues related to tracking and monitoring of the persons involved, which can violate the privacy of the participants if the data collection is too extensive or too sensitive. The data collection should be done by the principle of data minimization, and the data should be utilized only for the purpose of the research activities funded under ARISE. Finally, all the relevant GDPR and other data protection measures must be implemented.

### **Challenge 2: Complex Product Picking in industrial warehouses**

Challenge 2 involves the development of a Human-Robot Interaction solution for the context of product picking in industrial warehouses. The objective of the challenge is to overcome limitations of manual methods and traditional robots through the integration of collaborative robots in order to maximize efficiency and enhancing worker safety. The main ethical concerns of Challenge 2 are related to the Human-Robot interaction. This involves potential issues related to **Job Displacement, Health and safety**, as well as **Personal Data** and **Human participation**, and **AI**.

In terms of human participation, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all persons taking part in activities funded under ARISE. The recruitment criteria of participants should also be made clear with a view towards a diversity of persons involved.

In terms of potentially automating certain functions, the potential ethical issue is related to the potential of workers being displaced from their jobs. The participants/employees must be provided with the opportunities for training and upskilling.

The health and safety issues are related to the operation of collaborative robots in proximity with humans in industrial warehouses. Moreover, the operations utilize relatively new technologies and functions such as visual feedback, intuitive gestures, voice commands and overall augmented reality. As a result, the beneficiary must ensure the observance and implementation of relevant national health and safety guidelines in the context of activities funded under ARISE.

In terms of personal data and AI, Challenge 2 involves the utilization of cameras, voice command, real-time visual feedback, intuitive gestures and HoloLens glasses to create an augmented reality experience. These technologies also potentially involve various forms of personal data collection, which should be conducted under the principle of data minimization, whereby data is only collected for the purposes of the funded activities. The collected data

must also be processed and protected according to relevant data protection regulations (GDPR). Other relevant data security provisions also apply.

## TEF2

### Challenge 3: Flexible Collaborative robots

Challenge 3 involves the application of flexible collaborative robots in order to help manufacturing companies cope with an increasing demand variety while simultaneously increasing quality of the work and improving working conditions such as ergonomics. The main ethical concerns of Challenge 3 are related to the collaborative robots in the manufacturing context. This involves potential issues related to **Job Displacement, Health and safety, AI** as well as **Personal Data** and **Human participation**.

In terms of human participation, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all persons taking part in activities funded under ARISE. The criteria of recruiting participants to activities funded under ARISE should take into account the diversity of the workforce in terms of their abilities, backgrounds and orientations.

In terms of automating certain functions, the potential ethical issue is related to the potential of workers being displaced from their jobs. The participants/employees must be provided with the opportunities for training and upskilling.

The health and safety issues are related to the operation of collaborative robots in proximity with humans in manufacturing settings. As a result, the beneficiary must ensure the observance and implementation of relevant national health and safety guidelines in the context of activities funded under ARISE. This must be done contextually by taking into account the particular risks posed by collaborative robots and the way in which they are operated and how they collaborate with humans.

In terms of personal data and AI, Challenge 3 involves the collection of data from sensors and cameras to monitor operator movements and ergonomic posture. Specifically, it is mentioned that "a camera monitors the operator's posture, and he is alerted if his ergonomic indexes fall below a threshold". This creates potentially sensitive personal data related to an individual's health. This type of personal data collection should be conducted under the principle of data minimization, whereby data is only collected for the purposes of the funded activities. The collected data must also be processed and protected according to relevant data protection regulations (GDPR). Other relevant data security provisions also apply.

### Challenge 4: Smart Programming

Challenge 4 aims to embed intuitive interfaces into an HRI system to allow for easy adaptation. The main ethical concerns of Challenge 4 are related to the collaborative robots in

the manufacturing context. This involves potential issues related to **Job Displacement, Health and safety**, as well as **Personal Data** and **Human participation**.

In terms of human participation, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all persons taking part in activities funded under ARISE. The criteria of recruiting participants to activities funded under ARISE should take into account the diversity of the workforce in terms of their abilities, backgrounds and orientations.

In terms of automating certain functions, the potential ethical issue is related to the potential of workers being displaced from their jobs. Particularly in the case of non-automated warehouses, the proposed solution can raise the issue of job displacement. The participants/employees must be provided with the opportunities for training and upskilling.

Potential Health and Safety issues involve issues related to robotic assistance in the context of an automated warehouse. For example, the autonomous navigation systems and follow-me modes raise questions related to the safety of the staff in a warehouse context where a robot is operating. As a result, the beneficiary must ensure the observance and implementation of relevant national health and safety guidelines in the context of activities funded under ARISE. This must be done contextually by taking into account the particular risks posed by collaborative robots and the way in which they are operated and how they collaborate with humans.

In terms of Personal Data, the potential issues involve privacy concerns related to data collection, monitoring and tracking through sensors, cameras, and other devices such as intuitive interfaces. These might infringe with the privacy of the participants. The personal data collection should be conducted with strict principles such as compliance with the data minimization. Data collection should be limited to the activities funded under ARISE. The collection, processing and storage of personal data requires adherence to data protection regulation (GDPR) and data security.

### **TEF3**

In terms of TEF3, the objective is to create a human-centered HRI-framework that would enable robots to accommodate a variety of human needs in healthcare settings in order to create a more user-friendly, accessible and inclusive system. This is an ethical goal, but the process and methods of reaching this goal also raise a variety of ethical questions related to the ways in which technology enables robots to adapt to different preferences and to interact with people through multimodal signals in an "empathetic" manner.

### **Challenge 5: Enhanced robot functionality through multimodal HRI interactions**

Challenge 5 focuses on enhancing the functionality of robots through advanced multimodal human-robot interactions. It aims to improve the collaboration between humans and robots by utilizing different communication methods. The main ethical concerns of Challenge 5 are

related to the collaborative robots in the manufacturing context. This involves potential issues related to **Job Displacement, Personal Data, Human participation and AI**.

In terms of human participation, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all persons taking part in activities funded under ARISE. The criteria of recruiting participants to activities funded under ARISE should take into account the diversity of the workforce in terms of their abilities, backgrounds and orientations.

In terms of personal data and AI, the multimodal HRI interactions seem to extensively utilize cameras, microphones, and other sensors for the purposes of monitoring, tracking, and collecting potentially sensitive personal data. For example, the proposed robot can collect personal data through “facial expression and activity recognition” and is “designed to learn and adapt to individual user preferences, limitations, and desires”. These constitute potentially sensitive personal data, which are also utilized for the creation of a personalized profile. The way in which the robot would recognize different people is through multimodal identification; it can recognize users through face, body, or voice identification. This includes the collection and processing of speech, as well as facial, body and voice recognition, in addition to recognition of facial expressions such as emotions. Furthermore, the solution will utilize different AI techniques such as natural language processing, chatbots, LLM's and adaptive learning algorithms to enable individual user preferences. Particularly in the context of assisted living environments where there is a variety of sensitive data to be collected from patients, staff, and family members, these features and technologies create the potential for different ethical issues. Any potential beneficiary must therefore ensure that the data collection is conducted in accordance with the principle of data minimization and strictly limited to the purposes of the activities funded under ARISE. Moreover, the HRI-solutions should also consider the diversity of the participants in terms of their skills, physical condition and features such as accents. Finally, the collection, processing and storage of personal data requires adherence to data protection regulation (GDPR) and data security.

In terms of automating certain functions, the potential ethical issue is related to the potential of workers being displaced from their jobs. The participants/employees must be provided with the opportunities for training and upskilling.

#### **Challenge 6: Fetch & carry tasks in healthcare environments**

Challenge 6 aims to develop and implement robotic systems to perform autonomous fetch and carry tasks in a healthcare setting. The objective is to free up medical staff to focus on patient care while enhancing the efficiency and quality of care for example in hospitals. The main ethical concerns of Challenge 6 are related to the deployment of robots in the healthcare context. This involves potential issues related to **Health and Safety, Job Displacement, Personal Data, AI, and Human participation**.

In terms of human participation, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all

persons taking part in activities funded under ARISE. The criteria of recruiting participants to activities funded under ARISE should take into account the diversity of the workforce in terms of their abilities, backgrounds and orientations.

