Robotics4EU

Boosting Wider Adoption of Robotics in Europe

Deliverable 1.2

Robotics Community and Policymakers Needs Analysis

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Deliverable 1.2

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1. Executive Summary

This document presents the main findings drawn from desktop analysis, good practices analysis, interviews and online surveys conducted among robotics community members and policymakers during the first phase of the Horizon Europe funded Coordination and Support Action project Robotics4EU (2021-2023). The main objective of the mentioned activities was to gain **insight into the main issues in relation to deployment of robotics**, including the current practices, shortcomings and the needs and readiness of the stakeholders. Principles of GDPR were followed throughout the tasks completed to reach the objectives of this deliverable. The main findings will be taken into consideration in the planning of the upcoming events and activities of the Robotics4EU project.

Current issues related to deployment of robots

As a result of desktop research, the issues associated with deployment of robots are concluded into five categories: **socio-economic, ethical, data, legal and education and engagement.** The socio-economic issue analysis covers the labour force concerns stemming from the increasing robot involvement and digitalisation in the workplace, the digital divide, policy issues and environmental harm. Ethical issues study the potential consequences of digitalisation and robotics on the overall human well-being. These include, but are not limited to transparency, fair decision making, threats to traditional and cultural values, minority protection and gender equality. Data issues are concerned with digital and cybersecurity, data ownership and surveillance problems. Legal issues cover the data protection regulations, intellectual property laws and the lack of the legal framework regulating human-machine cooperation. Education and engagement issues deal with problems arising from the insufficient societal engagement in the technology-related decision making and shortage of scientists in the general public. While these issues are generally recognised as individual problems, this project aims to consolidate and explore their **comprehensive impact** on the uptake of robotics in any field.

Good practices from other projects

Good practices analysis looks over the **existing positive action applications easing the uptake of AI and robotics solutions across industries**. Good practice actions were divided into six categories, covering a range of solutions for uptake issues: Healthcare, Agri-food, Agile production, Inspection and Maintenance, Human-Robot collaboration, and Community. The latest is a category of projects that primarily deals with issues relevant to all robotics-related fields. Good practices were sorted and presented in a publication toolbox, containing all the resources published by the researched projects. Good practices publication toolbox includes digital community engagement platforms, case studies on robotics applications, and guidance tools for effective responsible innovation process implementation. RRI assessment toolbox focuses on disseminating the RRI principles and assessing whether projects are compliant with them, while the video toolbox includes the industry-specific tools for projects specialising on particular topics.

Robotics community readiness and robots' acceptability

To examine the current state of the AI readiness level among the robotics stakeholders, surveys and interviews were conducted and analysed. **The most impactful issues affecting the robotics uptake were identified, placing socio-economic, ethical, and legal issues as top concerns**. Furthermore, respondents identified specific problems

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in each of the five issue categories, identifying their most relevant concerns. The survey results show that robot acceptance is presumed to be a responsibility of developers, followed by end users and policymakers. Accordingly, the most important robot excellence criteria were reported to be functional efficiency and performance quality while user safety took the fourth place. Overall, the results indicate that there is a need for more accessible and transparent information on existing robot technologies.

When inquiring about **robots' acceptability, stakeholders tend to believe industrial robots (non-collaborative) performing specific tasks are widely accepted but robots that interact with their environments – intelligent robots – are generally not considered technologically ready for wide-spread implementation**. Many stakeholders reported never seeing an intelligent robot themselves, which shows the remote position such robots currently take up in everyday life. While a portion of stakeholders believe these robots are not yet ready for societal integration, they also believe that the adoption would occur naturally should the technology become widely available. This perception results from concerns with technological limitations rather than societal refusal. Societal refusal is often seen in the industrial side, particularly in fields where robots could perform some of previously human-led tasks. Here the emphasis of the concerns lies on employment security and individuals' rights.

Cooperation between policymakers and robotics community

As expressed by most policymakers surveyed in the project, **collaboration between the policymakers and the robotics community is limited in its productivity due to the lack of communication and technical knowledge possessed by the policymakers**. Currently there are shortcomings in providing objective information about the available robotics solutions and their capabilities. Considering this, transparent information should be available to all the stakeholders and the robotics community, and the policymakers must work together to coordinate and respond to each other's needs. Common goals of boosting widespread adoption of robotics can only be reached by building networks and sharing objective information in universal terms understandable to all robotics community members, policymakers, and the public.

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2. Introduction

The rapid advancement of technology, including robotics solutions has proven to have many advantages which contribute to people`s well-being and social cohesion in general. However, as new technologies are implemented, they bring a complex set of challenges that need to be addressed to ensure that robots are deployed in a safe and responsible manner. To achieve this, an in-depth understanding of the specific issues is needed. Furthermore, as the deployment of robots involves various stakeholders across the board, it is important to understand the challenges from the different perspectives of these stakeholders to provide effective solutions and boost the adoption of robotics.

2.1. About Robotics4EU

The Robotics4EU (2021-2023) project aims to ensure a more widespread adoption of (AI-based) robots in healthcare, inspection and maintenance of infrastructure, agri-food, and agile production. It will be reached through the implementation of the responsible robotics principles among the robotics community that results in societal acceptance of the robotics solutions in application areas. Robotics4EU will create and empower the EU-wide responsible robotics community representing robotics innovators from companies and academia in the fields of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production as well as citizens/users and policy/decision makers by rising awareness about non-technological aspects of robotics (ethics, legal, socioeconomic, data, privacy, gender) by organising community building and co-creation events bringing together robotics community and citizens, advocating for the responsible robotics among all stakeholder groups, incl. policy makers, developing a responsible robotics maturity assessment model and bringing the project results to the standardization bodies.

Robotics4EU will implement the following set of activities: 1) assessing the needs and developing a responsible robotics maturity assessment model that is a practical tool for the robotics developers and helps them to strategically plan and the uptake of the legal, societal and ethical aspects of robotics; 2) empowering the robotics community by organising capacity building events in healthcare, agri-food, agile production and infrastructure; 3) ensuring citizen acceptance of robotics (via citizen consultations) and assessing robotics ideas and applications provided by the industry with end-users (via online consultation and co-creation workshops); 4) reaching out to the policy makers by compiling a responsible robotics advocacy report, organising a high-level policy debate and transferring the results to the standardization bodies[1].

[1] Project information from CORDIS: https://cordis.europa.eu/project/id/101017283

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3. Methodology

The following activities were carried out in order to provide the current Robotics4EU project deliverable: desk research to identify the main stakeholders and issues in connection to the deployment of robotics; the collection of good practices and online surveys; and interviews in 15 countries. This section provides an overview of the methodology used within the mentioned data collection tasks. The following information is included:

- Best practices collection methodology
- Stakeholders' categorization
- The countries surveyed
- The questionnaire development
- Survey methodology
- Interview methodology

3.1. Best practices collection methodology

The aim of the good practices collection was to gather a set of actions projects perform in order to eliminate or minimize frequently occurring issues in the robotics field. A good practice is a practice that has been proven to work well and produce good results and is therefore recommended as a model. It is a successful experience, which has been tested and validated, in the broad sense, which has been repeated and deserves to be shared so that a greater number of people can adopt it.

In reaching out to project coordinators, the goal was to get access to documents and practical tools the projects used addressing issues mentioned. In selection of the projects, the following criteria were used:

- projects were currently running, or they had recently ended;
- projects had received European funding;
- projects were considered high level robotics projects that work on robotics solutions and understand the topic; and
- projects were covering one of the focus areas: agri-food, healthcare, agile production, inspection, and infrastructure, RRI, and innovation hubs.

In reaching out to projects, a 2-step approach was used. Firstly, a short survey was sent out to determine if the project qualifies according to the previously mentioned criteria (Appendix A. Short Survey Text). The short survey was sent out to the respective project coordinators, asking **whether the project has developed a practical tool for addressing issues identified** above. If the project qualified, a detailed survey was sent out (Appendix B. Detailed Survey Text). In the second round of the survey, a more detailed approach was used. Project coordinators were asked to provide more information about specific tools (Table 8. Publication toolbox, Table 9. RRI Assessment Toolbox,Table 9. RRI Assessment Toolbox)

3.2. Stakeholders

In order to facilitate the identification of stakeholders involved within both policymakers and robotics community in the surveys and interviews, these two larger groups were broken down into subgroups. The following tables introduce the subgroup categorization.

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Policymakers

Ministry	Specific ministries involved in robotics policy development
Other government body	All other government bodies involved in robotics policy development
Legal	Legal specialists or law firms that have participated in AI working groups etc
Working group/foundation	Any working groups established to enhance development in the field of robotics
Expert	Any individual experts that are relevant in the field at a policymaking level
Union/association	Unions/associations that are relevant to robotics policy development
Supervisory authority	National bodies dealing with data protection etc
Standardization	National standardization bodies or accredited certification organizations dealing with robotics, machinery

Table 1 - Robotics stakeholders: policymakers

Robotics community

Technical centre (Producers)	Organization that employs experts and provides services for robotics producers.
Public research centre (Producers)	State-owned research centre working on robotics development
University (Producers)	Universities engaged in robotics research
Training centre (Producers)	Engineering schools and higher education institutions that train their students in robotics
Private research centre (Producers)	Private-owned research centres
Robot manufacturer (Producers)	Designers and producers of robots, or even parts of robots
Industrial association (Producers)	Industry-based associations that brings together manufacturers in robotics
Employer (Consumers)	Companies that buy robots to implement them on their premises, for the needs of their occupational activities
Integrator (Consumers)	Companies with experts in robotics that help others in the installation and the setting up of the robots
Operator (Consumers)	Individuals who use robots to perform their occupational activities (co-manipulation, maintenance, etc.)
User association (Consumers)	Associations that bring together the consumers of robotics, and represent their interests
Insurance company (Consumers)	Organizations providing insurance to companies and individuals for the risks associated with the use of robotics

Table 2. Robotics stakeholders: robotics community

Specific stakeholders for each sub-group were identified in each country through desk research and their public contact information was collected. In addition, relevant contacts of the consortium partners were included. A total of 547 contacts were collected for the robotics community and 145 contacts for policymakers.

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In addition to the previously listed stakeholders within policymakers and robotics community, citizens were also included (as survey respondents) as non-expert end-users are an important target group for robot acceptability and their insights need to be taken into account when mapping the main issues.

3.3. Target countries

The countries were selected to include a range of geographic locations with different levels of robotics' development across the EU, as well as being countries where consortium members worked in. The following countries were included:

- Belgium
- Denmark
- Estonia
- France
- Germany
- Italy
- Latvia
- Lithuania
- Netherlands
- Norway
- Poland
- Portugal
- Spain
- Sweden
- Switzerland

3.4. Survey methodology

Survey questionnaires

Two different survey questionnaires were used – one **targeted specifically to policymakers** and the other to **the robotics community**. Both questionnaires were in English. The questionnaire development was a process done in collaboration between consortium partners. The specific wording and content of the questionnaire was tested among individuals who were not involved in the project. The questionnaires of both surveys are presented in Appendix D.

The survey questionnaire targeted toward robotics community members consisted of 19 and the questionnaire targeted toward policymakers of 18 questions. The first set of questions in the robotics community survey were aimed to provide understanding regarding the **level of familiarity and involvement of the respondents** in relation to robotics. The second set of questions was aimed to **identify the issues that are seen most impactful** by the respondents. Finally, the third section dealt with the topics of robots' acceptability. As for the survey questionnaire targeted toward policymakers, the first set of questions again aimed to identify the level of involvement in relation to robotics, the second set of questions was aimed to identify the issues that are seen most impactful, and the third set of questions was aimed to provide insight into the **shortcomings of cooperation between robotics community and policymakers**.

The survey instrument consisted of closed-ended questions, which also allowed respondents the opportunity to provide further detail if the 'other' option was selected from the multiple choices. The closed-ended questions were multiple choice, checkboxes, and matrix/rating scale questions. No identifying data were collected but respondents were provided with the opportunity to leave their contact e-mail in case they wished to be contacted regarding further activities of the Robotics4EU project.

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Survey implementation

The surveys were conducted using an **anonymous electronic survey** distributed through the web-based application SurveyMonkey to all the stakeholders who were previously identified. Surveys were sent out to the contacts during the period of March 8th – March 12th, 2021. A reminder invitation was sent out two weeks after the initial e-mail to contacts who had not responded.

Furthermore, the survey links were also widely distributed through the consortium partners' professional networks, in various robotics and technology related networks, social media and through press releases during the period of March 8th – April 9th, 2021.

In addition to the previously mentioned efforts, responses were collected through purchasing targeted contacts to ensure enough responses as efforts to share the surveys through direct contacts of stakeholders and public dissemination did not deliver a sufficient number of responses. To ensure that the survey reaches individuals from the robotics community, several criteria for industry sector and field of expertise were used.

A total of **1232 responses** were gathered through the two surveys. Out of these 231 were obtained through robotics community, 54 from direct contacts of policymakers; and 947 responses as purchased targeted responses. The responses were exported into a data analysis tool, after which it was checked and cleaned for analysis purposes.

Survey results analysis

The following steps have been conducted to ensure proper analysis of the survey results:

1. Export from SurveyMonkey to Excel
2. Prepare dataset format to be manageable with excel
3. Clean dataset by removing double entries, fix structural errors, handle missing data
4. Perform excel analysis

3.5. Interview methodology

The interviews were conducted as **semi-structured interviews** by the consortium partners via phone or a web conferencing platform in the respective languages of the stakeholders. All the interviews were conducted in compliance with GDPR regulations. No personal data was collected; however, the respondents were given the opportunity to opt in for further communication regarding upcoming activities and events of the Robotics4EU project. The collected data is stored in accordance with the project's privacy principles and data protection requirements.

The interview guide development was a process done in collaboration between consortium partners. The specific wording and content of the questionnaire was tested among individuals who were not involved in the project. The interview guide consisted of two questions to identify the interviewee's relation to robotics, followed by four discussion questions. The interview guide can be found in Appendix E. Interview guide

The interviewees were selected from the stakeholders who were identified as previously described. A total of **60 persons were interviewed**, **with 4 persons interviewed per target country**. The specific approach regarding the distribution of the interviewees is described in the following section.

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Distribution of interviewees

Since Robotics4EU focuses its research on **the four industrial priority areas** (agri-food, healthcare, inspection & maintenance of infrastructure, agile production), the industrial domain(s) of the interviewees' activities related to robotics were identified. 31% of the interviewees stated their connection with the health sector, 18% with agri-food, 16% with agile production, 15% with infrastructure and 22% with other domains. Among the "other" domains, we noted stakeholders from service robotics, aerospace, logistics, autonomous mobility, or education.

In addition, the people interviewed were identified either as **producers** (70% of the interviewees) or as **consumers** (30% of the interviewees). In the context of Robotics4EU objectives, there might be discrepancies between the expectation from the robotics community, depending on whether they are on the "demand" side of robotics (consumers - end users, buyers, etc.) or on the "supply" side (producers - research centres, manufacturers, etc.). In both cases, the hindrances for adoption may rely on the same issues, but stated differently: for example, if "safety" is considered an issue for acceptance of robotics, users would express that "*I do not want to acquire a robot because I don't know whether it's safe enough yet*", and on the producers' side it would be "*I cannot sell my robot because I don't know how to prove it's safe enough*".

While no other personal data was collected, the gender of the respondents was noted as Robotics4EU aims to achieve a gender balance throughout the activities to align with the pillars of responsible research and innovation. 37% of the interviewees were female while 63% were men and this will be elaborated more in the section Gender Equality.

3.6. Considerations regarding the methodology

Engagement of stakeholders

The surveys were designed to deliver information in relation to AI and robotics from the robotics community and policymakers. While responses were successfully obtained from 1232 individuals through different measures, there were some initial difficulties in reaching the members of the robotics community and policymakers.