In terms of personal data and AI, the key ethical issues revolve around privacy and the extent of sensitive data collection in a healthcare setting. According to the proposal, the robot must be able to recognize and understand human activities multi-modally (face, body, voice) in order to adjust itself accordingly. This requires multi-modal communication in the form of speech, text, gestures and visual displays. The robot utilizes speech recognition and natural language processing abilities as well as dialogue management via chatbots with the help of LLMs. As such, the utilization of multimodal detection abilities combined with natural language processing and LLMs creates the potential for excessive personal data collection. As such, this raises questions about the extent of personal and sensitive data collection. Personal data collection should be conducted under the principle of data minimization and accordance with the scope of the tasks and activities funded under ARISE. Moreover, features such as speech recognition and voice commands also raise potential ethical issues related to inclusivity. These abilities should accommodate persons from diverse backgrounds with different languages and accents as well as physical and mental abilities.

In terms of health and safety, the solution raises concerns about the safe deployment of robots in a healthcare setting. The aim is to enable robots to perform fetch and carry tasks autonomously while successfully navigating the dynamic social environment of a hospital. The navigation abilities of robots should be programmed in such a way that they won't pose safety hazards to patients and staff. As such, the beneficiary must ensure that relevant national legislation is observed when deploying the solutions. The implementation of the solution must be conducted in a contextual manner.

In terms of the impacts of assistance robots, the concerns related to potential job displacement via the automation of the so-called "low-added-value" routine tasks need to be considered. There should be the possibility to upskill the employees impacted by these solutions to take up more value-added roles. Moreover, the essence of human care work should not be displaced by these types of solutions.

#### TEF4

#### **Challenge 7: HRI for improving the efficiency of workers in high precision flexible tasks**

Challenge 7 aims to improve the efficiency of workers in high precision tasks within manufacturing environments. The main ethical concerns of Challenge 7 are related to the deployment of robots in a manufacturing context. This involves potential issues related to **Health and Safety, Job Displacement, Personal Data** and **Human participation**.

In terms of Health and Safety, potential ethical concerns are related to the safety of workers in an environment where a robot takes over some of the tasks and navigates in the shop floor. The employees must be able to interact with the robots, which requires training. The solution

employs operators interacting with robotic arms and automated guided vehicles in the shop floor.

The ability of the robot to take over some of the tasks raises questions about job displacement. In terms of automating certain functions, the potential ethical issue is related to the potential of workers being displaced from their jobs. The participants/employees must be provided with the opportunities for training and upskilling. Finally, the proposed solution must be implemented in an inclusive manner to accommodate a diverse pool of operators with different skill levels and backgrounds.

In terms of personal data collection, the proposed solution raises concerns about privacy and the extent of data collection. In this context it does not seem that there is much data collection conducted on the operator but nonetheless, this potentiality should be elaborated upon by the eventual beneficiary.

#### **Challenge 8: HRI for improving ergonomics in high precision tasks**

Challenge 8 aims to improve ergonomics in high precision tasks with the help of HRI. The main ethical concerns of Challenge 8 are related to the deployment of robots in high-precision tasks. This involves potential issues related to **Health and Safety, Job Displacement, Personal Data and Human participation**.

In terms of human participation, the general requirements of providing all the relevant information to participants in order to acquire the necessary informed consent apply to all persons taking part in activities funded under ARISE. The criteria of recruiting participants to activities funded under ARISE should take into account the diversity of the workforce in terms of their abilities, backgrounds and orientations.

In terms of personal data, the key ethical issues revolve around privacy and the extent of sensitive data collection. The proposed solution aims to address chronic health issues of operators related to work ergonomics. Ethical concerns include the collection of data by the camera and microphone, which raises privacy issues, monitoring and tracking issues, as well as issues related to the utilization of personal biometric data. According to the proposal, operator's working pose vis-à-vis the workpiece is adjusted with the help of the 3D camera. Accordingly, a camera captures images of the operator which are subsequently analyzed through human detection algorithms. This type of personal data collection raises potential ethical issues. Furthermore, the proposal states that a 3D camera takes images of the operator, in order to monitor the stress levels of the operator. Signs of stress are interpreted from facial expressions, characteristics of a person's speech, pitch, intonation, speech rate, volume etc. This raises many potential ethical issues, such as the need to consider the cultural and individual differences across participants. Overall, these features raise questions about the extent of personal and sensitive data collection. Personal data collection should be conducted under the principle of data minimization and in accordance with the scope of the tasks and activities funded under ARISE.

In terms of health and safety, the solution raises concerns about the safe deployment of robots in a high-precision setting. As such, the beneficiary must ensure that relevant national legislation is observed when deploying the solutions. The implementation of the solution must be conducted in a contextual manner.

In terms of introducing new robotic functionalities, the potential ethical issue is related to the potential of workers being displaced from their jobs. The participants/employees must be provided with the opportunities for training and upskilling.

- 3. Please describe your recommendations for addressing the ethical concerns mentioned above from the perspective of each of the four TEFs and the HRI challenges they present.**

#### **TEF1**

##### **Challenge 1: Dismantling and assembly of high-value products**

###### **Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

###### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

###### **Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

###### **General recommendations**

Voice command and camera functions & features should consider the different backgrounds, facial features, languages, and accents of participants. The beneficiary should elaborate on how this issue is addressed in an inclusive manner.

###### **Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has a lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

## **Challenge 2: Complex Product Picking in industrial warehouses**

### **Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must

be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

### **Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

### **General recommendations**

Voice command functions and camera features should consider the different backgrounds, facial features, languages, and accents of participants. The beneficiary should elaborate on how this issue is addressed in an inclusive manner.

### **Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

## **TEF2**

### **Challenge 3: Flexible Collaborative robots**

#### **Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

#### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

#### **Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

**General recommendations**

Voice command functions and posture monitoring features should consider the different backgrounds, bodily features, languages, and accents of participants. The beneficiary should elaborate on how this issue is addressed by taking inclusivity, diversity, and equality into account.

**Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

## Challenge 4: Smart Programming

### Human participants

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

### Automation / AI

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

### Health and safety

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

### General recommendations

Voice command functions and other technical features should consider the different backgrounds, physical features, languages, and accents of participants. The beneficiary should elaborate on how this issue is addressed by taking inclusivity, diversity, and equality into account.

### Personal Data

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

### **TEF3**

#### **Challenge 5: Enhanced robot functionality through multimodal HRI interactions**

##### **Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

##### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

**Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

**General recommendations**

Voice command functions and posture monitoring features should consider the different backgrounds, languages, and accents of participants. Moreover, in terms of the camera system, the way in which people's facial expressions are being analysed, should consider the diversity of participants. The beneficiary should elaborate on how this issue is addressed by taking inclusivity, diversity, and equality into account.

**Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

## **Challenge 6: Fetch & carry tasks in healthcare environments**

### **Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

### **Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

### **General recommendations**

Voice command functions and other multimodal features should consider the different backgrounds, languages, accents as well as the physical and mental abilities of participants (staff, patients, etc.). The beneficiary should elaborate on how this issue is addressed particularly with regards to the diversity of participants in terms of their different physical and other abilities and attributes.

**Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

**TEF4****Challenge 7: HRI for improving the efficiency of workers in high precision flexible tasks****Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

### **Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project. These guidelines and regulations should be further contextualized into the activities funded under ARISE.

### **General recommendations**

Voice command functions and other technical features should consider the different backgrounds, languages, and accents as well as the physical and other abilities of participants. The beneficiary should elaborate on how this issue is addressed by taking inclusivity, diversity, and equality into account.

### **Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

### **Challenge 8: HRI for improving ergonomics in high precision tasks**

#### **Human participants**

Obtaining the informed consent of participants (staff, employees, volunteers, patients etc.) is crucial for ensuring that the ethical requirements are being met. Detailed information on the informed consent procedures that will be implemented for the participation of humans must be provided. Similarly, templates of the Informed Consent Forms and Information Sheets used must be provided (in language and terms intelligible to the participants).

Furthermore, details on the procedures and criteria that will be used to identify/recruit research participants must be provided (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks, and benefits for the participants etc.).

#### **Automation / AI**

The beneficiary should elaborate on how participants such as employees are being given the opportunity to train their skills in HRI. Furthermore, the beneficiary should explain how the risk of job displacement is addressed in the activities funded under ARISE.

#### **Health and safety**

The beneficiary must ensure that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed for staff involved in this project.

These guidelines and regulations should be further contextualized into the activities funded under ARISE.

### **General recommendations**

Voice command functions and other technical features should consider the different backgrounds, languages, and accents as well as the different physical and mental abilities of participants. The beneficiary should elaborate on how this issue is addressed by taking inclusivity, diversity, and equality into account.