To ensure the necessary number of responses was gathered, targeted survey responses were purchased. Despite using controls to reach individuals within the robotics community, it was impossible to fully control the survey reaching only these stakeholders. Due to this, some of the survey respondents were identified as "regular citizens" with no relation to robotics. This, however, is not seen as problematic as it is important to involve public in the discussion. Nevertheless, to provide clarity and ensure that the analysis covers the opinions of the relevant stakeholders, the analysis in this report focuses on the robotics community and policymakers view and is supplemented with the citizen view.

As it proved to be especially difficult to reach the initial objective of 100 policymakers and it was not possible to control for specific characteristics to reach these stakeholders through targeted responses, the partners opted to collect additional responses from robotics community members to exceed the initial target of 1000 respondents. Furthermore, it became clear during the survey implementation process that these lines between the different stakeholders can be quite blurred as some respondents could be identified as both policymakers or robotics community members. Additionally, the partners have confidence that the survey responses are sufficient to make conclusions

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as the main goal of the inquiries was to provide insight into the main issues in relation to deployment of robotics from the policymakers' view and not to gain representative statistical data. Nevertheless, the involvement of policymakers will be kept as a priority throughout the upcoming activities of the project as the challenge to gather responses from this specific group might also signal the lack of cooperation which was identified as one of the challenges in the analysis of this report.

To conclude, the objectives of the research have in no way been compromised and have been fully reached despite the previously mentioned challenges.

Gender equality

Gender equality and fair distribution is one of the pillars of responsible research and innovation. In this regard, Robotics4EU deliverable D1.1 Societal Readiness Plan rightfully reminds of the six European Commission responsible research and innovation (RRI) policy keys, which highlight that the gender dimension must be properly considered in RRI. However, despite the efforts made, complete gender equality could not be reached in the panel of interviewees as women constituted 37% of the respondents. The consortium decided that fair gender distribution was the strictest constraint imposed when constituting the panel – in particular, the goal was to address women first, because it was expected they would be scarcer in robotics domains. The main reason may simply rely on the under-representation of women in technological areas, as illustrated by the numerous initiatives for the promotion of women in sciences (ICT, AI, robotics, etc.) and as indicated by the 2017 UNESCO report on the disparities of gender in research or confirmed by the 2018 Eurostat overview about "Women in Science and Technology". The distribution of the panel is in this regard quite coherent with the real overall distribution of genders: Eurostat noted 59% of men and 41% of women (domain-independent), with 79% of men when one considers specifically manufacturing domains.

Consumers vs users balance

It was noted in the definition of the panel that final consumers may be harder to identify and reach for consultation. Indeed, the "offer" side is naturally more visible since the stakeholders promote their products or research, then the entities are easier to identify for contact. Approaching end users is in comparison a harder task, since it may rely on identifying end users at home or at work, who may not be the principal targets of the usual distribution channels of the robotics community. The strategy mainly consisted in consulting user associations and identifying companies where we hinted robots might be used (such as manufactories).

Good practices

The insights collected during the good practice analysis should be used with care due to the rapid speed of new technology development. New good practices may arise in near future while other are likely to become obsolete. Therefore, it is advised that project managers, researchers, developers, and other interested parties to perform continuous research in the field and be open to potential expansions in the good practice definitions, toolsets and methods.

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4. Current issues and good practices

This task presents results of the desktop analysis of the current socio-economic, ethical, legal, educational, data- and engagement- related issues in the European robotics community. The leaders of past and ongoing projects were contacted to identify key findings and good practices to further disseminate the results and good practices of already funded projects.

4.1 Current issues

Digitalisation is transforming innovation processes, lowering production costs, promoting collaborative and open innovation, blurring the boundaries between manufacturing and service innovation, and generally speeding up innovation cycles. However, next to the benefits, emerging technologies carry several risks and uncertainties[2], and raise important **ethical, legal, privacy and cybersecurity as well as socio-economic issues** that will impact the growth of robotics in Europe.

// Current Issues

Socio-Economic Analysis	Ethics	Data
• Fear of tech unemployment • Loss of worker autonomy • Rising inequality in earnings • Rising skill gaps and skill depreciation • Uneven distribution of wealth • Insufficient protection of worker rights (gig-economy) • Policy issues • Geographical disparity • Digital divide • Environmental problems	• Safety and security at the workplace • Lack of responsibility and accountability • Lack of transparency & liability • Infringements of traditional and cultural norms and values • Gender inequality • Insufficient protection of the minority groups • Human rights abuse • Negative impact on peace	• Surveillance issue • Lack of informed consent • Lack of data control and • Lack of contestability • Vulnerability of cyber physical systems • Cyberwarfare (social & political manipulation) • Data theft (network security) • Unbalanced power in data ownership

Legal	Education and Management
• Intellectual property infringement • Lack of global governance • Lack of and lag in regulatory development • Lack of GDPR compliance • Unclear and unharmonized regulations (inconsistent set of rules for human-machine cooperation) • Lack of legal rights awareness related to data and technology	• Insufficient public engagement • Lack of methods and empowerment • Education issues (lack of resources, knowledge availability and informal science education) • Inequality in development (education sector not following trends fast enough) • Lack of trust in science • Insufficient empowerment of the general public

Figure 1. Current issues

While identifying and categorising these issues, scientific publications, good practice tools and the 6 Responsible Research and Innovation (RRI) framework dimensions were

[2] From OECD Science, Technology and Innovation Outlook 2016 https://read.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016_sti_in_outlook-2016-en#page20

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used. Aiming to stay open to new categories, an open research approach was taken to map out and categorise other sub-issues that might not have been identified otherwise.

4.1.1. Socio-economic issues

Socio-economic issues come down to a concern that robots are increasingly competing for jobs against humans, increasing skill, wealth and earnings gap and causing numerous policy-, worker rights and environmental issues in the socio-economic context.

A common concern for the future of work is that jobs are being eliminated and we are heading for a future of **mass technological unemployment.** While such fears are not new, there is no empirical support on the claims despite widespread workplace automation.[3] Nonetheless, robot applications do impact the job market, causing changes in the labour and wealth distribution and regional and geographical disparity. **Job polarisation** arises because many of the tasks performed by medium-skilled workers can be automated using digital technologies.[4] The trend of job polarization, as well as the emergence of new wealth and last-mile work, shows that there is likely to be a fraction of jobs with relatively low human skill requirements which cannot be automated. Safeguarding the quality of these jobs in terms of **wages and non-wage characteristics such as autonomy** can become a key challenge in societies.

This is even more important given how the trend of urbanisation has impacted workers of different skill types, as urban areas have become more abundant in high-skilled jobs, while the availability of middle-skill work has declined.[5]

Digitalization causes shifts in production, leading to a **reallocation of work across borders**, becoming an important force shaping the future of labour markets.[6] Apart from international impact in the allocation of work and workers**, the regional distribution** and the nature of those jobs has **also shifted within countries' borders**. A large body of research documents shows that high-skilled workers have increasingly moved to more densely populated (i.e., urban) areas over the last 35 years. This can lead to a digital divide on local, regional, and even international levels.

Increasing emphasis on automation and the role that interactive robots will play in the long-term economic prospects of the EU are the driving forces for new work forms and emerging market systems, calling for revised legislation. The need for robotics and labour market regulations becomes increasingly prevalent as 'new work forms' such as the 'gig economy' emerge. Workforce automation means that less on-site employees will be needed on a consistent basis, forming a hybrid workforce consisting of both robots and humans. Since robots can perform large volumes of manual and analytical work, constant human involvement is less needed. As automation becomes more sophisticated, human involvement will consist of tasks rather than jobs. Contractors will come and go according to organisational needs while robots increasingly make more and more decisions.

[3] Mokyr, J. et al., "The History of Technological Anxiety and the Future of Economic Growth: Is This Time Different?" Journal of Economic Perspectives, 29 (2015): 31
[4] VoxEU, Sense and nonsense in the public discussion of the future of work. https://voxeu.org/content/sense-and-nonsense-public-discussion-future-work
[5] Autor, D.H., and Salomons, A. "New Frontiers: The Evolving Content and Geography of New Work in the 20th Century." (2019), Working Paper
[6] From INBOTS White Paper on Interactive Robots: http://inbots.eu/wp-content/uploads/2019/07/Attachment_0-1.pdf

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Evidence indicates that there is an increase in **new forms of work** that differ from the traditionally large groups of full-time workers with permanent contracts. The extent of worker protection rights in the gig-economy is an important issue to address. Temporary workers often must be registered as self-employed and cannot enjoy the same institutional and social protections, provided through full-time employment contracts, including but not limited to minimum hourly wage, paid holiday leave, parental leave, paid sick days and more. This type of work is also more on the rise amongst women and minorities.[7] Even though these issues may also appear in the ethical issues category, we address them here on a global, socio-economic level because they raise questions on **policy and legal regulations**. Changes in technology are usually followed by changes in policy. While this issue is frequently discussed in the circles of policymakers, it is **difficult to plan and enforce technology-related regulations and laws**, especially on an international level. Most of the developed policy is related to AI funding and AI policy emphasising requirements that new technological development has to satisfy.[8] Public authorities can also support ethical technological developments by considering the overall societal impact of those technologies. Through a combination of voluntary policy measures and complementary regulation, more businesses will be obliged to integrate Sustainable Development Goals in their business models. This is how maximum societal value creation could be secured not only for shareholders and stakeholders but also for the society at large, accounting for the **social, environmental, ethical, consumer concerns and human rights**.[9]

Fear of technological unemployment
Loss of worker autonomy
Rising inequality in earnings
Rising skill gaps and skill depreciation
Uneven distribution of wealth
Insufficient protection of worker rights (gig-economy, platform economy)
Policy issues (subsidies, institutions, political agenda, digitalisation strategy)
Development of policy issue
Agents involved
Regional and geographical disparity
Digital divide
Environmental harm (harmful materials, greater energy consumption, harm to animals)

Table 3. Socio-economic Issues

4.1.2. Ethical Issues

Ethical issues encompass the possible negative consequences of robotics on the human well-being. Ethical issues include **safety and** cyber**security at the workplace**, **responsibility**, **quality of life** and **peace** concerns. Robots may affect our autonomy, our sociability, and our sense of self. Furthermore, questions related to **responsibility and accountability** can arise: who is responsible when an intelligent robot causes an accident? In robot care and robot-assisted care, the use of robots may lead to **reduced human contact, privacy, and personal liberty. Risk management and safety**

[7] Katz, L.F., and Krueger, A.B. "The Rise and Nature of Alternative Work Arrangements in the United States, 1995–2015." Industrial & labour Relations Review 72 (2019): 382–416
[8] AI HLEG, 2019, "High-Level Expert Group on Artificial Intelligence: Ethics Guidelines for Trustworthy AI". European Commission, 09.04.2019. https://ec.europa.eu/digitalsingle-market/en/news/ethics-guidelines-trustworthy-ai
[9] From INBOTS White Paper on Interactive Robots: http://inbots.eu/wp-content/uploads/2019/07/Attachment_0-1.pdf

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assurance are commonly referenced goals in robotics. How this is achieved, precisely, seems to vary widely between robotics fields. For example, risk management for healthcare robotics may revolve more tightly around security, accuracy, privacy, and patient outcomes; risk management in manufacturing might encompass values such as precision, speed, situational awareness, communication, collision avoidance, and failsafe mechanisms. Values the field prizes as goals highly depend on the previously presumed "risks" in that field, automation design and robot task and aim programming. While approaches in addressing risk management and safety assurance are different, the challenge exists across all fields.

The defined ethical questions and issues also include gender imbalances, particularly in decision making roles, robotics research and the integration of gender dimension in the research and innovation content. Although **gender gaps** in the research funding success rates is decreasing at EU level, men still have a higher success rate than women. 57% of tertiary graduates in the EU are women, but only 24.9% of them graduate in ICT-related fields, and very few enter the sector. In 2018, women made up 13% of the graduates in ICT-related fields working in digital jobs compared to 15% in 2011. While numbers of women in science and engineering jobs are overall increasing throughout years, females remain a minority share in such occupations[10]. Globally, figures indicate that women's participation in the ICT and digital sector are not improving significantly.[11] The lack of women's involvement in the robotics field may result in gender-bias AI system training, stemming from the lack of female perspective in data, research content, decision making as well as design and interface questions. Male-dominated workforce in robotics is more likely to disregard female perspectives and concerns, resulting in unintentionally excluding product users from engaging with the digital environment. AI systems therefore should be designed based on perspectives, needs, expectations and contexts of all potential and current users[12].

Lack of responsibility and accountability
Lack of liability (identification)
Lack of transparency
Infringements of traditional and cultural norms and values
Gender inequality
Removing barriers to recruitment, retention and career progression of women researchers
Gender imbalances in decision making
Integrating gender dimension in research and innovation content
Insufficient protection of the minority groups
Human rights abuse
Lack of integrity in the research itself
Negative impact on peace

Table 4 - Ethical Issues

[10] From She Figures 2018: https://ec.europa.eu/info/publications/she-figures-2018_en
[11] From Women in the digital age: https://op.europa.eu/en/publication-detail/-/publication/84bd6dea-2351-11e8-ac73-01aa75ed71a1#document-info
[12] From Artificial Intelligence and Gender Equality and Gender Equality: https://en.unesco.org/system/files/artificial_intelligence_and_gender_equality.pdf

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Technology and the use of AI systems can further result in prejudice or unfair treatments, because of data bias, algorithm bias and/or outcome bias. Some systems with high utility might not be available to everyone outside that area of implementation and can result in unfair advantages for one group when compared to another. The systems developed might be using a software that has implications regarding user characteristics, thereby rendering them less useful and applicable on an individual basis outside that societal group on which these implied characteristics were made. For example, certain cultural group needs could be potentially neglected in the development processes, forcing those groups to act outside their cultural or religious norms to obtain the digital service. Another potential problem area is the predetermination of individuals' activities or rights to services when the automated decision is based on societal or legal characteristics, such as t individual's criminal records. Activity forecasting based on past data can result in unfair discrimination and targeting of minorities and historically racially profiled groups in society, exacerbating the issue further.

4.1.3. Data Issues

Privacy and security. Smart devices and IoT-based systems are a potential threat to privacy and data protection due to the mass collection of data and can enable forms of social control and political manipulation. Intelligent software agents may raise concerns in relation to privacy and **data protection, responsibility, and accountability**. Here dangers of **data mining involving sensitive information** and the **misuse of online insights** (navigation, communication, location, purchase behaviour, consumption) were identified. These issues endanger the core values of privacy protection broadly impacting the society.

Digital security is the economic and social facet of **cybersecurity,** concerning all stakeholders: businesses, public administrations, other organisations, and individuals. It has an impact on assets, safety, reputation, opportunities, and economic and social activity continuity. As a result, challenges regarding **disrupting availability**, **integrity** and **confidentiality** of hardware, software, networks, and data arise. Big data creates issues such as **data driven discrimination** due to **automated decision making**. In this context, big data can cause a shift in power due to the new **data divide**, based on who owns, collects, and analyses the data.

Digital technology enables a new paradigm of **open science**, which has three main pillars: open access to scientific publications and information; enhanced access to research data; and broader engagement with stakeholders. Digital technology is also enlarging the process of discovery. Open science could make science more efficient and effective and streamline the translation of research findings into innovation and socio-economic benefits. However, this shift also requires **policy adjustments**.

Surveillance issue (authorization, transparency, legal mandate, online/offline activity monitoring)
Lack of informed consent
Lack of control and empowerment about access to data (including personal data)
Lack of contestability (lack of options, ability to choose to share your data)
Vulnerability of cyber physical systems
Cyberwarfare (social control and political manipulation)
Data theft (issue of network security)
Unbalanced power in data ownership

Table 5. Data Issues

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3.1.4 Legal Issues

Legal issues include having clear definitions, ensuring liability in terms of civil law rules on robotics, testing, and privacy regulations. The rise of interactive robotics brings a considerable challenge for the law: how should the law deal with robot-assisted inventions and human-robot co-creation? Indeed, the probabilistic nature of AI-driven software and the complexity of rule-based algorithms, could theoretically lead the robots to learn how to produce new works and inventions. In this context, a debate of such ownership arises; if robots or AI applications become capable of inventing original products and ideas (potentially subject to protection by copyright, patents, designs and trade secrets) who should own them? [13] If the worker trains the robot to perform a certain action, or in some form enhances the productivity of the robot by improving on existing capacities, should the worker also be entitled to **IP rights/patent rights, or do the rights belong to the robot's manufacturer**? Newest advances in robotics expose the potential for independent robot creativity in the future through evolutionary or genetic algorithms allowing machines to devise new, un-bias data sets[14]. Rapid machine learning and genetic algorithms are already being used in search of clean energy materials. If initiatives as such prove to be successful, the theoretical debate on legal robot creation and discovery protection might have to turn to practical implementation.