### **Personal Data**

The beneficiary must explain how all the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimization' principle). Detailed information on the informed consent procedures with regards to data processing must be provided.

The beneficiary should clarify if the funded activities involve tracking, monitoring, or the observation of participants. Justification must be given in case of processing of personal sensitive data such as health -related data. The beneficiary must check if special derogations pertaining to the rights of data subjects, or the processing of health data have been established under the national legislation of the country where the research takes place and submit a declaration of compliance with respective national legal framework(s).

If applicable, the main beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the GDPR a detailed data protection policy for the project/pilot must be provided.

If applicable, the beneficiary must confirm that the research data will be anonymized or pseudonymized and the description of these techniques that will be implemented must be provided.

If applicable, a description of the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the participants must be provided. Similarly, a description of the security measures that will be implemented to prevent unauthorized access to personal data or the equipment used for processing must be provided.

In case personal data are transferred from the EU to a non-EU country or international organization, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be provided.

In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be provided.

In case of further processing of previously collected personal data, an explicit confirmation that the beneficiary has lawful basis for the data processing and that the appropriate technical and organizational measures are in place to safeguard the rights of the data subjects must be provided.

**4. Please describe the possible ethical concerns that have already been addressed in the descriptions of the TEFs and their associated HRI challenges. If possible, highlight at least one strength for each of the TEFs.**

**TEF1:** In terms of TEF1, as in the whole project, the main strength is the focus on safety of the operators in implementing the proposed solutions. However, while technical solutions for overall risk management are in place, this does not guarantee that broader ethical issues are being addressed.

**Challenge 1:** Ethical concerns related to the safety of the operators have been addressed by the proposed solution's mechanisms (i.e. the safety button) that can help to mitigate potential risks related to injuries and accidents. The overall aim to reduce waste is also commendable. However, the focus on efficiency and safety does not address the potential ethical issues related to the solution.

**Challenge 2:** Ethical concerns related to the safety and functioning of the solutions have been elaborated upon through the aim of minimizing the risks for injuries or accidents (i.e. the safety button). There are also other technical features that contribute towards a safer deployment of the solution, such as the objective to recognize different user voices. The overall aim to reduce waste and to improve efficiency and safety do not address many of the ethical questions related to the proposed solution.

**TEF2:** In terms of TEF2, there is a strong emphasis on the collaborative network behind the initiative. The network includes actors from a variety of different research institutions and organizations, industry firms and academia. The diversity of stakeholders is a positive feature. However, this does not guarantee that ethics is taken seriously.

**Challenge 3:** The key ethical feature of Challenge 3 is the utilization of a flexible robot assistants with user-friendly interfaces to improve operator's ergonomics and to protect operators from injuries, while crucially retaining human oversight. Nonetheless, the utilization of a posture monitoring system also raises its own ethical issues. The focus on efficiency and safety does not address the potential ethical issues related to the solution. To summarize, the various technical features enable better conditions, but they also involve certain ethical issues from the point of view of EU regulation.

**Challenge 4:** As in the previous case, the inherent objectives of the challenge aim to create a more inclusive space for employees to utilize the HRI system while preserving their autonomy, even without a background in coding/programming. However, the focus on efficiency and safety does not address the potential ethical issues related to the solution. These objectives of

the challenge also pose certain ethical questions in terms of how they are implemented within the activities of the potential beneficiary.

**TEF3:** In terms of TEF3, the objective is to create a human-centered HRI-framework that would enable robots to accommodate a variety of human needs in healthcare settings in order to create a more user-friendly, accessible and inclusive system. This is an ethical goal, but the process and methods of reaching this goal also raise a variety of ethical questions related to the ways in which technology enables robots to adapt to different preferences and to interact with multimodal signals in “an empathetic” manner.

**Challenge 5:** The solution aims to create an adaptive robot that can help to alleviate the differences between users and stakeholders. This includes an adaptable, personalized, and human-centric framework that will enhance interaction between non-expert users and robots with the help of multimodal communication. In ethical terms, the challenge positively recognizes the importance of designing robots “for and with the end-users/stakeholders” in healthcare settings such as assisted living context. Nonetheless, the way in which these features are built raises a variety of ethical questions. The focus on efficiency and safety does not address the potential ethical issues related to the solution.

**Challenge 6:** The solution aims to help medical staff to focus on “direct patient care”, which is a commendable goal. In ethical terms, the challenge focuses on creating a solution that the end-users can trust in very specific context of hospitals. This contextuality and trust are key parameters for the ethical deployment of any technology. Nonetheless, the solution also raises a variety of ethical questions. The focus on efficiency and safety does not address the potential ethical issues related to the solution.

**TEF4:** In terms of TEF4, the strength of the solution lies in its objective to create a healthier and a more human-centric environment for employees by improving their ergonomics and by considering a variety of employee preferences and characteristics.

**Challenge 7:** A key ethical consideration in this challenge is the operator’s well-being and their different skill-levels. These ethical considerations are implemented through a variety of technical features including the safety button. However, the focus on efficiency and safety does not address the potential ethical issues related to the solution.

**Challenge 8:** The aim of the solution is to address issues related to manual tasks requiring high precision such as chronic ergonomic issues. The objective is to increase an operator’s well-being by creating better working conditions. However, the goal of the solution raises ethical questions in terms of utilizing operator data for these purposes through a variety of sensors. The general focus on efficiency and safety does not address the potential ethical issues related to the solution.

- 5. In the ARISE project, the HRI challenges presented by the TEFs serve as inspiration for FSPT projects in the upcoming two open call programs (2025-2026 and 2026-2017). In addition to technical mentoring, the ARISE consortium will provide**

**the FSTP projects guidance on ethical considerations. Please describe the type of key ethical questions you anticipate arising during the project that are relevant to FSTP projects ethics mentoring.**

The main issue is to create awareness on the basic ethics requirements involved in EU-funded projects such as the ones related to human participants, AI, personal data collection, as well as health and safety issues. By addressing these basic issues that are often involved at least to some capacity in virtually every project, a potential beneficiary or a grantee can have more certainty that they have addressed the main ethical considerations related to their activities funded by the EU.

**6. Your other remarks and recommendations.**

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**Reviewer:** Emad Yaghmaei

**1. Please describe the general nature of the ARISE project, its key elements and the testing and experimentation facilities (TEFs).**

The EU-funded ARISE project (Agile, human-centric, and Real-time enabled open Source technologies advancing industrial HRI in Europe) is a multidisciplinary project with the main objective of advancing Human Robotic Interaction in industrial settings. ARISE aims at expanding, simplifying, and lower the cost of HRI in Europe through the development and demonstration of the AgileHRI concept. The vision of ARISE project entails a future where a human-centric and sustainable approach to HRI encourages and empowers companies to invest in industrial HRI solutions.

To realise this vision while overcoming major HRI application challenges, ARISE will seek to achieve four major goals: increase the efficiency and cost-effectiveness of the development, deployment, and maintenance of HRI solutions; develop open-source reusable modules to push industrial HRI beyond the state-of-the-art; demonstrate openness and agility as enablers of sustainable HRI solutions; and ensure the impact and sustainability of the project results by fully engaging stakeholders and ADRA ecosystem.

Specifically, two major tools will be developed within the project: the ARISE All-in-one middleware and the ARISE SSH Framework.

The ARISE All-in-one middleware is an integrated solution with multiple tools and utilities that reduce the costs and efforts required to design and implement complex industrial projects.

The ARISE SSH Framework for human-centred and ethical HRI is a structured approach to the project's work which ensures that key ethical, legal, and societal considerations are integrated into technological developments.

In order to showcase the value and usability of the ARISE project tools, four TEFs will take place during the project.

TEF1, hosted by CARTIF in its Pilot Factory, offers diverse experiments and experiences to push the boundaries of HRI in industrial contexts by focusing on two challenges: (1) dismantling and assembly of high-value products and (2) complex product picking in industrial warehouses.

TEF2 is provided by INT and consists of the JOiiNT LAB, a laboratory based on a solid collaborative network which will leverage its technologies and competences to address two challenges: (3) flexible collaborative robots and (4) smart programming.

TEF3 is presented by PAL Robotics, a specialised hub for testing robotic technology with a focus on healthcare settings. This TEF aims at enabling robots to exhibit clear and understandable behaviour while working to address two challenges: (5) enhancing robot functionality through multimodal HRI interactions and (6) developing robotic systems able to autonomously perform fetch and carry tasks in healthcare environments.