Arising legal issues include the **lack of global governance** (not having a unitary body of rules for all kinds of robotic applications), **absence of legal framework** for testing, **intellectual property infringement,** lack and lag in regulatory development due to the fast pace of technological development and its adoption in the modern workplace (including the lack of clear regulations for free flow of data). The current legal framework covers machinery and intellectual property rights, but the advent of autonomous and semi-autonomous systems enabled by AI, require further regulatory development.

To continue technological development without restraint, the legal employment framework should address a "safety net" concept as a transition period. Vulnerability of certain groups (based on age, gender, ability etc.) must be considered while the existing workforce adjusts to the new technological developments and applications. Another potential solution could be positive discrimination measures, or affirmative action in favour of human workers. Companies would be encouraged to satisfy quotas of human workers, while implementing training programmes to facilitate employee transition into a more technologically advanced working environment.

Lack of awareness and legal frameworks in human enhancement technologies is an extensive legal issue, affecting the perception of human rights. Human enhancement technologies allow humans to perform beyond their natural biological capacities with the help of technology [15]. While various enhancement devices such as neurostimulators, pacemakers or activity trackers (e.g., smart accessories) are widely used in medical settings, their regulation beyond healthcare is practically inexistent. Firstly, it causes legal questions and concerns for human dignity as some people might feel pressured to use enhancement devices to keep up with the increasing standards at work. Secondly,

[13] From INBOTS White Paper on Interactive Robots: http://inbots.eu/wp-content/uploads/2019/07/Attachment_0-1.pdf pp 22-25

[14] Jennings, P.C., Lysgaard, S., Hummelshøj, J.S. et al. Genetic algorithms for computational materials discovery accelerated by machine learning. npj Comput Mater 5, 46 (2019). https://doi.org/10.1038/s41524-019-0181-4

[15] Konrad Siemaszko, Rowena Rodrigues, & Santa Slokenberga. 2020. SIENNA D5.6: Recommendations for the enhancement of the existing legal frameworks for genomics, human enhancement, and AI and robotics. Zenodo. http://doi.org/10.5281/zenodo.4121082.

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since the technology is novel and potentially vulnerable to hacking, data breaches are likely to occur alongside malicious manipulation of device purpose. Since smart devices collect and store large amounts of personal information, the potential to cause harm is high and the legal framework must consider security implications and criminal liability for such data breaches. Meanwhile, free data flow and collection is essential to the device's main function and purpose. Now, there is no specific regulatory system governing human enhancement devices beyond the scope of product safety requirements.[16]

Other policy issues responding to robotic automation and its **taxation regulation** may arise as well. A tax on robots would be particularly difficult to design and implement because estimating the extent of robotic involvement in profit generation is nearly impossible. Additionally, a tax on robots raises questions about the intention of such measure. It can be designed as a fiscal measure to compensate for the decrease in tax coming from employed human labour, however this approach would be difficult to justify given that in Germany and Japan, with relatively high robot density, unemployment is much lower. [17]

Intellectual property infringement
Lack of global governance
Not having a unitary body of rules for all kinds of robotic applications
Absence of legal framework for testing
Other policy issues
Lack of and lag in regulatory development
Lack of compliance to GDPR
GDPR seen as not sufficient
Unclear and unharmonized regulations (inconsistent sets of rules for human-machine cooperation)
Lack of awareness of the legal rights related to data and technology
Absence of legal standards to ensure privacy and free flow of data
3D printing, privacy and intellectual property

Table 6. Legal Issues

4.1.4. Education and engagement issues

Digital technology is providing new tools that are revolutionising institutional relationships and the way society operates, empowering individuals, and their ability to actively participate in societal processes, contribute to decision-making and production. Effective interaction between public administrations, citizens and businesses is essential to build the digital society. However, the information and resources on technology integration that governments and public administrations provide for citizens can be **difficult to understand**. This leads to a **sense of detachment between the public bodies** and the democratic process itself. [18]

Education systems are critically important for innovation through the development of skills and networks that nurture new ideas and technologies. However, whereas digital technologies are profoundly changing the way we work, communicate, and enjoy

[16] Konrad Siemaszko, Rowena Rodrigues, & Santa Slokenberga. 2020. SIENNA D5.6: Recommendations for the enhancement of the existing legal frameworks for genomics, human enhancement, and AI and robotics. Zenodo. http://doi.org/10.5281/zenodo.4121082.
[17] From INBOTS White Paper on Interactive Robots: http://inbots.eu/wp-content/uploads/2019/07/Attachment_0-1.pdf , pp 106-107
[18] From HubIT: https://www.hubit-project.eu/key-challenges

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ourselves, the world of education and learning is **not yet experiencing the same technology-driven innovation process** as other sectors. The is a general lack of research concerning the issues in education, shortfall in scientists at all levels of society as well as science education outside the classroom (informal science education) and its effects of non-educational activities. When the public education system is not following the change imposed by technological development, the inequality gap widens between those who have access to modern technologies and those who are constrained by their environment and social status. This **creates unfair advantage to privileged groups giving them exclusive access to opportunities that should otherwise be widely accessible**.

On the other hand, rapid diffusion of open access publications and science-related news online increase opportunities for all citizens to access and generate science-related content. However, the **lack of editorial oversight and fact-checking** established in the traditional media increases the likelihood of such information being misleading or incorrect. Spontaneous news on social media cause a rapid spread of misinformation and thus further widen the separation between science and the general public.

Insufficient public engagement
Lack of empowerment
Lack of methods for engagement and empowerment
Education issues (lack of education resources, shortfall in science knowledgeable people, shortfall of informal science education)
Equality
Inequality in development (education sector not following trends fast enough)
Lack of credibility and authority given by general public to science (diminishing trust)
Lack of empowerment of general public

Table 7. Education and Engagement Issues

The work of identification and classification overlooks a wide and extensive range of issues associated with digitalisation and open innovation from both general and industry-specific perspectives. Desk research shows that the investigation into **ethical, legal, privacy and cybersecurity and socio-economic issues** tends to focus on specific problems rather than explore the comprehensive impact of those problems on the European robotics growth. For this reason, the current deliverable aims to analyse and connect those concerns under an all-inclusive system, providing a consolidated issue analysis.

4.2 Good practices

To collect a **database of existing good practices**, this project reached out to leaders of past and ongoing projects to identify key findings and good practices, and further expanded results with desktop research. Furthermore, the issues defined were matched with good practices and conclusions and insights were drawn.

4.2.1. List of projects

Our initial list had about 60 projects, 30 out of which self-qualified. Detailed feedback was received from 10 projects, mainly sharing publicly available links and additional information based on internal discussions. The consortium network was utilised to gather

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as many responses as possible and desktop research followed. Final pool of projects analysed reached approximately 50 projects.

Projects were categorised according to their main focus area (**health, agri-food, agile production, inspection and maintenance of infrastructure**). Since some projects cover one or more aspects of RRI, they were grouped into a community category. Additionally, several projects that focus on human-robot collaboration were identified, these were categorised as a separate group.

Figure 2. Projects analysed for collection of good practices

Several projects in the beginning stages without any materials available were identified. These projects already consider some important factors of good practices, such as **replicability, transferability, and internal communication** to reach the common goal of addressing a certain issue. However, in this report the focus is on addressing and **analysing existing tools**, and later **disseminating those tools** to the projects that haven't developed them yet.

4.2.3. Toolbox of good practices

Various publications (research papers and published good practices addressing a specific topic), videos, infographics and pictures were identified as relevant materials that can be further disseminated and promoted to help new projects that wish to develop their own good practices toolboxes.

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Publication Toolbox shows to be the most valuable tool yet, as it touches on various topics, challenges and discussions.

PUBLICATIONS TOOLBOX			
ISSUE	*LINK*	*FOCUS*	*PROJECT*
LEGAL, SOCIO-ECONOMIC	Artificial Intelligence and civil law: liability rules for drones	COMMUNITY	INBOTS
RRI	Responsible Research and Innovation in Robotics. Book of abstracts and presentations		
RRI	Self-coaching tools for conducting responsible research and innovation (RRI) with social robots		
DATA	Artificial Intelligence as Producer and Consumer of Copyright Works: Evaluating the Consequences of Algorithmic Creativity		
ETHICS	Ethical Analysis of AI and Robotics Technologies		SIENNA
ETHICS	Exoskeletons for all: The interplay between exoskeletons, inclusion, gender, and intersectionality		LIFEBOTS
ETHICS	Children's perceptions of social robots: a study of the robots Pepper, AV1 and Tessa at Norwegian research fairs		
ETHICS	Queering machines		
ETHICS	Human-robot care relations: A reflection on the movie 'Robot and Frank'		
ETHICS	Talking over the robot A field study of strained collaboration in a dementia-prevention robot class		
SIX RRI DIMENSIONS	Insights & Achievements		HubIT
GOOD PRACTICES DEPOSITORY	Tried-and-tested Practices		
ETHICS	Cactus-inspired design principles for soft robotics based on 3D printed hydrogel-elastomer systems	AGILE PRODUCTION	GROWBOT
ETHICS	The Bio-Engineering Approach for Plant Investigations and Growing Robots. A Mini-Review		
SOCIO-ECONOMIC	The economic impact of robotics and artificial intelligence	HUMAN-ROBOT COLLABORATION	REELER
ETHICS	Towards responsible robotics through cultural change and lived ethics		
ETHICS, SOCIO-ECONOMIS	The Impact of Automation on Employment: Just the Usual Structural Change?		
LEGAL, ETHICS, SOCIO-ECONOMIC	The Use of Ethnography to Identify and Address Ethical, Legal, and Societal (ELS) Issues		
SOCIO-ECONOMIC	Environment: Primordial Condition for a Sustainable Future	AGILE MANUFACTURING	ACROBA
EDUCATION & ENGAGEMENT, SOCIO-ECONOMIC	Disruptive Innovation Technology for Inclusive Education	HUMAN-ROBOT COLLABORATION	cybSPEED

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EDUCATION & ENGAGEMENT, SOCIO-ECONOMIC, ETHICS	CYBER-PHYSICAL SYSTEMS FOR SOCIAL APPLICATIONS		
ETHICS	Human Multi-Robot Safe Interaction: A Trajectory Scaling Approach Based on Safety Assessment	AGRI-FOOD	CANOPIES
ETHICS	Safety in human-multi robot collaborative scenarios: a trajectory scaling approach		
SOCIO-ECONOMIC, ETHICS, LEGAL	Impact assessment report	INSPECTION & MAINTENANCE	PILOTING
SOCIO-ECONOMIC, ETHICS, LEGAL	Principles for impact assessment of PILOTING against SoEL requirements		

Table 8. Publication toolbox

Various Responsible Research and Innovation tools can be a useful resource for accessing whether the project takes RRI principles into account and to which extent.

Table 9. RRI Assessment Toolbox

RRI ASSESSMENT TOOLS			
		FOCUS	*PROJECT*
RRI	RRI tools	COMMUNITY	RRI COMMUNITY
RRI	Responsible innovation self-check tool		INNOVATION COMPASS
RRI	The PRISMA Responsible R&I Toolkit		PRISMA
RRI	Responsibility Navigator		RESPONSIBILITY NAVIGATOR
RRI	Societal Readiness Thinking Tool		NEW HORIZON
RRI	Hub IT assessment toolbox		HUB IT

Video Toolbox can be of help to the projects that focus on a specific topic.

VIDEO TOOLBOX			
		FOCUS	*PROJECT*
ETHICS	SIENNA Technology, ethics, and human rights	COMMUNITY	SIENNA
SOCIO ECONOMIC	BSR Bioinspired Soft Robotics lab	AGRI-FOOD	GROWBOT
SOCIO ECONOMIC	Networking European farms to enhance innovation through demonstration	AGRI-FOOD	NEFERTITI
SOCIO ECONOMIC	EURAKNOS Project	AGRI-FOOD	EURAKNOS
SOCIO ECONOMIC	SHERLOCK - Seamless and safe human – centred robotic applications for novel collaborative workplace	INSPECTION & MAINTENANCE	SHERLOCK H2020 PROJECT

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ETHICS	Responsible Ethical Learning with Robotics	TOPICAL	REELER

Table 10. Video toolbox

It was found through surveys that several projects started in January 2021, three months prior to the preparation of this deliverable. For example, the survey covered projects by DrapeBot – human-robot collaboration draping, CURSOR – search and rescue operation technology project, ReconCycleS3 and High Tech Farming Partnership. These projects actively work on developing good practices depositories that were collected, systematised, and listed in the toolboxes above.

Therefore, this group of projects was not yet in the development stage or not ready to create these tools. However, they have indicated multiple categories of issues that their projects are focused on and expressed interest to receive previously developed good practices. From this feedback, the database of tools is useful to the project and will be implemented the dissemination process.

4.3. Insights and analysis

From our research and analysis of available good practices and further comparison with the gathered issues, main takeaways are:

- Each category of projects focuses on a topic related to their area of work;
- Out of the list of identified issues many concerns are not actively addressed (no tools developed);
- Community projects map out most of the issues and they have the biggest database of publications that can be further disseminated.

HEALTHCARE
ETHICS
Safety and security at workplace
Integrity of research itself
EDUCATION AND ENGAGEMENT
Public engagement
Empowerement of general public

AGRI-FOOD
SOCIO-ECONOMIC
Environmental harm
Harm to animals
Greater energy consumption
ETHICS
Safety and security at workplace
EDUCATION AND ENGAGEMENT
Education issues, resources

AGILE PRODUCTION
ETHICS
Safety and security at workplace
Responsibility and accountability

INSPECTION AND MAINTENANCE
ETHICS
Safety and security at workplace
Responsibility and accountability

HUMAN-ROBOT COLLABORATION
ETHICS
Transparency
Gender inequality
Protection of minority groups

COMMUNITY
SOCIO-ECONOMIC
Addressing most of the issues
ETHICS
Addressing most of the issues
DATA
Addressing most of the issues
LEGAL
Addressing most of the issues
EDUCATION AND ENGAGEMENT
Addressing most of the issues

Table 11. Overview of good practices and issues covered

In general, healthcare projects tend to focus on **ethics, safety, and security** at the workplace, but are also mentioning integrity of the research itself. These projects extend their focus into **public engagement, educating about the solutions and empowering the public** to learn more about the possibilities and positive impact of robotics in healthcare. Agri-food projects tend to focus on **socio-economic issues** that are closer to **environmental impact**. Solutions are created to prevent harm to animals, the environment and improve energy savings. They also address safety and security at the

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workplace and employee education on safety when using robotics solutions. Agile production and inspection and maintenance groups primarily address **safety and security at the workplace** as well as **responsibility and accountability issues**. Human-robot collaboration projects focus on ethics, while addressing education and engagement in this context. Finally, the community group of projects is successful at identifying all the issues mentioned.

There is room for improvement in the good practices area. To make an impact in addressing concerns in robotics projects, it may be necessary to centralise the list of issues and their sub-categories. With the right structure, the consideration of the RRI dimensions could be enforced from the legal perspective, by the international governing body or at the funders level. Projects should be encouraged to understand and address the issues that are closely related to their fields with a concrete purpose in mind, rather than simply aim to “check the boxes”. There should be the minimum requirement of issues addressed and agreement on how these issues can be proactively addressed.