TEF4 is offered by POLIMI in its Industry 4.0 Lab and concerns the challenges of (7) leveraging HRI to improve the efficiency of workers in high precision flexible tasks and (8) leveraging HRI for improving ergonomics in high precision tasks.

**2. Please describe the possible ethical concerns that can be anticipated from the perspective of each of the four TEFs and the HRI challenges they present.**

**TEF1**

**Challenge 1: Dismantling and assembly of high-value products**

The challenge entails developing an industrial HRI solution to enable collaborative work between robots and human workers in dismantling and assembling high-value products. The solution aims to automate tasks, enhance efficiency, mitigate risks associated with hazardous materials handling and accommodate secondary processes, ultimately ensuring worker safety and improving overall productivity in the working environment.

This evaluation identifies several ethical concerns arising from this challenge. Privacy is a central issue as the integration of advanced robotics in industrial contexts often involves the collection and processing of personal and sensitive data through cameras, sensors, and other monitoring systems. It is critical to ensure that data is securely managed, used solely for the intended purpose, and protected against unauthorized access. Workers must also provide informed consent before their data is collected and processed, fostering trust in the deployment of such systems. Inclusivity and accessibility represent another major concern. The system must accommodate a diverse workforce, considering differences in physical conditions, skills, and needs. For example, the Voice Command Recognition feature should be inclusive of workers with non-standard accents, while visually impaired, far-sighted, or near-sighted workers must be able to effectively use any augmented reality tools such as the MR HoloLens glasses. Failure to design inclusively risks excluding or disadvantaging certain groups of workers. Furthermore, safety and reliability are critical to ensuring the well-being of workers in this collaborative environment. Misinterpretations of gestures or commands, as well as system failures, could lead to accidents or injuries, particularly in tasks involving hazardous materials. The project must implement robust health and safety protocols, comply with relevant regulations, and design fail-safe mechanisms to protect workers. From a workforce perspective, the challenge also raises concerns about job displacement. Automation may reduce the need for human labour in certain tasks, creating uncertainty for workers. A clear strategy for upskilling and reskilling workers is necessary to help them adapt to new roles and collaborate effectively with robotic systems. Additionally, measures to mitigate the impact of potential job losses must be outlined.

Finally, environmental and dual-use concerns must be addressed. The processes involved in dismantling and assembling high-value products should align with sustainable practices, minimizing the environmental footprint. The potential for dual-use or misuse of robotic systems should also be considered, with compliance statements ensuring that such risks are addressed.

## Challenge 2: Complex Product Picking in industrial warehouses

The challenge aims to develop a Human-Robot Interaction (HRI) solution for product picking in industrial warehouses. It seeks to overcome limitations of manual methods and traditional robots by integrating collaborative robots into the process. The key is ensuring the seamless collaboration between humans and robots, prioritizing worker safety while maximizing efficiency in product picking. The solution must also adapt to the high variability in shapes and weights of products, as well as handle purchase orders from IT systems. The focus is on improving human-robot interaction to optimize product picking operations in industrial warehouses.

Ethical concerns arising from this HRI scenario start with workers safety and reliability. Collaborative robots must operate in close physical proximity to human workers, hence a higher risk of accidents or injuries if systems fail to properly recognize human movements or adapt to dynamic environments. Robust fail-safe mechanisms and adherence to safety protocols are essential to ensure physical safety and minimize risks of injuries as well as material waste. Privacy and data security represent another significant concern, as the system works on data collected through cameras and microphone to improve collaboration and optimise operations. While this data collection is essential for the HRI solution, it deeply connects with concerns about consent, data security, and potential misuse of personal information. Measures must be in place to ensure compliance with data protection regulations such as GDPR and limit data collection to what is strictly necessary for the system's functionality. Inclusivity and accessibility are key to ensuring the ethical integration of collaborative robots. The system must accommodate a diverse workforce, considering variations in physical abilities, skills, and communication styles. Failure to account for such diversity could exclude certain groups of workers or create inequities in their interactions with the robots. Continuous engagement with users and monitoring the social impact of the system can help mitigate potentially negative implications on workers.

From a workforce perspective, concerns about job displacement are central. As a result, strategies for upskilling and reskilling workers are essential to help them transition into new roles and maintain relevance in an increasingly automated environment. Moreover, data security is another critical concern, as the system involves not only the handling of personal data but also sensitive operational data related to warehouse management and purchase orders. Ensuring the security of this information and preventing unauthorized access is crucial to maintaining trust in the system.

Lastly, the environmental impact of deploying collaborative robots in warehouses must be considered. The design and operation of these systems should prioritize energy efficiency and sustainability to minimize their environmental footprint. Additionally, the potential for dual-use and misuse of these robots in non-industrial or unethical applications should be addressed through compliance statements and ethical safeguards.

**TEF2****Challenge 3: Flexible Collaborative robots**

The challenge focuses on the need of flexible HRI solutions in dynamic working environments to address an increasing demand variety. Challenge 3 addresses such a need of flexibility at the hardware and software level by demonstrating the feasibility of Flexible Collaborative robots.

Several ethical concerns arise in this context, starting from privacy and data security. Flexible robots in dynamic environments rely heavily on data collected from sensors, cameras, and other systems to adapt to changing scenarios. This process may involve monitoring workers' movements, behaviours, and potentially sensitive information, raising significant concerns about the collection, storage, and use of personal data. Ensuring robust data protection measures and compliance with data protection regulations, such as GDPR, is critical to maintain trust and safeguard workers' privacy.

Inclusivity and accessibility are also key ethical concerns. Flexible systems must be designed to accommodate a diverse workforce, including individuals with different physical abilities, skill levels, and cultural or linguistic backgrounds. If the robots' adaptability does not extend to recognizing diverse user inputs or accommodating varying worker needs, certain groups could be unintentionally excluded or disadvantaged.

The psychological and social impact of Flexible Collaborative Robots in the workplace must also be taken into account. A framework for assessing and addressing these impacts is essential to anticipate and mitigate potential negative effects. Safety and reliability are crucial in dynamic environments where the risks of accidents or system failures are higher. Miscommunication or errors in task execution could pose risks, particularly in high-stakes or hazardous environments. Robots that adapt to changing tasks must have rigorous fail-safe mechanisms and real-time monitoring capabilities to ensure safe interactions with human workers. With regards to workforce, the introduction of Flexible Collaborative Robots raises concerns about job displacement. As robots become increasingly capable of adapting to diverse tasks, some roles may be eliminated or significantly altered. A strategy for upskilling and reskilling workers is essential to help them transition to new roles and maintain their relevance in the workplace.

Environmental concerns are also relevant, as the development and deployment of flexible robotics may involve increased resource consumption or waste generation. Ensuring that HRI solutions align with sustainable practices is essential to minimise the environmental footprint of these systems.

Finally, the potential for dual-use and misuse of flexible robotics technologies must be addressed. Flexible systems that can adapt to diverse tasks might inadvertently be repurposed for unethical or harmful applications. Compliance statements and ethical safeguards must be in place to prevent such risks.

#### **Challenge 4: Smart Programming**

Challenge 4 addresses the need to embed intuitive interfaces into the HRI system to allow operators without coding skills to easily reprogramme it and thereby adapt the system to different products.

Several ethical concerns arise from this challenge, starting with worker safety and reliability. While the robots aim to safeguard operators from injuries and ergonomic risks, there remains a concern about system failures or inaccuracies during collaborative tasks that might lead to severe accidents or injuries. Ensuring robust fail-safe mechanisms, real-time monitoring, and clear intervention protocols is crucial to mitigate these risks and ensure safe operations. Inclusivity and accessibility are among key concerns as well. The intuitive interfaces must be designed to accommodate a diverse workforce, including individuals with varying technical skills, physical abilities, and cognitive capabilities.

Furthermore, privacy and data security concerns arise from the system's reliance on sensors, cameras, and monitoring tools to track tasks and interactions. Such data collection, while necessary for functionality, poses risks to workers' privacy and may lead to discomfort or resistance among operators. Robust data protection measures, transparency about data use, and obtaining informed consent from workers are essential to address these concerns and build trust in the system.

The psychological and social impacts of collaborative robots require consideration as well. Continuous worker engagement, training, and clear communication about the complementary role of robots can help mitigate these risks together with an impact assessment strategy in place.