Based on the analysis of good practices, the main conclusions are:

- The scope of the good practices analysed by the various projects is relatively small. The short issue lists imply that the analysed projects tend to only address the issues that are directly related to their specific fields of expertise. Universal concerns (such as cybersecurity or data protection) are likely to be neglected. Addressing the general matters concerning the entire robotics and technology field can be critical, therefore, the projects should take in consideration all categories of concern prior to developing their solutions;
- Data issues are not proactively addressed (no tools developed), which can be a cause for concern, especially in the group of inspection and maintenance projects, who develop drone-related robotics solutions;
- Legal issues are not in the focus in most of these projects (no tools developed);
- The list of issues provided is not centralised and enforced. RRI principles list could be further developed and extended to cover more topics, (issue table is provided in Current issues and good practices analysis.

A good practice template was created and will be utilised for the duration of the project. This template has a rating system to evaluate whether the good practice serves its purpose and to which extent. Details of the template can be found in the Appendix section.

5. Robotics Community Readiness

The objective of this robotics community readiness analysis is to provide a descriptive **overview of the survey and interview findings**. The following analysis relies on the results of the surveys conducted among **members of the robotics community, general public and policymakers**. In addition, a deeper reflection provided in this chapter includes insights gathered from interviews that were held with the members of the robotics community and policymakers.

5.1 Level of familiarity and relation to robotics

The first set of questions in the robotics community survey were aimed to provide understanding regarding the level of familiarity and involvement of the respondents in relation of robotics. First, the respondents were asked to specify the **type of stakeholder** sub-group they represent. Robot producers represented 61% of the respondents, among

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whom 14% self-identified being representatives of technical centers, 10% as public research centers, 15% as university or training centers, 9% as private research centers, 10% as representatives of robot manufacturers and 4% as representatives of industrial association of robot developers. Companies using or integrating robots represented 21% of the respondents, among which 5% self-identified as decision makers in companies buying or using robots, 7% as robot integrators and 9% as robot operators. Robot users represented 13% of the respondents, with 3% self-identifying as associations of robot users and 9% as individuals buying or using robots. Insurance companies for robotic products represented 2% of the respondents.

Lastly, 34% of the respondents declared having no link with robotics, and 4% declared a different relation (students, public organizations, amateur roboticists, press, etc.). Their responses are analyzed separately to provide further insight.

Among respondents who declared a link with robotics, 31% declared being fully familiar with robots, 51% declared being quite familiar and 18% declared not at all being familiar with robots.

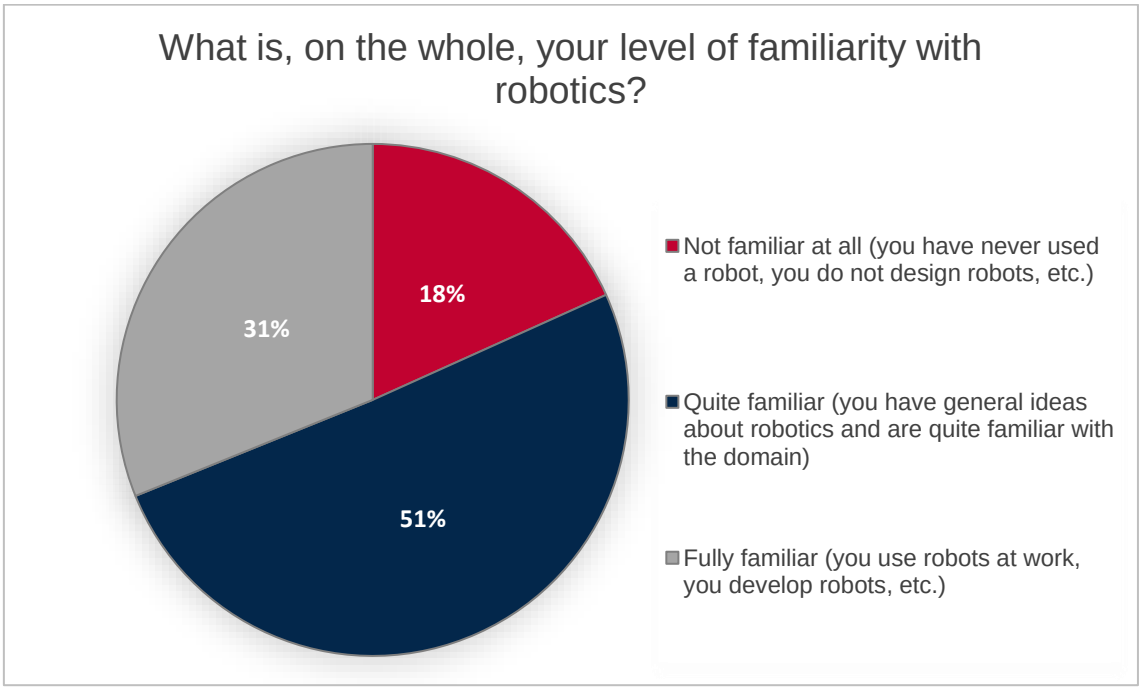

Figure 3. Survey respondents' level of familiarity with robotics

Additionally, the respondents were asked to indicate which **specific areas** they interact with robots in. The four focus areas of the project were provided, and respondents had the option of choosing several. 29% of the respondents declared to mostly interact with robots in healthcare, 26% in inspection and maintenance of infrastructure, 25% in agile production and 21% in agri-food. 11% of the respondents declared they have no interaction with robots. 12% of the respondents specified other fields which were not provided, for example education, domestic robots, defense etc.

5.2. Issues identified as most impactful

The next set of questions was aiming to help identify the issues that are considered most prevalent in connection to the **deployment of robotics**. The respondents were asked to

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select three issues which they consider most impactful within five different categories. The options to choose from were provided in the survey in the following categories: socio-economic, ethical, data, legal, and education and engagement. This analysis is complemented with the opinions from the survey targeted at policymakers as an identical set of questions was included in the latter.

Among **socio-economic** issues (Table 33) "Fear of technological unemployment" was the most selected, with 60% of respondents choosing the option. "Rising skill gaps and skill depreciation" and "Loss of worker autonomy" were the following, with 37% and 32% of respondents accordingly. When comparing the general population to members of the robotics community, more people have considered that "Rising inequality in earnings" and "Environmental harm" were important issues.

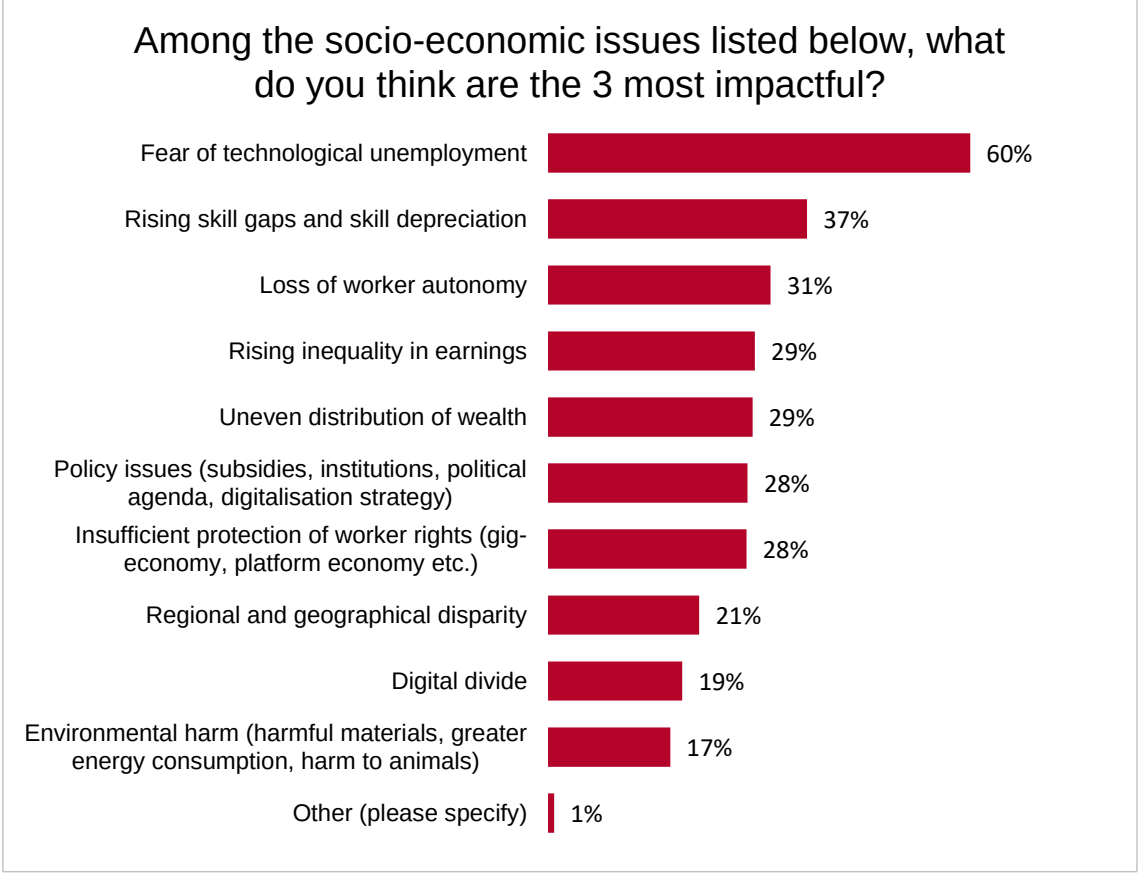

Figure 4. Socio-economic issues identified by respondents

Based on the results of the policymakers' survey, fear of technological unemployment was also seen as the most impactful socio-economic issue (53%), followed by rising skill gaps and skill depreciation (50%). The third most impactful issue according to policymakers differs from the opinion of robotics community, as policy issues were highlighted (36%) while in the case of the robotics community issues of worker autonomy were considered more impactful. Policymakers were also asked to indicate the field where socio-economic issues are considered most pressing and the most selected option was the field of agri-food (53%).

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Among the **ethical** issues (Table 4) provided two were most selected: “Issue of safety and security at workplace” by 44% and “Lack of responsibility and accountability” by 43%, followed by “Lack of transparency” by 38% of the respondents. The general population assigned a lot more importance to “Human rights abuse” compared to the robotics community.

Regarding ethical issues, the three most impactful issues aligned between policymakers and robotics community stakeholders with a difference in the order of the top three. Policymakers considered “Lack of responsibility and accountability” to be the most impactful (69%), “Lack of transparency” was chosen as the second (44%) and “Issue of safety and security” as the third (36%). Ethical issues were considered most pressing in the field of healthcare (56%).

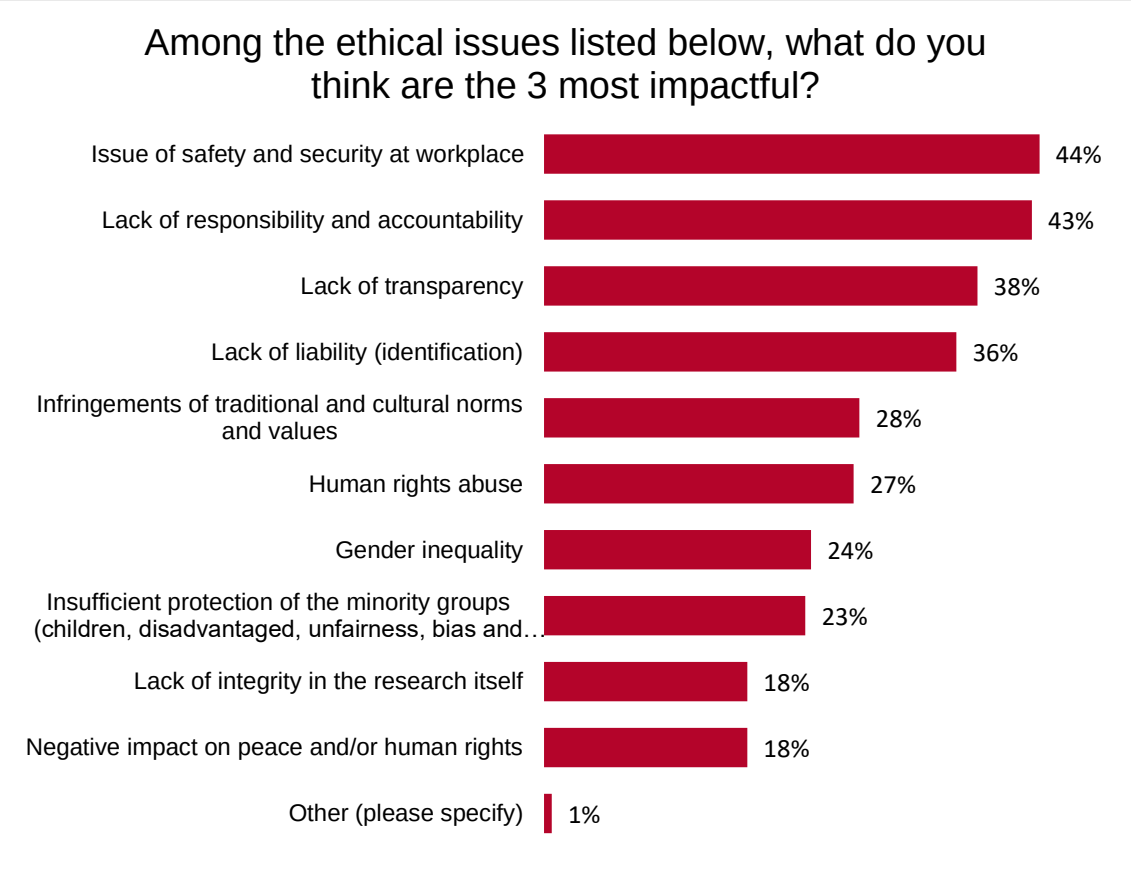

Figure 5. Ethical issues identified by respondents

When identifying issues relative to **data** (Table 5), the most selected issue was “Surveillance “issue” (authorization, transparency, legal mandate, online and offline activity monitoring) at 49% of respondents, followed by “Vulnerability of cyber physical systems” at 47% and “Lack of control and empowerment about access to data “at 38% of respondents. On this subject, the responses from the general population were overall like the ones from the robotics community, with only the option of “Insufficient protection to the minority groups” standing out as it was identified as more of an issue by the prior.

When asked about issues of data, policymakers indicated that “Cyberwarfare (social control and political manipulation)”, “Unbalanced power in data ownership” (47% both) and “Vulnerability of cyber physical systems” (44%) are the most impactful issues, while stakeholders within the robotics community focused more on issues that have to do with

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people's personal rights. Data issues were considered most pressing in the field of healthcare (44%).