From a workforce perspective, the automation of certain tasks raises concerns about job displacement. The project is expected to explain how the need to upskill and reskill workers is addressed.

Accountability is another critical concern: clear guidelines must define responsibility for errors, injuries, or operational failures. Establishing accountability frameworks for both workers and robotic systems is essential to ensure ethical and operational clarity.

Finally, environmental sustainability and the potential for misuse must also be addressed. The development and deployment of robotic systems should align with sustainable practices that minimize their energy consumption and environmental impact. Additionally, safeguards must be in place to prevent misuse of such adaptable systems.

#### **TEF3**

#### **Challenge 5: Enhanced robot functionality through multimodal HRI interactions**

The focus of Challenge 5 is to enhance the functionality of robots through advanced multimodal human-robot interactions. This challenge aims to improve how robots and humans

collaborate on functional tasks by utilizing a combination of communication methods such as verbal, gestures, and visual cues.

Several ethical concerns arise from the described scenario, with the primary one being privacy. As the envisioned multimodal HRI interactions rely on the heavy use of cameras, microphones, and sensors to capture, analyse, and elaborate a response to human inputs, privacy is the most significant issue with regards to collection and processing of personal and sensitive data. Ensuring a robust management of data security and attesting that the collected data will not be used for other purposes than those specified by the project is crucial to the development of trustworthy HRI interactions. The substantial amount of data required for the development of the envisioned robots requires a considerate approach to data management within this challenge.

Inclusivity, accessibility, and the risk of biased systems also represent key ethical concerns. The design and development of the system should take into account the diversity of the users that might result, for instance, in different accents, physical conditions, gestures, and physical look. Additionally, the design of the system must consider the differences between operators in their technical skills and knowledge. A failure in capturing the diversity of the users may eventually lead to a certain group of users being excluded or disadvantaged by the interaction with the robots.

This challenge raises further concerns on the potentially negative psychological and social impact of the robots on the users: feelings of alienation, dehumanization, discomfort, and the risk of overreliance on technology are among the potential negative consequences of the interaction with robots. An impact assessment framework in place for the continuous monitoring of the evolution of HRI interactions would contribute to the mitigation of such risks.

Moreover, safety and reliability of the system are ethical concerns in light of the negative impacts that failures of the system or misinterpretations of verbal commands or gestures may cause.

From a broader perspective, further ethical concerns arise with regards to potential negative implications for the workforce, which may range from the risk of displacing workers to the impact that continuous HRI interactions may have on their skills on the long term.

### **Challenge 6: Fetch & carry tasks in healthcare environments**

Challenge 6 addresses the development and implementation of robotic systems designed to autonomously perform fetch and carry tasks within healthcare settings. By automating these routine tasks, the aim is to free up medical staff to focus on direct patient care and other critical responsibilities, enhancing overall efficiency and care quality in hospitals.

Several ethical concerns arise from this scenario, with privacy and data security at the forefront. The robots' capabilities and reliance on people recognition, including facial, body,

and voice detection, raise concerns about the collection, storage, and use of personal and sensitive data.

Another critical concern is represented by inclusivity and accessibility. The system must accommodate diverse users, including individuals with disabilities, varied linguistic capabilities and accents, and different cultural norms. Speech recognition systems and natural language processing must accurately understand non-standard accents, languages, and speech patterns to avoid excluding specific user groups. Multimodal communication must also be designed to ensure that individuals with visual, auditory, or physical impairments can effectively interact with the robots. Regular audits of these systems might help to identify and mitigate potential biases against specific demographic groups.

Safety and reliability are crucial concerns in the deployment of robots in healthcare environments, given the sensitive and high-stakes nature of such settings. Social navigation capabilities must be rigorously tested to ensure that robots do not inadvertently cause harm or disrupt workflows by navigating too closely to humans or misunderstanding group dynamics. The ability to recognize human activities and adjust behavior appropriately must be precise, as errors could have direct consequences for patient or staff safety. The project must also consider potential psychological and social impacts, particularly regarding how staff and patients perceive and interact with the robots. Clear communication about the complementary role of robots in supporting, not replacing, human efforts is essential.

From a workforce perspective, the deployment of assistive robots raises concerns about job displacement, hence the importance of prioritizing upskilling and reskilling programs to enable these workers to take on more value-added roles. Finally, environmental sustainability and the potential for misuse of the technology must be considered. The development and operation of these robots should minimize energy consumption and environmental impact, aligning with broader sustainability goals. Finally, safeguards must be in place to prevent the technology from being repurposed for unethical or harmful applications.

#### TEF4

##### **Challenge 7: HRI for improving the efficiency of workers in high precision flexible tasks**

Challenge 7 addresses the deployment of Human-Robot Interaction (HRI) to improve the efficiency of operators working on tasks requiring a high level of precision and flexibility by preparing the workspace for operators, aiming at reducing the overall setup time. Several ethical concerns may arise from this scenario, where safety of workers and reliability of the system are paramount due to the potential material damage or harm to operators that errors or malfunctions might cause. Furthermore, the capability of the robot to take over high-precision tasks raises concerns about the risk of workers displacement and the deskilling of operators. At the same time, workers capacity to interact effectively with the robots in terms of skills and knowledge is essential to ensure a smooth cooperation between the actors of this challenge. Another significant ethical concern regards privacy and data protection, as the integration of HRI systems often rely on data collection and analysis of real-time data to optimize interactions.

Questions of bias, fairness, inclusivity, and accessibility represent ethical concerns highlighting the need to ensure that the system can accommodate a diverse range of operators and avoid inadvertent exclusion of certain groups of users. For this reason, a monitoring system for the HRI performance and social impact is encouraged to address any potential negative implication of the system on workers. The environmental sustainability of the system is an additional concern arising from the challenge. The development of the HRI system is expected to prioritize energy efficiency and minimize waste, in alignment with broader sustainability goals. Finally, in light of the potential for dual-use of high-precision robots, the project must demonstrate that safeguards are in place against the potential misuse of the system.

### **Challenge 8: HRI for improving ergonomics in high precision tasks**

Challenge 8 aims at improving human ergonomics and comfort while performing a high-precision task with the deployment of HRI. Precision manual tasks usually require a dedicated fixed frame and they may cause health issues over time if the frame is not properly adjusted. The cobot envisioned in Challenge 8 is set to automatically position and hold the workpiece according to the operator's ergonomics and comfort. Several ethical concerns arise from this scenario, especially in view of the heavy reliance of the cobot on data collected through the RealSense Camera D435i and microphone, in connection with its capability to identify and analyse the operators' ergonomics and comfort, recognize signs of stress, and respond to orders. Privacy and data security emerge therefore as critical issues due to the significant amount of personal and sensitive data that the cobot needs to process in order to accomplish its purposes, including body dimensions, speech patterns, and other biometric data. Compliance with data protection regulations and workers' informed consent on the usage of their data are essential to ensure a trustworthy HRI. Moreover, inclusivity and accessibility of the system represent ethical concerns in connection with the risk of biased systems that inadvertently exclude or disadvantage certain groups of workers from the functional cooperation with the cobot. The design of the HRI system must take into account the diversity of the users in terms of, for instance, cultural patterns, accents, and physical features and conditions. Equally important concerns are safety and reliability of the system. Errors in the cobot's positioning or orientation adjustments could lead to operational inefficiencies and material waste and, most of all, could pose serious risks to the operator's safety. The system must include robust fail-safe mechanisms and be extensively tested to ensure that it can reliably adapt to the operator's requirements without causing harm or disruption. Misinterpretations of speech commands or inaccuracies in physical feature analysis could result in inappropriate adjustments and unpleasant collaboration with the system. The deployment of cobots for high-precision tasks may furthermore pose ethical questions on the potential displacement of workers, the risk of deskilling, and the need to reskill them in order to collaborate efficiently with the system. In addition to that, the project must also address the aspect of environmental sustainability expected from the cobot. In conclusion, the potential for misuse of the system must be considered by the project, ensuring that its capabilities will not be repurposed for unethical applications.

3. Please describe your recommendations for addressing the ethical concerns mentioned above from the perspective of each of the four TEFs and the HRI challenges they present.

## TEF1

### Challenge 1: Dismantling and assembly of high-value products

Based on the ethical concerns identified above for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### Human workers

- Upskilling and reskilling: the project must define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.
- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the Voice Command Recognition capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third-party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project should highlight the importance of workers' informed consent before the HRI solution is deployed.