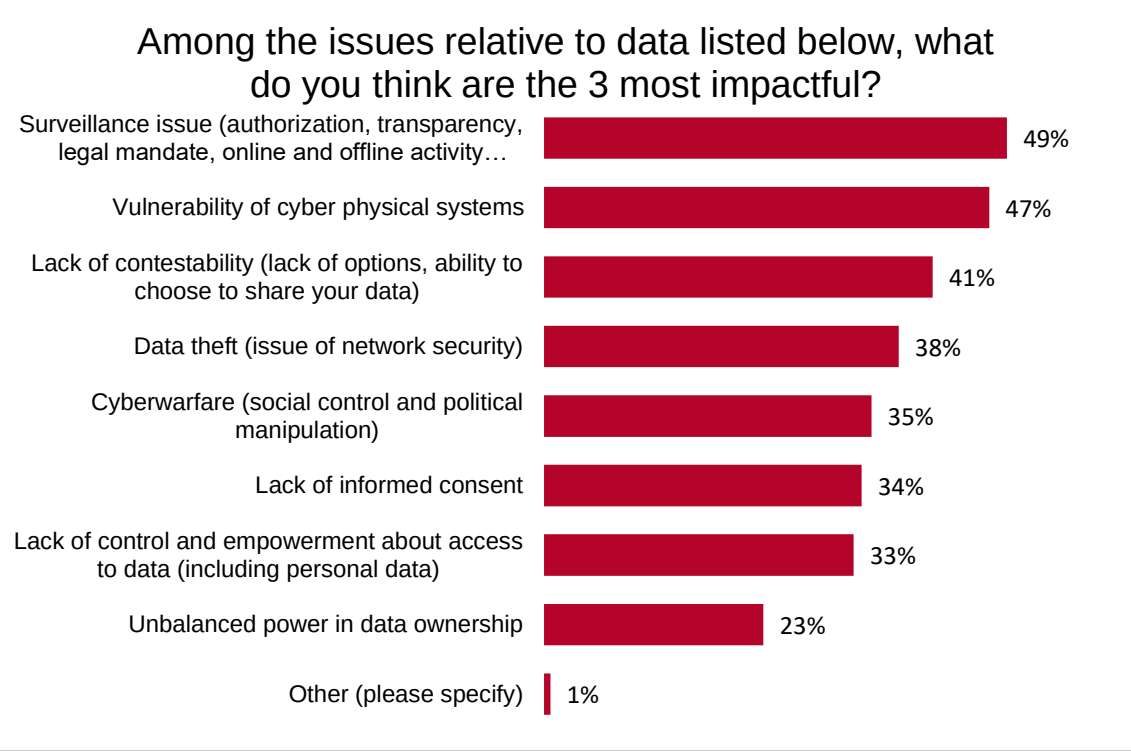

Figure 6. Issues related to data identified by respondents

The most selected issue among **legal** issues (Table 6) was "Lack of and lag in regulatory development "(lack of clear regulations for free flow of data) at 57% of respondents, followed by "Lack of global governance" (not having a unitary body of rules for all kinds of robotic applications) at 52%, followed by "Intellectual property infringement" at 51% of respondents. The responses of the general population differed quite a lot from the robotics community. The options "Intellectual property infringement", "GDPR seen as not sufficient" and "Unclear and unharmonized regulations" were selected less often, while "Lack of awareness of the legal rights related to data and technology" and "Lack of global governance" were selected more often by members of the general population.

In terms of legal issues, policymakers consider "Lack of and lag in regulatory development" (61%); "Lack of awareness of the legal rights related to data and technology" (58%); and "Unclear and unharmonized regulations" (56%) as the most impactful issues. This indicates that lack of regulations in general is a concern from the policymaking view and this notion was also highlighted in the interviews and conversations held with policymakers throughout the data collection task. Legal issues were considered most pressing in the field of healthcare (42%).

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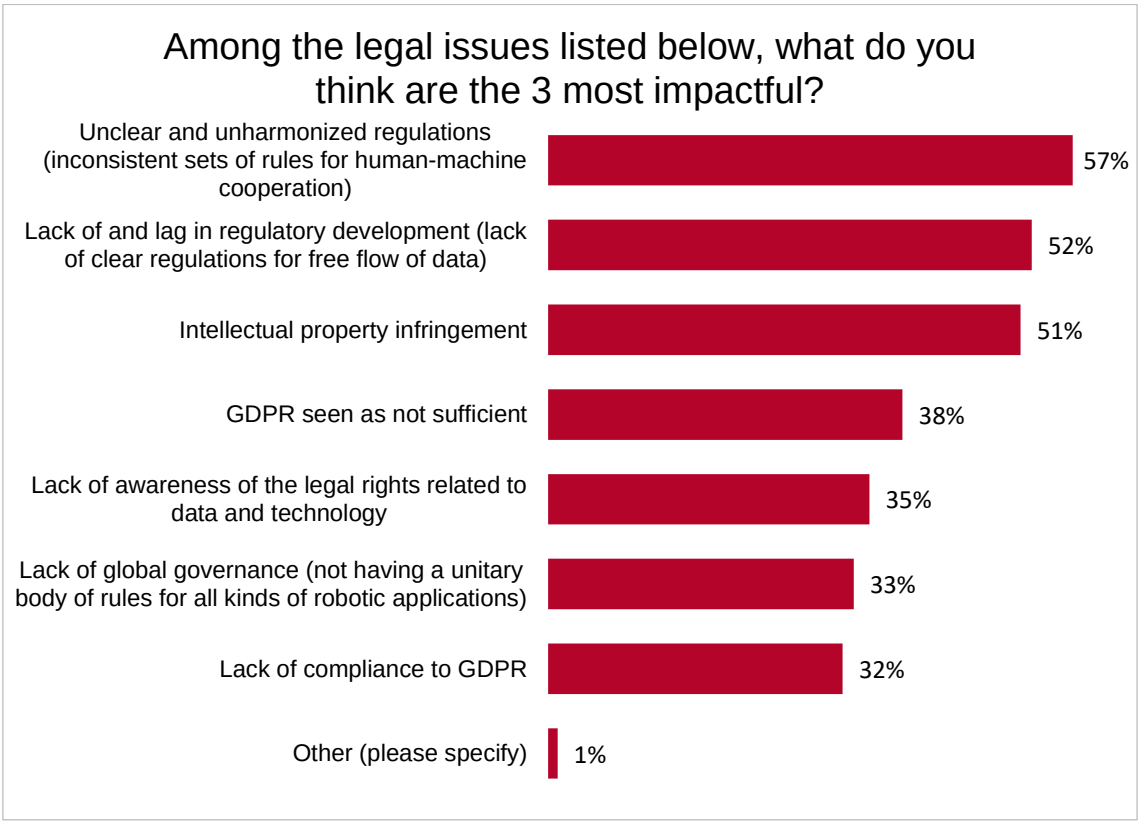

Figure 7. Legal issues identified by respondents

The most selected issue within issues relative to **education and society engagement** (Table 7), by far, was “Education issues” (lack of education resources, shortfall in science knowledgeable people, shortfall of informal science education) at 68% of respondents, followed by “Inequality in development” (education sector not following trends fast enough) at 51% and “Lack of methods for engagement and empowerment” at 46% of respondents. On this topic there was a large difference between the robotics community and general population: respondents who have no link to robotics were twice as likely as the robotics community to select “Lack of empowerment” as an important issue.

Similarly, to robotics community members, policymakers also indicated that education issues (81%) and inequality in development (75%) are the most pressing issues. In addition, policymakers considered “Insufficient public engagement” (39%) as the third most impactful issue. Education and engagement issues were considered most pressing in the field of agri-food (42%).

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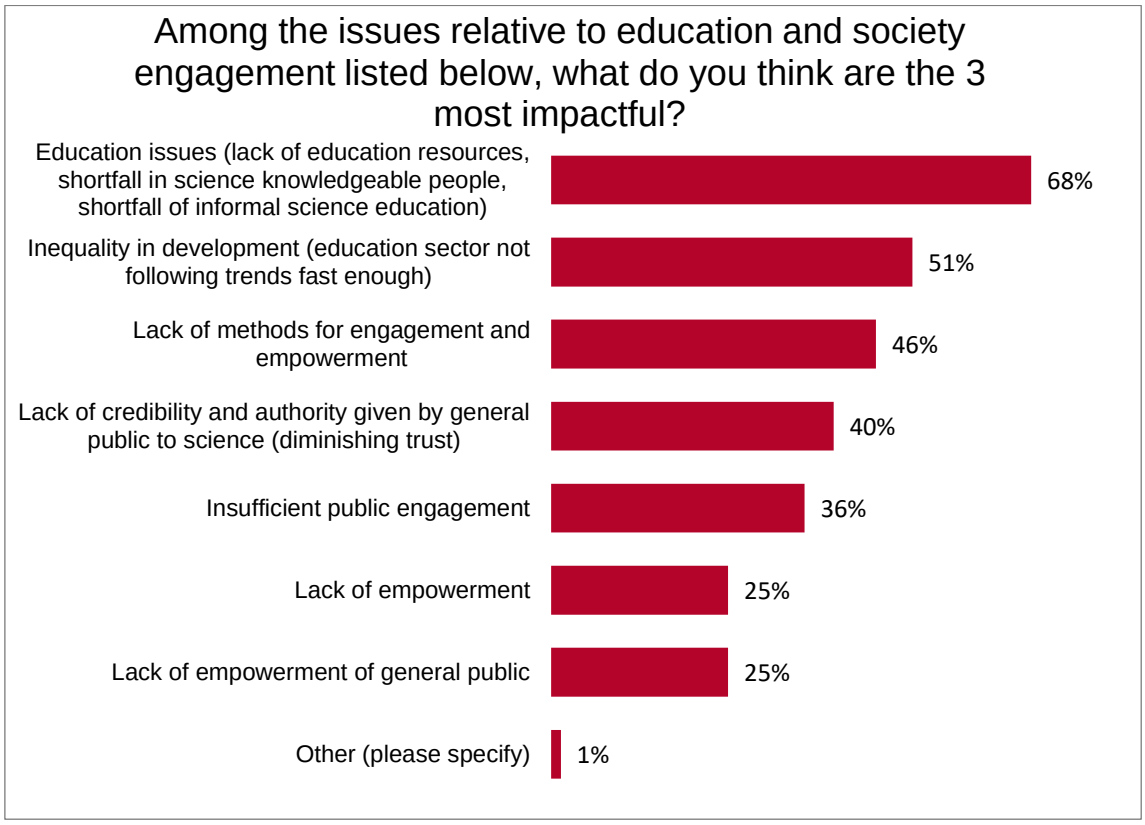

Figure 8. Education and society engagement issues identified by respondents

In addition to selecting options provided in the list, the respondents had the opportunity to provide additional issues they perceived to be missing. Some of the suggested issues were as follows:

- Sustainability (life cycle of robots, increased WEEE and energy needs)
- Research and research-to-industry transfer
- Open-source strategies
- Interoperability between vendors
- Psychological well-being in a cooperation with new technologies
- Human rights and freedom

5.3. Acceptability of robots

The following set of questions dealt with the question of robots' acceptability including misbehaviours of robots, criteria of excellence, awareness regarding regulations and the tools necessary for the deployment of responsible robotics. In determining the acceptability of robots, respondents were first asked to select the type of stakeholder they consider most **impacted by a misbehaviour** (issue of safety, breach of regulations, robot failing to do its task, etc.).

Individuals (users of the robot in their daily lives) was the most selected category by far, with 39% of respondents, followed by expert end-users at 21% and manufacturers also at 21% (

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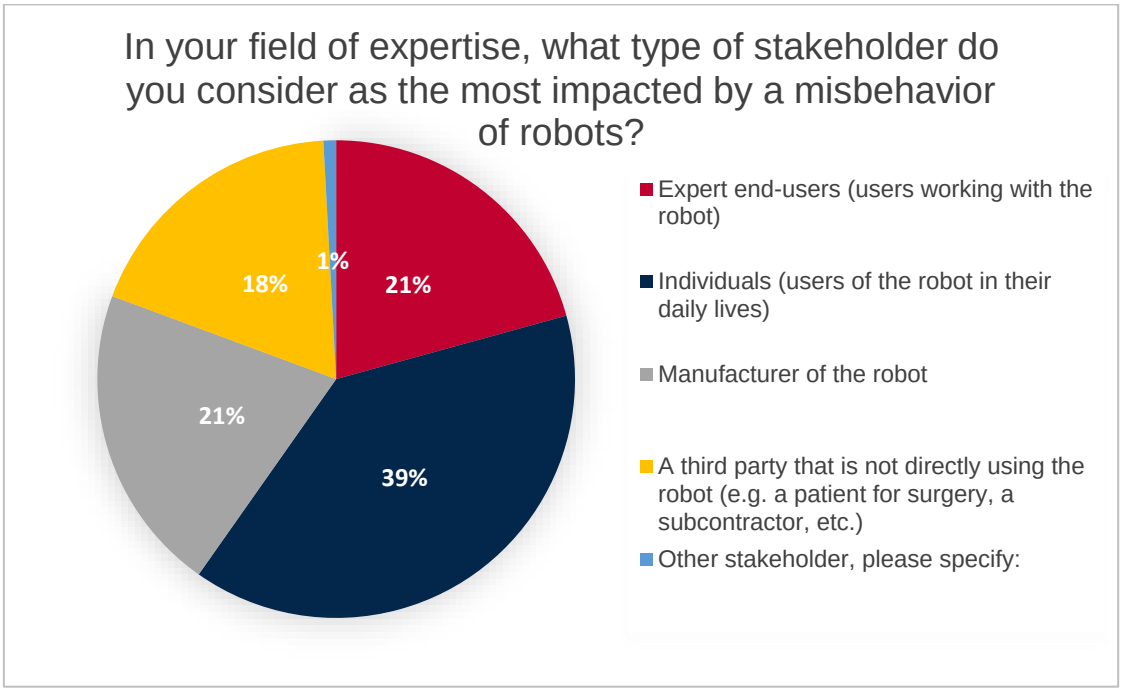

Figure 9). No relevant other categories were proposed in "Other stakeholder" option.

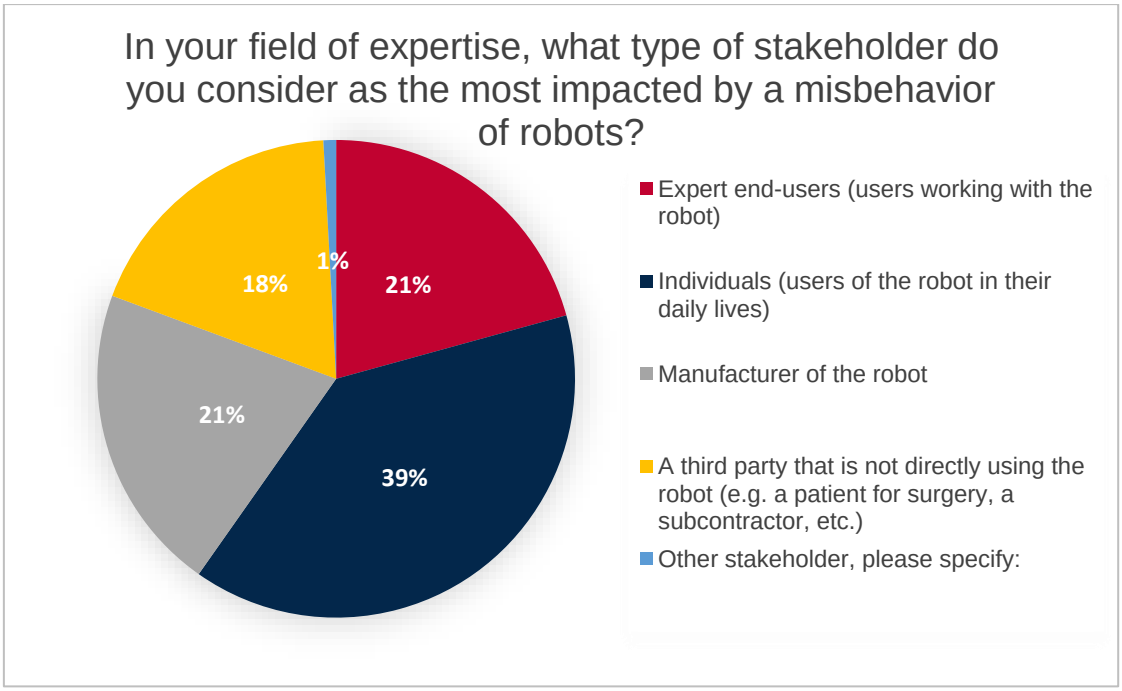

Figure 9. Stakeholders most impacted by a misbehaviour of robots identified by respondents

Respondents were also asked to identify whether they are potentially **impacted by robots' misbehaviors**. The vast majority (91%) indicated that they are not while only a small portion (9%) of the respondents considered themselves to be impacted.

Robots' acceptability was also looked at through the impact of specific stakeholders. When asked to determine the actor who can the **influence the acceptability of robots most**, the most selected answer was end-users at 31%, followed by robot developers at 27% and policymakers at 20% (Figure 10). From the policymakers' view, people who are not directly using robots (e.g., patients for surgery) are most likely to be impacted by

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robots' misbehaviours. In addition, expert end-users (users working with robots) and individuals using robots in their daily lives are stakeholders who were considered at risk when it comes to misbehaviours of robots. It is interesting to note that the perceived impact of end-users and robot developers is different between the robotics community and the general population. Members of the general population selected robot developers as the most impactful actor (at 30%) while members of the robotics community selected end-users (at 31%). This reflects the fact that user perception is inherently biased and calls for a consideration of end-users' opinions independently of the robotics community.

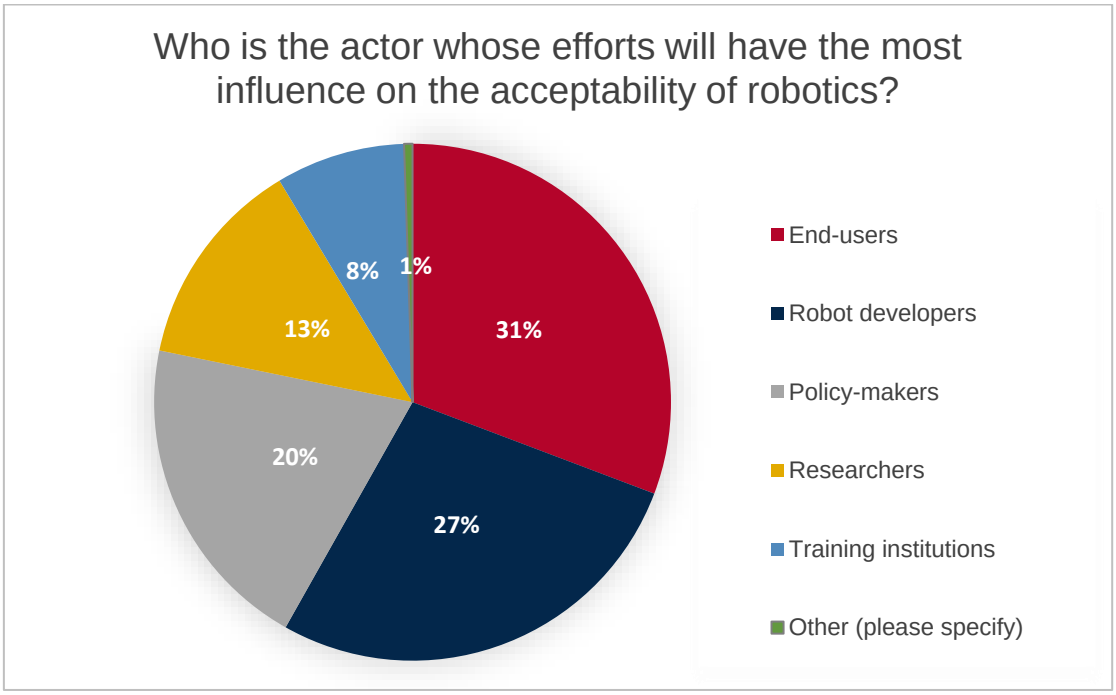

Figure 10. Actors whose efforts will have the most influence on the acceptability of robotics identified by respondents

Respondents were also asked to identify the most important **criteria of excellence** for robots (Figure 1111). For this question, participants were asked to rank six criteria from most to least important. The rankings were then processed using weighted average ranking.

While this ranking shows that the result and quality of robot actions are perceived as more important than user-friendliness, safety and productivity, this interpretation should be made with caution. As respondents had to create an order of the criterions provided, it is unclear whether they considered some of the issues to be of equal importance. Furthermore, rankings should be analysed by accounting for the respondent profile to gain deeper insight. A small skew exists on this topic between the robotics community and the public: members of public prioritize the robots' capacity to make its actions understandable over its harmlessness to users. This difference can be analysed as perceived opacity of robots' actions and should call for more studies on this subject.

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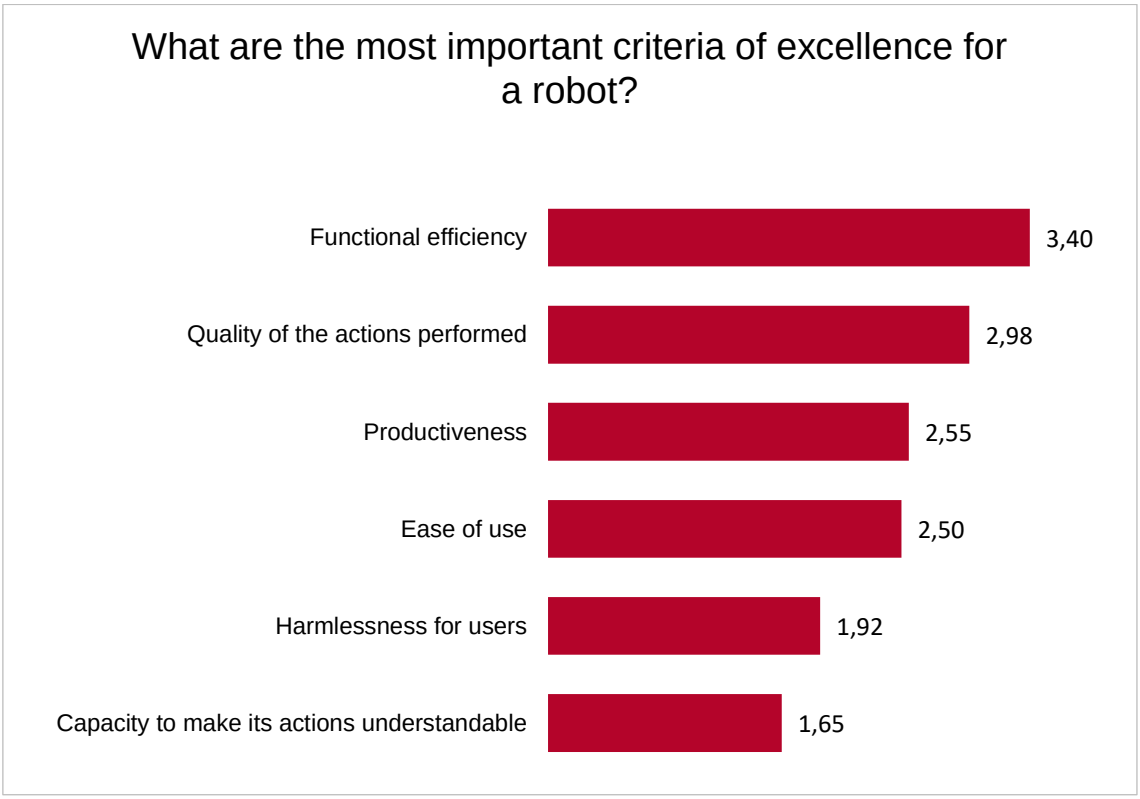

Figure 11. Weighted average ranking of criteria of excellence

Additional criteria were suggested through an open comment field. The following were suggested by at least two respondents:

- Price or price/quality ratio
- Trusted by end users (reliability/safety, data ownership)
- Reduced environmental footprint, ecological design, possibility to repair
- Positive impact on society (social usefulness)
- Cultural competences/ ability to communicate in a transparent and intuitive fashion.

Respondents were also asked about their **awareness regarding regulations** to assess the level of familiarity of the robotics community members with the current regulations (Figure 12) 37% of the respondents self-assessed themselves as being fully aware of applying regulations, 50% as being partially aware and 13% as not being aware of the regulations. As could be expected, the awareness percentages drop if the respondents that are not affiliated with robotics are considered: only 14% of them declare being fully aware of the applicable regulations. These results could be interpreted as a call for more education on the functioning of regulations and for a more transparent and accessible system.

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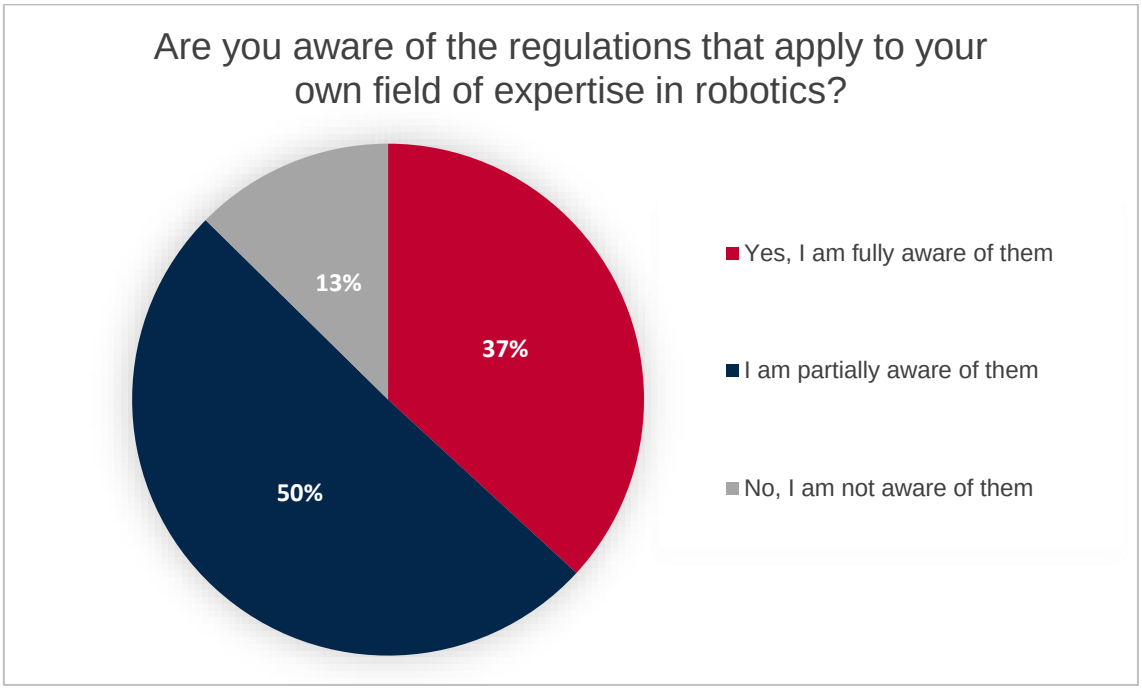

Figure 12 Survey responses to the question "Are you aware of the regulations that apply to your own field of expertise in robotics?"

To understand what is considered **necessary to successfully deploy responsible robotics**, participants were asked to select all the measures they saw relevant (Figure 13). The most needed tool appears to be “Certification procedure for safety” at 53.76% of the responses, followed by “Certification procedure for ethical compliance” at 42.37% of the responses. The other propositions received 34% or less of votes. The opinions of members of the general population align with the results of the robotics community survey, as do the opinions of policymakers.

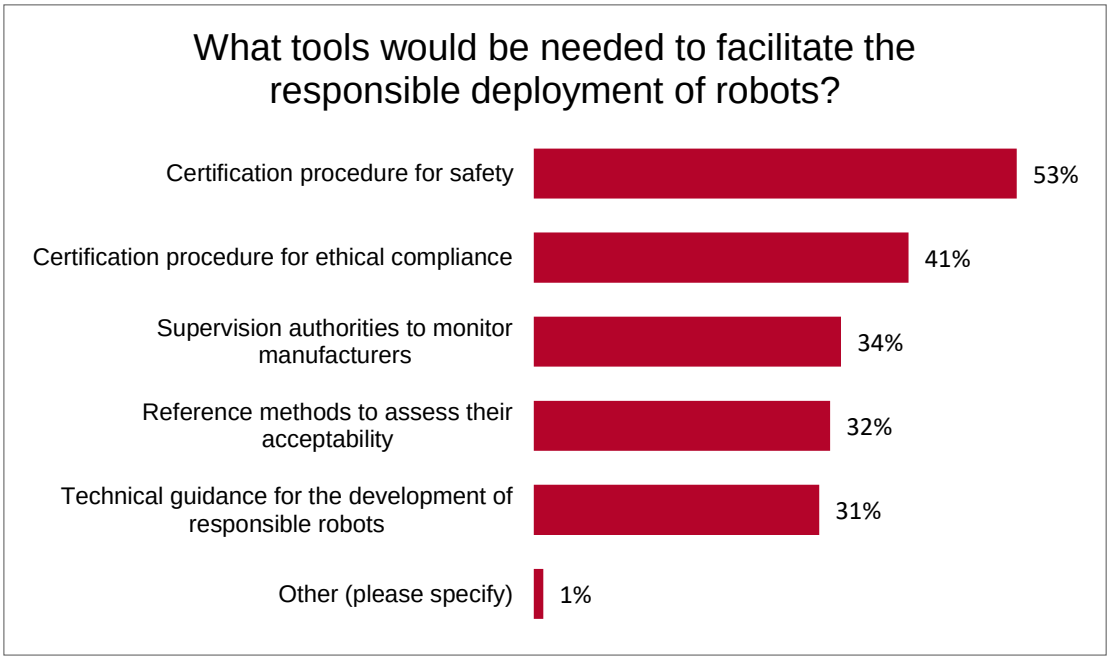

Figure 13. Survey responses to the question "What tools would be needed to facilitate the responsible deployment of robots?"

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The results of the survey can be summarized as follows: the main social issue raised by respondents is **fear of technological unemployment**, which re-joins the safety and security at workspace and responsibility/accountability issues. Overall, the **main concerns were safety, efficiency and quality of actions performed**. The proposed means of progress are education and clear governance, with additional certifications to ensure safety and ethical compliance. While policymakers' priorities were directed more toward issues that might be more specific to policy and regulation, their opinions in general were aligned with the opinions of the stakeholders within the robotics community. The latter quite understandably focused more on **issues that are directly connected to people's personal lives**, including issues of individuals' rights, employment, and safety.

An interesting development would be to investigate the opinions of the general public and robotics community. Some topics seem to show a large bias in opinion, and this should be considered in future decisions. For example, the focus on minority groups protection is something that could be overlooked if policies were selected according to the opinions of the robotics community alone. In the same way, it should be carefully considered which actors can influence robot acceptability, as non-members of the robotics community will expect the work to come from robot developers, who in turn expect end-users to act. The topic of robot acceptability needs to be analysed with a strong bias control as the subject of future research.

5.4. Deeper reflections on the acceptability of robots

Interviews were conducted with 60 individual stakeholders from the robotics community, to deepen the reflection on the current issues identified in section 4 of the current document. In the context of the interviews, the goal was to understand if the current issues do match, overall, the opinions of the individuals. In addition to surveys, this Robotics4EU activity allows tackling the subject of acceptability of robotics by leveraging several consultation methods.

One can note first that the notion of "acceptability" has been particularly debated by the interviewees. Several respondents noted the difference between the notion of "accepted" (already well established in the community) and "acceptable" (the propensity to be accepted). The interviewees noted in most cases that the **acceptability varies greatly according to the domain of application**: overall, industrial robots are already accepted, and the issues generally lies within social robotics, or in general with robots trying to interact "intelligently" with humans. Respondents highlighted that this notion of "intelligence" explains the discrepancies in acceptance. An industrial robot (excluding the new-gen collaborative robots) only needs to perform specific task, which relates to automation rather than to AI-driven robotics. Robots which are meant for interacting with a complex environment (autonomous mobile robots, social robots, etc.) are considered by the interviewees as generally not technologically ready, hence a potential deficit in their acceptability: they are not here yet. This major distinction particularly highlights the average value noted in Figure 14: some types of robots are already accepted; some are not yet. Figure 14 shows that Consumers are slightly more positive about the notion of acceptability than the Producers. Here again, this greatly depends on what the interviewee understood in the term "acceptable".