#### Accountability

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

#### Inclusive design

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command Recognition capability and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how visually impaired, far-sighted, and near-sighted workers, if any, are expected to use the MR HoloLens glasses.

#### Health and safety

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.

- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

#### **Environment**

- The project should outline the sustainability practices adopted to dismantle, assembly, and assess potential consequences on the environment.

#### **Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

### **Challenge 2: Complex Product Picking in industrial warehouses**

Based on the ethical concerns identified above for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### **Human workers**

- Upskilling and reskilling: the project is expected to define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.
- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the Voice Command Recognition capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third-party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them.

Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.

- Informed consent: the project should highlight the importance of workers' informed consent before the HRI solution is deployed.

#### **Accountability**

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

#### **Inclusive design**

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command Recognition capability and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how visually impaired, far-sighted, and near-sighted workers, if any, are expected to use the MR HoloLens glasses.

#### **Health and safety**

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.
- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

#### **Environment**

- The project is expected to outline the sustainability practices adopted by the development of the HRI system and assess potential consequences on the environment.

#### **Dual-use and misuse**



- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

## TEF2

### Challenge 3: Flexible Collaborative robots

Based on the ethical concerns identified above for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### Human workers

- Upskilling and Reskilling: the project is expected to define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.
- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the Voice Command Recognition capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third-party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project must ensure that workers' informed consent is obtained before the HRI solution is deployed.

#### Accountability

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

#### Inclusive design

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command system envisioned and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how workers diversity (e.g. in terms of physical abilities, physical conditions, body types) is taken into account in the development of the Real-time Posture monitoring system.

#### Health and safety

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.

- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

#### **Environment**

- The project should outline the sustainability practices adopted to dismantle, assembly, and assess potential consequences on the environment.

#### **Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

#### **Impact assessment**

- The project is strongly encouraged to elaborate an action plan to assess the impact of the system on users on a regular basis.
- Feedback loop: the project must clarify how the feedback of users can be incorporated into the system to improve its functionalities.

### **Challenge 4: Smart Programming**

Based on the ethical concerns identified above for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### **Human workers**

- Upskilling and reskilling: the project is expected to define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.

- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the Voice Command Recognition capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project should highlight the importance of workers' informed consent before the HRI solution is deployed.

#### **Accountability**

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

#### **Inclusive design**

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command system envisioned and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how workers diversity (e.g. in terms of physical abilities and physical conditions) is taken into account in the development of the HRI system, with particular regards to functional requirements such as the follow-me mode.

#### **Health and safety**

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.
- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.

- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

#### **Environment**

- The project should outline the sustainability practices adopted to dismantle, assembly, and assess potential consequences on the environment.

#### **Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

#### **Impact assessment**

- The project is strongly encouraged to elaborate an action plan to assess the impact of the system on users on a regular basis.
- Feedback loop: the project must clarify how the feedback of users can be incorporated into the system to improve its functionalities.

### **TEF3**

#### **Challenge 5: Enhanced robot functionality through multimodal HRI interactions**

Based on the ethical concerns identified above for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### **Human users**

- Upskilling and reskilling: the project must define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.
- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the speech recognition capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project must highlight the importance of users' informed consent before the HRI solution is deployed.

#### **Accountability**

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system and potential misunderstandings between the user and the robot.

**Inclusive design**

- Accuracy and bias: the development of the HRI solution should take into consideration users' diversity, especially with regards to the speech recognition capability and RGB-D cameras and the risk that the system does not recognise non-standard features in the attempt to identify people's facial expressions and emotions. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how users' diversity has been considered in the development of the system.

**Transparency**

- The project must provide clear documentation on the functioning of the system that will enable users to understand the correlations between inputs and outputs.

**Health and safety**

- Risks to H&S: the project should assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.
- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

**Data Security**

- Informed consent: the project must ensure users understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

**Environment**

- The project must outline the sustainability practices adopted to and assess potential consequences on the environment.

**Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

**Impact assessment**

- The project is strongly encouraged to elaborate an action plan to assess the impact of the system on users on a regular basis.
- Feedback loop: the project must clarify how the feedback of users can be incorporated into the system to improve its functionalities.

### **Challenge 6: Fetch & carry tasks in healthcare environments**

Based on the ethical concerns illustrated in the previous section for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### **Human workers**

- Upskilling and reskilling: the project is expected to define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.
- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the Voice Command Recognition capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third-party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project should highlight the importance of workers' informed consent before the HRI solution is deployed.

#### **Accountability**

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

#### **Inclusive design**

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command system envisioned and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how workers diversity (e.g. in terms of physical abilities, physical conditions, body types) is taken into account in the development of the system.

#### **Health and safety**

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.

- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

#### **Environment**

- The project should outline the sustainability practices adopted to dismantle, assembly, and assess potential consequences on the environment.

#### **Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

#### **Impact assessment**

- The project is strongly encouraged to elaborate an action plan to assess the impact of the system on users on a regular basis.
- Feedback loop: the project must clarify how the feedback of users can be incorporated into the system to improve its functionalities.
- Regular audits of the HRI systems might help to identify and mitigate potential biases

#### **TEF4**

##### **Challenge 7: HRI for improving the efficiency of workers in high precision flexible tasks**

Based on the ethical concerns illustrated in the previous section for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

#### **Human workers**

- Upskilling and reskilling: the project is expected to define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.

- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: in light of the risks posed by unauthorised data collection and third party access, the project is expected to clarify how these are considered and what are the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project should highlight the importance of workers' informed consent before the HRI solution is deployed.

#### **Accountability**

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

#### **Inclusive design**

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command system envisioned and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.
- Inclusivity: the project must explain how workers diversity is taken into account in the development of the system.

#### **Health and safety**

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.
- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

**Environment**

- The project should outline the sustainability practices adopted to dismantle, assembly, and assess potential consequences on the environment.

**Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

**Impact assessment**

- The project is strongly encouraged to elaborate an action plan to assess the impact of the system on users on a regular basis.
- Feedback loop: the project must clarify how the feedback of users can be incorporated into the system to improve its functionalities.

**Challenge 8: HRI for improving ergonomics in high precision tasks**

Based on the ethical concerns identified above for this specific challenge, a set of recommendations may support the project in addressing and mitigating potentially negative risks arising from this challenge.

**Human workers**

- Upskilling and reskilling: the project must define the strategy adopted to ensure that workers possess the right knowledge and skills required to collaborate efficiently with robots.
- Job displacement: the project must explain how the risk of displaced workers due to automation is taken into consideration, and outline what are the measures required to mitigate this risk.
- Privacy: the Speech Command Detection capability raises concerns with regards to privacy and the risks posed by continuous listening of the device, unauthorised data collection, and third party access. The project is therefore expected to clarify how these risks are considered and the mitigation strategies in place to address them. Moreover, the project must explain how the camera embedded in the system collects data for the sole purpose of the HRI solution.
- Informed consent: the project should highlight the importance of workers' informed consent before the HRI solution is deployed.

**Accountability**

- The project must clarify how accountability and liability for the performance of the HRI system are established and managed, with particular regards to failures of the system.

**Inclusive design**

- Accuracy and bias: the development of the HRI solution should take into consideration workers' diversity, especially with regards to the Voice Command Recognition

capability and the risk that the system does not recognise non-standard accents. The project should highlight how the inclusive design of HRI solutions is ensured.

- Inclusivity: the project must explain how workers diversity in terms of e.g. technical skills and physical features is taken into account in the development of the system.

#### **Health and safety**

- Risks to H&S: the project must assess the potential risks to health and safety of human workers and outline the measures in place to overcome such risks.
- H&S procedures: the project must ensure that the proposed HRI solution follows procedures that conform with the relevant local/national/European guidelines and legislation.
- The project must produce protocols for safe physical interaction, including a detailed specification on fail-safe mechanisms.

#### **Data Security**

- Informed consent: the project must ensure workers understand and sign an informed consent form before their personal data is collected and processed.
- The project must demonstrate compliance with relevant data protection regulations and GDPR. A description of the security measures to protect collected data from unauthorised access is necessary.
- In case of further processing of previously collected personal data, an explicit confirmation that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included.
- In case the HRI solution is developed and trained using data collected from a third party, an API integration compliance form must be provided.

#### **Environment**

- The project should outline the sustainability practices adopted to dismantle, assembly, and assess potential consequences on the environment.