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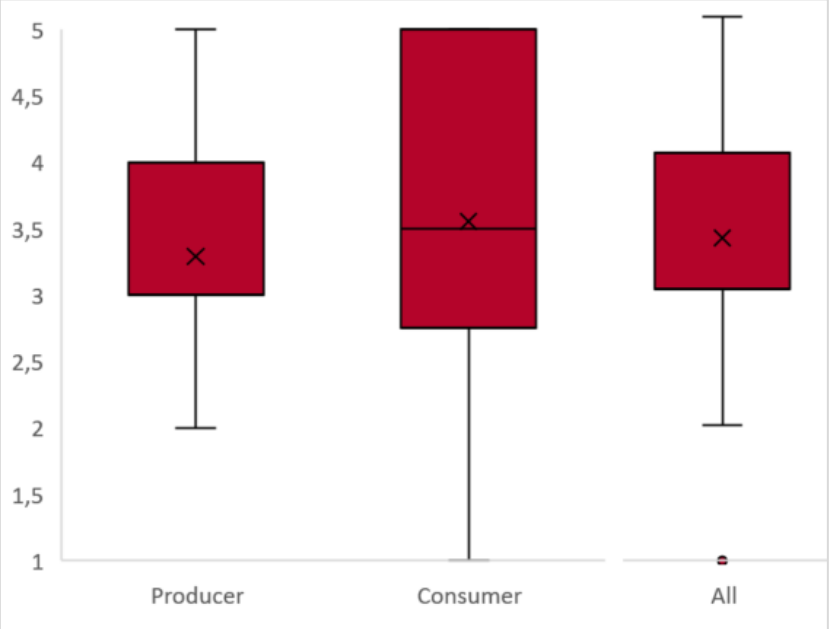

Figure 14. Rating of "acceptability" among all interviewees and according to the interviewee type (18 consumers, 42 producers). (1= not acceptable, 5 = fully acceptable)

Regarding the five categories of issues previously identified, no specific type of category stood in the interview panel (see Figure 15). Overall, the themes broached by the interviewees are already present in the list of issues identified previously (4.1 Current issues): needs for transparency, safety, training, etc. Several interviewees highlighted the importance of technologies to be affordable, to be adopted – one can easily understand that in this view, the "adoption" of robotics means the possibility to first *access* the device. In this regard, several respondents noted that adoption would be facilitated if the general public is better informed about robotics (their functions, their performance, their roles...), and this may go through displaying more robots in public areas. Several individuals (on the consumer side) even noted that they have never even seen an "intelligent" robot (interactive robot) themselves. This leads us to ponder - how can they adopt a technology that they have not used yet?

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Figure 15. Synthesis of the categories of issues evoked by the interview panel.

Robotics4EU aims for a widespread adoption of robotics by focusing on four priority areas, as specified earlier. On the interviews, the respondents were encouraged to discuss the **types of robots, or domains, that would require in their opinion a specific coverage**. Although the interviewees may have been expected to mention specifically the traditional critical domains (military, energy, medical, etc.), an analysis of the key concepts they mentioned highlights that although healthcare is predominantly represented (perhaps due to the proportion of representatives of the healthcare domain in the sample), military robotics has not been broached more than, for examples, drone types. The "industry" domain was covered by many interviewees, but rather specifically on "emerging" critical domains: **agriculture, transportation, or logistics**, where safety compliance and efficiency are known to be among the main current technological concerns. Some interviewees noted however explicitly that this should be "safety before efficiency", meaning that safety-related issues must be appropriately addressed before considering the overall robot's performance.

In addition to domains, the interviewees identified functions of robots they considered important. The overall notion of "**level of autonomy**" was amongst the top subjects of concern, that goes along with social robotics, and the "i**nteractivity**" capabilities of robotics. In this regard, the interviewees often noted that the vicinity to human beings (or to human vital resources such as food) is a major limitation towards adoption, as long as these robots have not proved that they are safe, that they react appropriately (no disturbance to humans), and that they indeed provide a real service (direct benefit for humans or added value of automation). In this context it was thus noticed that the notion of performance of the technology is predominant: what is the use of having a robot if it is nothing but a toy. "**Technological advance**", "**better sensitivity to environment**", "**proven efficiency", "more than a demonstrator",** are notions that were conveyed by many interviewees.

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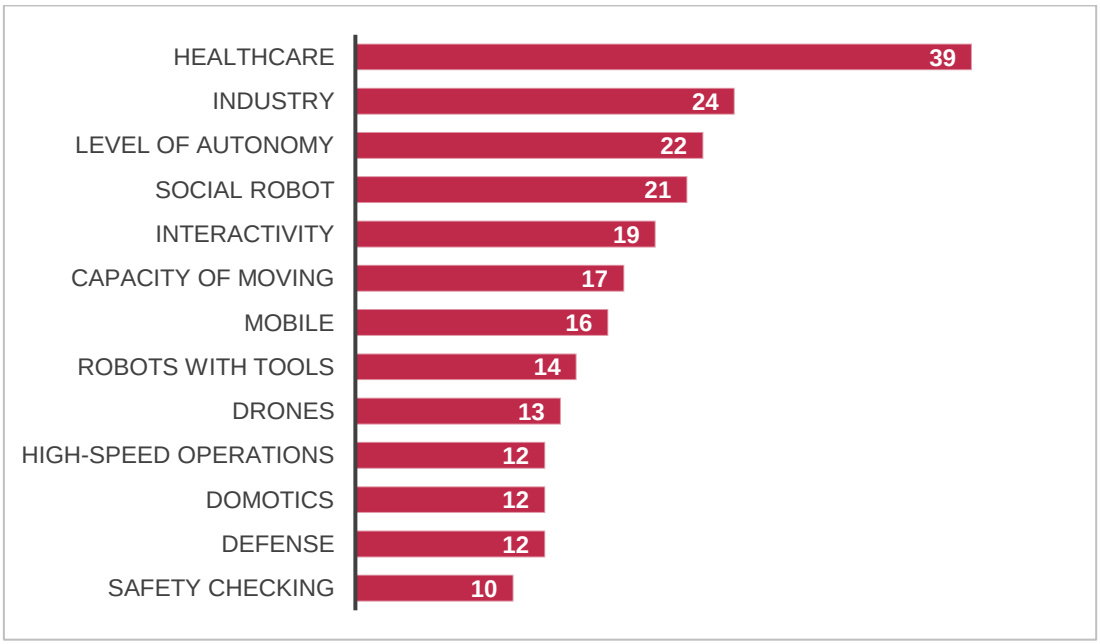

Figure 16. Keywords of "critical" robotic areas broached by the interviewees (domains, or functions, or types of robots).

Concerning the overall readiness of society for the integration of robotics ("Are we ready to integrate robots, yes or no"), which represents the last question of the interview, Figure 177 pictures the distribution of "Yes" and "No" among the interviewees; one should note however that in the procedure, interviewees were encouraged to select between "Yes" and "No", which does not constitute an appropriate scale for such a subjective estimation (a Likert scale would have been preferable). As a reminder, the objective of this question was to make them **discuss and debate the overall notion of integration of robots in society**. In this regard, we thus do recommend that these figures are used with great caution.

As expected, the last question of the interview rather brought the oral comment "But it depends". Indeed, the interviewees noted that the integration of robots relies mainly on the type of function performed by the robots. Often, interviewees mentioned the existing lawn mowers and vacuum clears that are fully integrated in society. Social robots, collaborative ones, "next gen" robots seem on the contrary so remote from the current scene that their adoption is not a perspective in the immediate future. Many interviewees mentioned however that this adoption will naturally occur, as is the case with any disruptive technologies from the past (smartphones, Internet, etc.). By the time society is familiar with this new "intelligent" AI-driven robotics, which means that they are more present in everyday lives, society will naturally adopt them. Despite the 33% of respondents who were more in favour of a "No" to readiness of integration in society, it was noticed that these persons considered that they are not ready because of limitations in the technological advance, and that the real access to these devices does not really exist yet. Figure 14 and Figure 17highlight that Consumers seem on the whole slightly more positive about the future integration of robotics: from the point of view of the user, this will just be another new technology, and it will simply be accepted over time if it performs the task that is expected of it.

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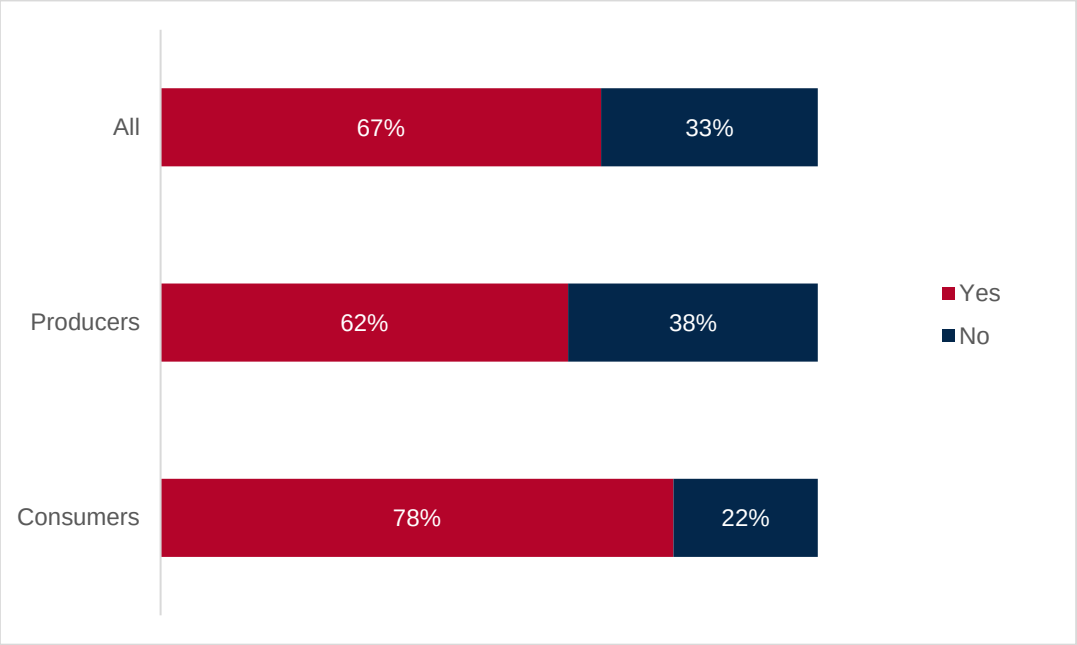

Figure 17. Readiness of society towards robotics integration, as expressed by the interview panel. (These statistics must be considered with caution)

5.5. Cooperation between policymakers and robotics community

The following analysis is based on the survey responses and individual consultations with policymakers who were involved in the project. The information that is presented as quantified results should be approached with caution as a relatively small number of policymakers was involved. Nevertheless, the objective of this inquiry into the views of policymakers was not to collect quantifiable data but rather to identify opinions that could be utilized in the upcoming activities of the Robotics4EU project to set focus and choose topics that should be prioritized.

When asked to rate the **current cooperation between the robotics community** (robotics innovators from companies and academia as well as citizens/users) and policymakers, 79% of the survey respondents described communication as “insufficient or very insufficient” while 21% rated it “sufficient” or “good”. The main shortcomings of the cooperation according to the survey respondents were lack of communication and lack of technical knowledge of policymakers (both options chosen by 59% of the respondents), followed by lack of transparency (32% of the respondents) as presented in Figure 18 below. One of the other shortcomings suggested by several respondents was related to corporations and lobbyists making it difficult for policymakers to have direct access to the robotics community. When asked to identify the most important parties for cooperation, robot developers (71%) and end-users (59%) were chosen by most respondents.

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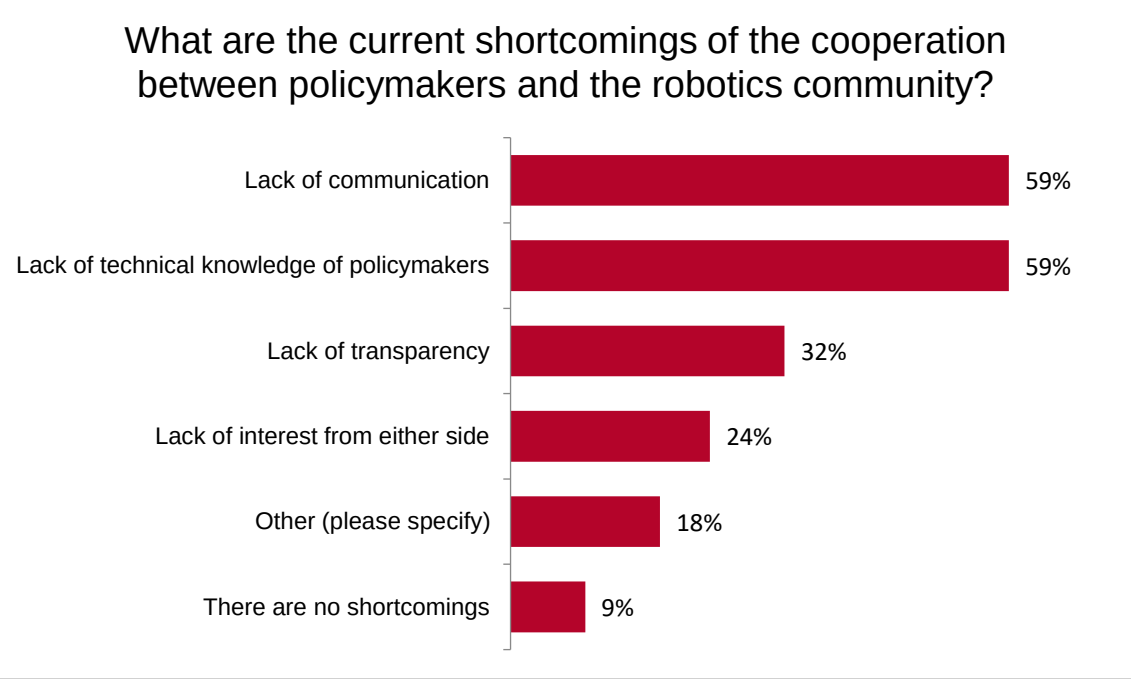

Figure 18. Shortcomings as identified by survey respondents

Survey respondents were also asked to indicate the **main activities to foster better cooperation** (Figure 19) and most respondents (62%) chose establishing systematic cooperation models (e.g., cooperation networks) as the most important activity. Increasing knowledge/awareness among policymakers to foster cooperation with the robotics community was the second most important activity selected by the respondents (59%), followed by increasing investments and funding (38%).

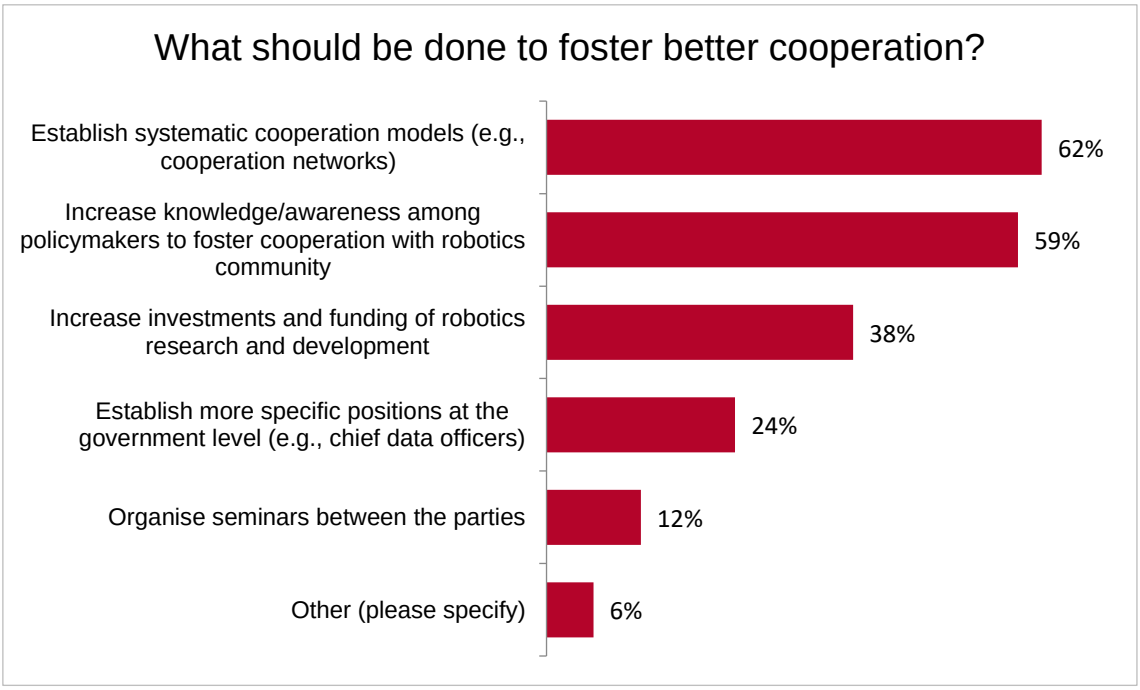

Figure 19. Activities needed to foster better cooperation as identified by survey respondents

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Increasing awareness and providing objective information about the available robotics solutions and their capabilities was brought up in conversations with policymakers and robotics community members as a crucial measure to **enhance cooperation and deepen the understanding about the possibilities that deployment of robots can offer**. These possibilities should be showcased in a manner which is easy to understand and offers specific examples of cases where robot technologies were successfully implemented. Both policymakers and the members of the robotics community agree that non-expert citizens often lack adequate information and attributes characteristics to robots based on what they have seen in the movies or from extreme cases they have seen covered in the media. Because of this, they are often unaware of the actual **risks connected to robots** and might imagine risks in a distorted or exaggerated way. In addition, companies that could potentially deploy robotics in their operations also lack detailed information about the specific possibilities that are available, and the costs associated with integrating robotics solutions. Furthermore, as this information is often unavailable also to policymakers (especially at a local level) they are unable to offer support for activities and policy-planning that would help boost the adoption of robotics. To address these shortcomings, all the relevant stakeholders should have **access to objective information** about the possibilities that are available.