#### **Dual-use and misuse**

- The project must complete a dual-use compliance statement.
- The project must complete a misuse compliance statement.

- 4. Please describe the possible ethical concerns that have already been addressed in the descriptions of the TEFs and their associated HRI challenges. If possible, highlight at least one strength for each of the TEFs.**

#### **TEF1**

The main strength of TEF1 from an ethical perspective is its focus on safety improvements among industries and the human-centric approach that emerges from the description of the envisioned HRI systems. In particular, the capacity of the robot to adapt to the operators' conditions and preferences indicates the project's commitment to inclusivity.

**Challenge 1** already addresses the ethical concerns of workers safety and reliability of the system, which are defined as a priority of the challenge. The safety button with the function of stopping the robot in case of failure is a suitable example of measure in place to avoid and/or mitigate the risk of injuries and physical accidents.

Similarly, **Challenge 2** indicates workers safety as one of the goals of the HRI system and it envisions a safety button on the robot to minimize the risk of accidents. Furthermore, the goal of 95% accuracy in the system's ability to recognize the users voice certainly contributes to the risk of excluding certain workers from the cooperation with the robot.

#### TEF2

The main strength of TEF2 is the solid collaborative network underlying the JOiINT LAB initiative, which brings together different actors ranging from institutions and research organisations to academic entities and industrial companies. This variety in expertise is certainly beneficial to the achievement of the project's objectives as it ensures that different types of stakeholders and diverse perspectives can contribute to the project outcomes.

**Challenge 3** already addresses the concerns of workers safety and well-being through the camera-based posture monitoring system that allows the robotic assistant to analyse the posture of the operator and alert him/her in case the ergonomic indices are not correct. However, the definition of more mechanisms in place to ensure workers safety in case of failures of the system is encouraged to increase the protection of workers as well as the general level of trust in the robotic assistant.

**Challenge 4**, on the other hand, addresses the concern of enabling workers to use efficiently the HRI system even if they do not possess programming competences. The intuitive interfaces feature makes the envisioned HRI systems feasible for a diverse range of operators.

#### TEF3

The goal of making the HRI system technology intuitive and user-friendly for hospital staff constitutes one of the main strengths of TEF3, as it acknowledges the importance of accommodating the needs of users that differ in their technical knowledge and skills.

**Challenge 5** addresses the need to consider the diversity of users by recognizing the high variability of stakeholders involved. The adaptiveness of the robot to the users it interacts with is a relevant feature that increases the functionality and fairness of the system.

**Challenge 6** takes into account the concern about safety of the operators and patients in healthcare settings through the envisioned social navigation system. In particular, the ability to request for help when the navigation is interrupted increases the level of trust in the safety of the system.

#### TEF4

TEF4 has the potential to create realistic environments to test research findings and developing customized solutions. The main strength of this TEF4 is the robust human-centric

approach to the design of the HRI systems that do not only focus on the enhancement of productivity and efficiency of workers, but also on the need to accommodate individual preferences and well-being. Moreover, the goal of improving workers ergonomics through HRI indicates the commitment to foster a technology that benefits human beings and society as a whole.

**Challenge 7** addresses the concern about the safety of the HRI system through several features of the robot: the safety button to stop the functioning of the robot in case of failure or emergency is a proper safeguard mitigating the risk of accidents or injuries.

**Challenge 8** addresses the need to consider the diversity of users in terms of body features by using each operator's physical data as inputs to the calculation of the right position and orientation of the workpiece according to the ergonomics and comfort of the user.

- 5. In the ARISE project, the HRI challenges presented by the TEFs serve as inspiration for FSPT projects in the upcoming two open call programs (2025-2026 and 2026-2017). In addition to technical mentoring, the ARISE consortium will provide the FSTP projects guidance on ethical considerations. Please describe the type of key ethical questions you anticipate arising during the project that are relevant to FSTP projects ethics mentoring.**

N/A

- 6. Your other remarks and recommendations.**

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**Reviewer:** Agnieszka Sprońska

**1. Please describe the general nature of the ARISE project, its key elements and the testing and experimentation facilities (TEFs).**

ARISE project focuses on advancing Human Robot Interaction (HRI) in industrial settings via the development and implementation of the All-in-one middleware as well as the ARISE social sciences and humanities (SSH) framework for human centred and ethical HRI.

The ARISE All-in-one middleware will be integrated from several tools provided by the project partners (Vulcanexus, DDS Enabled Context Broker Technology, ROS4HRI and Library of AI Powered components) in order to enable HRI solutions providers to reduce the costs and efforts of designing and implementing complex industrial HRI projects.

The All-in-one middleware developed in ARISE will be implemented and tested via the FSTP pilot projects which will need to address the challenges defined by four Testing and Experimentation Facilities (TEFs), focused on few different industrial, logistics and healthcare scenarios.

All the processes and experimentations in the project will be supported by the ARISE SSH framework for human-centred and ethical HRI, covering different guidelines, principles and specifications aimed at ensuring that the industrial HRI projects are ethically compliant.

The major focus of the ARISE project and the developed framework is on key aspects of human-centricity of technologies and AI trustworthiness such as: privacy and data governance, worker safety, human autonomy and oversight/agency, fairness, transparency, explicability and accountability, legal uncertainty and liability, gender, non-bias and non-discrimination as well as societal and environmental implications.

The following report has been prepared upon the analysis of the information provided by the ARISE project consortium representatives, contained in two documents: The first ethics review 2024

- ARISE\_Materials for the first ethics review\_fall 2024 – overall description of the project and the TEFs along with detailed overview of the challenges with exemplary use-cases, aimed at serving as an inspiration for the FSTP projects
- ARISE setup additional information – document clarifying the scope of the project and planned activities in response to questions asked by the reviewer.

**2. Please describe the possible ethical concerns that can be anticipated from the perspective of each of the four TEFs and the HRI challenges they present.**

Considering the project's objectives to provide support to third-parties (FSTP projects) in the form of the All-in-one middleware and various services (mentoring, access to realistic testing and experimentation infrastructure) as well as to test/assess the usefulness of solutions both designed by the project as well as proposed by the projects funded under the FSTP

mechanism, the preliminary analysis of the planned activities leads to the conclusion that the ARISE project tackles the following ethics issues:

- directly – within the activities performed by the project consortium:
  - Processing of personal data (mainly non-sensitive business data) for the purposes of the Open Calls processes, services provision, coordination and reporting as well as dissemination/outreach,
  - Environment, health and safety – in terms of participation of consortium partner's employees in preparation and or maintenance of the facilities and equipment (e.g. autonomous collaborative robots – mobile platforms and robotic arms, hazardous materials) that will be made available as part of the services offered to third parties,
  - AI technologies development/deployment – development of the ARISE All-in-one middleware that employs AI technologies and tools, that should cover requirements related to:
    - human agency, autonomy and oversight,
    - technical robustness and safety – including cybersecurity issues,
    - privacy and data governance,
    - Transparency,
    - diversity, non-discrimination and fairness,
    - societal and environmental well-being,
    - Accountability;
- indirectly, in relation to the activities performed by third parties, which will be supported with services offered by the TEFs involved in the project – these, however, should be treated as potentially arising, since it is at this stage of the project (first Open Call launched) difficult to precisely envisage all the types of activities and experiments that will be performed:
  - Involvement of humans, including vulnerable groups (e.g. elderly, patients etc.) for development and testing of particular solutions for human-robot interaction,
  - Personal data processing, including sensitive data (e.g. face, body posture, voice, gaze tracking) as well as profiling for users' recognition and their behaviour assessment,
  - Environment, health and safety in terms of use of elements that can make harm to humans (autonomous collaborative robots – mobile platforms and robotic arms, hazardous materials, heavy objects etc.),
  - AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development of other solutions employing AI technologies.

Finally, considering the potential large extent of personal data processing (including collection and storing) in combination with AI technologies development/use, the cybersecurity issues should be of particular concern both for the own project developments and for the FSTP projects to be funded under the ARISE umbrella.

All the above mentioned issues are of concern for all the TEFs and challenges defined in the ARISE project, however, their extent may vary depending on the actual scope of the developments and experiments to be performed.

## TEF1

### Challenge 1: Dismantling and assembly of high-value products

The issues of concern are:

- Involvement of humans for development and testing of solutions,
- Personal data processing, including sensitive data (e.g. face, body posture, voice, gaze tracking),
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots, hazardous materials),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

### Challenge 2: Complex Product Picking in industrial warehouses

The issues of concern are:

- Involvement of humans for development and testing of solutions,
- Personal data processing, including sensitive data (e.g. face, body posture, voice, gaze tracking),
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

## TEF2

### Challenge 3: Flexible Collaborative robots

The issues of concern are:

- Involvement of humans for development and testing of solutions,
- Personal data processing, including sensitive data (e.g. face, body posture, voice),
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots, heavy objects),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

### Challenge 4: Smart Programming

The issues of concern are:

- Involvement of humans for development and testing of solutions,

- Personal data processing, including sensitive data (e.g. body posture, voice),
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

### TEF3

#### **Challenge 5: Enhanced robot functionality through multimodal HRI interactions**

The issues of concern are:

- Involvement of humans for development and testing of solutions, including vulnerable groups (elderly, patients),
- Personal data processing, including sensitive data (e.g. face, body posture, voice) as well as profiling and behaviour assessment,
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

#### **Challenge 6: Fetch & carry tasks in healthcare environments**

The issues of concern are:

- Involvement of humans for development and testing of solutions, including vulnerable groups (elderly, patients),
- Personal data processing, including sensitive data (e.g. face, body posture, voice) and behaviour assessment,
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

### TEF4

#### **Challenge 7: HRI for improving the efficiency of workers in high precision flexible tasks**

The issues of concern are:

- Involvement of humans for development and testing of solutions,
- Personal data processing,
- Environment, health and safety – use of elements that can make harm to humans (autonomous/automated collaborative robots),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

### Challenge 8: HRI for improving ergonomics in high precision tasks

The issues are of concern are:

- Involvement of humans for development and testing of solutions
- Personal data processing, including sensitive data (e.g. face, body posture, voice) and behaviour assessment,
- Environment, health and safety – use of elements that can make harm to humans (autonomous collaborative robots),
- AI technologies development/use/deployment– implementation and testing of the ARISE All-in-one middleware as well as development/use/deployment of other solutions employing AI technologies.

#### **3. Please describe your recommendations for addressing the ethical concerns mentioned above from the perspective of each of the four TEFs and the HRI challenges they present.**

The main recommendation for the project's own developments that will employ AI technologies (All-in-one middleware) is to perform self-assessment regarding the solutions offered by the project and ensure compliance with the principles of the ethics-by design that is encompassed in the following legislation and guidance documentation:

- Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act)<sup>15</sup>;
- Ethics guidelines for trustworthy AI of the Independent High Level Expert Group on AI (HLEG)<sup>16</sup> and Assessment List for Trustworthy Artificial Intelligence (ALTAI)<sup>17</sup>
- Ethics By Design and Ethics of Use Approaches for Artificial Intelligence<sup>18</sup>

Moreover, considering that the same ethics issues are of concern for all the TEFs and challenges (even though to a various extent), it is recommended that several aspects are addressed/developed centrally within the ARISE project and applied accordingly across the TEFs/challenges as well as for all the FSTP projects:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation following the European standards and legislation, including potential involvement of vulnerable groups (elderly, patients, disabled etc.);

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<sup>15</sup> The AI Act. Available at: <https://eur-lex.europa.eu/eli/reg/2024/1689/oj>

<sup>16</sup> Ethics guidelines for trustworthy AI of the Independent High Level Expert Group on AI (HLEG): <https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai>

<sup>17</sup> Assessment List for Trustworthy Artificial Intelligence (ALTAI). Available at: <https://digital-strategy.ec.europa.eu/en/library/assessment-list-trustworthy-artificial-intelligence-altai-self-assessment>

<sup>18</sup> Ethics By Design and Ethics of Use Approaches for Artificial Intelligence. Available at: [https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-by-design-and-ethics-of-use-approaches-for-artificial-intelligence\\_he\\_en.pdf](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-by-design-and-ethics-of-use-approaches-for-artificial-intelligence_he_en.pdf)

- Detailed policy on personal data processing and protection covering the following aspects:
  - compliance with GDPR and respective national legal framework(s),
  - informed consent procedures for personal data processing,
  - technical and organisational measures to be implemented in order to safeguard the rights and freedoms of the data subjects (e.g. the right to access, right of erasure etc.),
  - security measures to be implemented in order to prevent unauthorised access to personal data and the equipment used for processing,
  - anonymisation/pseudonymisation techniques that will be implemented;
- The procedure to monitor the ethics compliance of all the FSTP projects that will be selected for funding, including also the evaluation/assessment of related ethics issues in the process of selection of FSTP projects, introducing the list of basic ethics requirements for the experiments and providing guidance documentation on the issues involved;
- Health and safety policies related to experimentation within the TEF facilities.

## TEF1

### Challenge 1: Dismantling and assembly of high-value products

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence,
  - XRSI Privacy Framework<sup>19</sup>

### Challenge 2: Complex Product Picking in industrial warehouses

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence,

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<sup>19</sup> XRSI Privacy Framework. Available at: <https://xrsi.org/publication/the-xrsi-privacy-framework>

- XRSI Privacy Framework.

## TEF2

### Challenge 3: Flexible Collaborative robots

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence.

### Challenge 4: Smart Programming

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence.

## TEF3

### Challenge 5: Enhanced robot functionality through multimodal HRI interactions

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation, including particular focus on vulnerable groups (patients, elderly, disabled etc.),
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence.

### Challenge 6: Fetch & carry tasks in healthcare environments

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation, including particular focus on vulnerable groups (patients, elderly, disabled etc.),
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence.

#### TEF4

##### **Challenge 7: HRI for improving the efficiency of workers in high precision flexible tasks**

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence.

##### **Challenge 8: HRI for improving ergonomics in high precision tasks**

The following measures should be applied:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Detailed policy on personal data processing and protection compliant with GDPR and respective national legal framework(s),
- Health and safety policy related to experimentation within the TEF facilities,
- Ensuring compliance with/following guidance of:
  - Regulation (EU) 2024/1689 (Artificial Intelligence Act),
  - Ethics guidelines for trustworthy AI of the HLEG and ALTAI,
  - Ethics By Design and Ethics of Use Approaches for Artificial Intelligence.

4. **Please describe the possible ethical concerns that have already been addressed in the descriptions of the TEFs and their associated HRI challenges. If possible, highlight at least one strength for each of the TEFs.**

Basing on the documentation provided it is not fully clear how the ethical concerns identified in previous section of this report will actually be addressed within the project. The described use cases mention several assumptions regarding ensuring the safety, human autonomy, oversight and agency, employing human-centred approach and participatory design, however – basing on the documents provided and taking into account that the presented use-cases are exemplary and will serve only as an inspiration to the actual FSTP projects, which scopes are not known yet – it is hard to assess which of the ethical concerns will ultimately be addressed and how by the solutions proposed and experiments performed at the TEFs.

It is, however, clearly visible from the descriptions of the goals for each TEF and use- case that the ARISE consortium presents fair awareness of some of the ethics issues at hand and an evident concern towards addressing them properly.

- 5. In the ARISE project, the HRI challenges presented by the TEFs serve as inspiration for FSPT projects in the upcoming two open call programs (2025-2026 and 2026-2017). In addition to technical mentoring, the ARISE consortium will provide the FSTPs guidance on ethical considerations. Please describe the type of key ethical questions you anticipate arising during the project that are relevant to FSTP ethics mentoring.**

Considering that the main theme of the projects will be the human-robot interaction in majority employing the AI technologies, it can be expected that the main issues of concern will be related to AI trustworthiness and ethics-by-design/privacy-by-design, including principles and requirements related to:

- human agency and fundamental human rights: autonomy, dignity and freedom,
- privacy and data governance,
- fairness and non-discrimination,
- individual, social and environmental well-being, including impact on work and skills,
- reliability, transparency and explainability of technologies,
- accountability and human oversight.

Additionally, as mentioned in section 4 of this report, taking into account that the same ethics issues are of potential concern for all the TEFs and challenges, the guidance provided by the ARISE project to the FSTP projects should also cover aspects related to proper execution of the experiments:

- Recruitment and informed consent procedures as well as incidental finding policy for human participation,
- Personal data processing and protection policy,
- Health and safety policies.

**6. Your other remarks and recommendations.**

It might be advisable that, apart from the direct mentoring services, the project will offer training and/or webinars devoted to the SSH framework for human-centred and ethical HRI

developed in the project as well as the ethical dimension of the experiments performed in the TEFs.