As pointed out by policymakers, it is also important to have a clear overview of the different activities and projects directed towards making robotics more acceptable in order to create a systematic overview of the information that has already been gathered. Often projects or activities are engaging the same stakeholders repeatedly and this can negatively impact the motivation of the stakeholders to participate. Information that has already been gathered should be systematized and used by those involved in the research and activities related to furthering the adoption of robotics.

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6. Conclusions

As robot technologies are developing rapidly and robots are becoming more common in our lives, it is integral to focus on the possible challenges that arise. These challenges must be tackled through a **holistic approach** that is based on **cooperation** and considers perspectives of the **robotics community members, policymakers, and citizens**. The Robotics4EU project aims to do this by generating discussion and enhancing cooperation. To this end, the most important takeaways from the analysis that was covered through desktop research and survey/interview analysis, are concluded below. These key topics are taken into consideration throughout the upcoming activities of the Robotics4EU project and they may also serve as guidelines for policymakers.

Improve cooperation between the robotics community and policymakers

The **conversation between policymakers and robotics producers** needs to be improved and policymakers need to be made aware about the specific **needs of the robotics community**. To improve cooperation, it is necessary to continue organizing projects and events that are designated to raise **awareness** and build **networks** between the relevant stakeholders. It is also important that these projects collaborate to avoid overlap and exhaustion of the stakeholders within the robotics community.

Focus on advancing human-robot interaction

In developing robots that interact with humans the focus should be in providing **smoother interactions** in order to provide robots that are more user-friendly. They must have a better **sensitivity to their environment** (more sensors, more complex decisions, more interactivity). In one word, they should be more "collaborative" and their decisions should be understandable and transparent. This should remain as a critical focus in the development of new robot technologies.

Prioritize solving key challenges related to safety and privacy

Safety and privacy are challenges which stand out as concerns, and these should be aggressively addressed. **Robots must be safe**, they must be able to deal correctly with hazardous environments, and above all they must react properly/safely in the vicinity of humans. In addition, **privacy of individuals** should be ensured, and the discreetness of social robots should be a critical design element.

Increase societal awareness about the positive impact of robots

As technological unemployment is still a major concern, it is important to showcase that robots are advantageous for work and are not intended to replace humans. There is a big need for **communication to address these fears related to robots** taking away peoples' jobs and to promote the true benefit for human well-being. Furthermore, citizens must get used to seeing robots so that they would have a **realistic understanding** about the current robot technologies and how they are used.

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PARTNERS
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7. Appendix

Appendix A. Short Survey Text

SURVEY NAME: Robotics4EU Good Practices Survey

Dear Sir/Madam

We approach you on behalf of the Horizon2020 project Robotics4EU that started in January this year.

Our project aims to contribute to more widespread adoption of robots in Europe in the areas of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production. We will do this by raising awareness about non-technological aspects of robotics: ethics, cybersecurity, data privacy, legal and socio-economic issues among the robotics community and citizens.

We are interested in exploiting the resources and results of previous EU projects. As you are the coordinator of the NAME OF THE PROJECT, I kindly ask you to reply to a short questionnaire that helps us to understand whether we could take up your project results. It will take approximately 2 minutes to complete the questionnaire.

Thank you very much for your time and cooperation,

The Robotics4EU team

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

Robotics4EU Good Practices Survey

Write the name of your initiative/project here

Your answer

Write your contact information here

Your answer

Does your project address any of the following issues in the robotics community? Mark issue(s) that your project addresses.

- [ ] Socio-economic
- [ ] Ethics
- [ ] Data privacy
- [ ] Legal
- [ ] Cybersecurity
- [ ] Other:

In addition to you, is there someone else who should be contacted regarding information about your project? If yes, please leave their contacts below.

Your answer

Could you recommend any additional projects/contacts that we should consider in our research?

Your answer

Do you have additional comments?

Your answer

Submit

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Appendix B. Detailed Survey Text

SURVEY NAME: Robotics4EU: Boosting Wider Adoption of Robotics in Europe

Dear **(Name)**

We approach you on behalf of the Horizon2020 project Robotics4EU (https://www.robotics4eu.eu) that started in January this year. As a coordinator of **(Name of the project)**, you have been identified as a relevant actor regarding good practices development related to robotics. Your input is considered very valuable for the Robotics4EU project.

Our project aims to contribute to more widespread adoption of robots in Europe in the areas of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production. We will do this by raising awareness about non-technological aspects of robotics: ethics, cybersecurity, data privacy, legal and socio-economic issues among the robotics community and citizens.

Goal of this survey is to gather tools that your project used in addressing issues in the robotics community (socio-economic, ethics, data, legal and civil engagement and participation) and to identify success criteria, challenges and opportunities for replication of your methods and tools.

The survey will take approximately 8 minutes to complete. If you have any questions about the survey, please email us at: info@robotics4eu.eu

Thank you,

The Robotics4EU team

The information provided by you in this questionnaire will be used for research purposes. It will not be used in a manner which would allow identification of your individual responses. All the data will be used in compliance with General Data Protection Regulation (GDPR).

The research is carried out in the context of the European H2020 project Robotics4EU (Robotics with and for Society – Boosting Widespread Adoption of Robotics in Europe) funded by the EU grant #101017283. Only the researchers involved in the Robotics4EU project at the following organizations will have access to the answers of the survey: Civitta Eesti AS (Estonia), Laboratoire national de métrologie et d'essais (France).

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

Robotics4EU Good Practices Survey

Robotics4EU
Boosting Wider Adoption of Robotics in Europe

Write the name of your initiative/project here

Your answer

Share the website link of your project

Your answer

Do you agree to be involved in the Robotics4EU activities:

- [ ] I am ready to be interviewed to give more insights to the topic
- [ ] I would like to get more information about the workshops that cover non-technological aspects of robotics
- [ ] I am interested in testing robotics applications or ideas with end-users through online consultations and/or co-creation workshops with citizens
- [ ] I am interested in becoming an Advisory Board member of Robotics4EU
- [ ] I am ready to give input to the responsible robotics advocacy report and/or take part from a policy debate
- [ ] I would like to receive the Robotics4EU newsletter (ca 2 newsletters per year)

What is the context and the situation (or challenge) being addressed in your project?

Your answer

Provide a short description of the activities and good practices of your project. (A good practice is a practice that has been proven to work well and produce good results and is therefore recommended as a model. It is a successful experience, which has been tested and validated, in the broad sense, which has been repeated and deserves to be shared so that a greater number of people can adopt it.)

Your answer

Share a link to a good practice, if possible

Your answer

Which category(ies) of issues does your initiative address?

- [ ] Socio-economic
- [ ] Ethics
- [ ] Data privacy
- [ ] Legal
- [ ] Cybersecurity
- [ ] Other:

What tools have you developed?

- [ ] Training manuals
- [ ] Guidelines
- [ ] Fact-sheets
- [ ] Publications
- [ ] Posters
- [ ] Assessment tools
- [ ] Other:

What were the challenges in developing and/or applying these tools?

Your answer

Based on your experience, what are the conditions that contribute that a good practice will be successfully replicated?

Your answer

What other existing tools have you used in the implementation of your project?

Your answer

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In which countries has this good practice/tool been applied?

Your answer

What has been the outcome of this good practice?

Your answer

Is the outcome descriptive/quantitative/direct results?

◯ Option 1

Has the good practice reached a positive impact? If yes, please explain

Your answer

Do you have additional questions and suggestions?

Your answer

Submit

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Appendix C. Good practice template

This template includes information on good practices as well as a form to fill in. The form can be used as a checklist to verify that you have covered as much as possible when documenting a practice and identifying good practices.

Good Practices Repository

Robotics4EU

Title of the Initiative

Write the name of the Initiative here

Stakeholders

Name one	Name two	Name three
Name four	Name five	Name six
Name seven	Name eight	Name nine

Description

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Proin laoreet mauris ac tellus viverra, in fringilla risus fermentum. Donec sed suscipit nibh, quis egestas augue. Pellentesque sit amet leo ac velit accumsan placerat. Nullam neque leo, suscipit id molestie a, laoreet a dui. Fusce eu sollicitudin mauris. Duis nec tincidunt ex, et lobortis purus. Proin efficitur tempus nunc, sit amet dignissim tortor placerat in. Maecenas scelerisque nulla quis laoreet rhoncus. Donec at dictum mi.

Sed fermentum pulvinar nisi, ac maximus lectus rhoncus ut. Nunc in dolor luctus, dapibus ipsum et, cursus neque. Integer odio orci, finibus eget lorem ac, commodo convallis ante. Duis finibus libero lorem, pulvinar hendrerit tellus aliquet a. Integer in pharetra ligula. Integer malesuada tortor ex, volutpat eleifend leo sagittis nec. Fusce id volutpat ex, quis porttitor risus. Integer iaculis nibh eget diam pulvinar mollis. Nulla nulla arcu, tristique vel tellus ac, porta dictum felis. Sed felis augue, varius in risus laoreet, gravida porttitor lorem. Cras aliquet elementum mi eu condimentum. Proin at tellus suscipit, tempor sem in, accumsan est. Sed eleifend tellus et tellus luctus bibendum. Nam aliquet imperdiet interdum. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia curae;

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senectus et netus et malesuada fames ac turpis egestas. Nullam gravida dolor ac ligula accumsan ultrices. Vestibulum id urna vel enim interdum commodo. Donec aliquet blandit porttitor. Nam non lectus faucibus, tempus risus vitae, lobortis erat. Maecenas aliquam justo ipsum, at aliquet dui fringilla ut. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia curae; Phasellus mi dolor, ullamcorper sodales volutpat non, mollis at nulla. Nunc ultricies velit felis, sit amet sodales tortor ultrices id. Mauris viverra ligula vitae fermentum suscipit. Nunc ullamcorper, dolor nec finibus fermentum, tellus orci sagittis lectus, vitae dignissim ipsum ante interdum orci. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Nam fringilla nibh id dolor lobortis accumsan.

Phasellus dapibus quis diam a consequat. Aenean in quam a enim auctor accumsan laoreet non neque. Aliquam malesuada hendrerit quam, eu consectetur magna scelerisque id. Donec id dignissim orci. Nam bibendum mattis dui. Quisque quis nunc porttitor, egestas sapien in, iaculis nisi. Morbi ac ex tempus arcu consectetur iaculis vel ac est. Quisque ullamcorper justo non purus mattis, et ornare nisl bibendum. Proin et luctus nisl, vel bibendum est.

Website	Share website link your project
URL of the Practice	If you have a separate link describing the good practice (including links for download), add the link here
Related Websites	What are the Websites of the projects under which the good practice was identified and reproduced?

Related resources
What training manuals, guidelines, fact sheets, publications, posters, and other documents have been created and developed as a result of the good practice?

Issues addressed
Which category(ies) of issues does your good practice address?

✔ Socio economic ✔ Ethics ✔ Legal ✔ Data ✔ Education and Engagement

Success criteria and constrains
What are the criteria you considered for implementation of good practice and lessons learned?

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- Success criteria *(conditions that you think best contributed to application for the good practice)*
- What are the challenges encountered in applying the good practice? *Theoretical constraints not met (barriers)? How have they been addressed?*

Replicability and Adaptability
What are the possibilities of replicability and adaptability of this good practice?
→ Based on your experience, list internal and external conditions that should be in place for good practice to be replicated *(institutional, economic, social, environmental)*
→ What are the tools and methods needed to adapt the good practice to make it possible to transfer successfully?

Geographical coverage
What is the geographical range where the good practice has been used? Specify when possible, the country, region, town.

Outcome of the practice
What has been the outcome of this good practice? *(please provide the information based on comparable results)*
→ Is the outcome descriptive/quantitative/direct results?
→ Has the good practice reached a positive impact? If yes, please explain.

Sustainability
What are the elements that need to be put into place for the good practice to be institutionally, socially, economically and environmentally sustainable?

Contact details
Contact information of the people involved in the project/ initiative?

Appendix D. Survey questionnaires

Policymakers Survey

Robotics4EU: Boosting Wider Adoption of Robotics in Europe

The results of this survey will provide analytical support to the project implementation and identify the greatest challenges, bottlenecks and needs in enabling wider adoption of (AI-based) robotics in the areas of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production specifically from the policymaking point of view.

As you have been identified as a relevant actor regarding strategic policy development related to robotics, your input is considered very valuable for the Robotics4EU project.
It will take approximately **10 minutes** to complete the survey.

The information provided by you in this questionnaire will be used for research purposes. It will not be used in a manner which would allow identification of your individual responses. All the data will be used in compliance with General Data Protection Regulation (GDPR).

By completing this survey, you are consenting to participate in this study.
Please click "Next" to begin the survey.

The research is carried out in the context of the European H2020 project Robotics4EU (Robotics with and for Society – Boosting Widespread Adoption of Robotics in Europe) funded by the EU grant #101017283. Only the researchers involved in the Robotics4EU project at the following organizations will have access to the answers of the survey: Civitta Eesti AS (Estonia), Laboratoire national de métrologie et d'essais (France).

* 1. Your country

Choose one of the options below.

- Estonia
- Latvia
- Lithuania
- Poland
- Denmark
- Sweden
- Norway
- Italy
- Spain
- Portugal
- Switzerland
- Germany
- France
- Belgium
- Netherlands
- Other (please specify)

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* 2. Your organisation

Please indicate what type of organisation or position you represent. You may choose several if applicable.

- [ ] Ministry
- [ ] Other government body
- [ ] Legal
- [ ] Working group/foundation
- [ ] Expert
- [ ] Union/association
- [ ] Supervisory authority
- [ ] Standardization/certification
- [ ] Other (please specify)

* 3. In the context of policy making/regulations related to deployment of robotics, you have participated in the following:

Please characterize the responsibilities of your involvement. You could select several fields.

- [ ] Legislation development
- [ ] Working group activities
- [ ] Providing consultations
- [ ] Supervisory activities
- [ ] Have not participated in any activities related to deployment of robotics
- [ ] Other (please specify)

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* 4. Related to what field(s) have you participated in the above-mentioned policymaking activities?

Please indicate the relevant sector. You could select several fields.

- [ ] Healthcare
- [ ] Agile production
- [ ] Inspection and maintenance of infrastructure
- [ ] Agri-food
- [ ] Haven't been involved in policy making related to robotics
- [ ] Other (please specify)

* 5. Among the **socio-economic** issues listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Fear of technological unemployment
- [ ] Loss of worker autonomy
- [ ] Rising inequality in earnings
- [ ] Rising skill gaps and skill depreciation
- [ ] Uneven distribution of wealth
- [ ] Insufficient protection of worker rights (gig-economy, platform economy etc.)
- [ ] Policy issues (subsidies, institutions, political agenda, digitalisation strategy)
- [ ] Regional and geographical disparity
- [ ] Digital divide
- [ ] Environmental harm (harmful materials, greater energy consumption, harm to animals)
- [ ] Other (please specify)

Issues regarding deployment of robotics from policymakers' point of view

Robotics4EU partners have identified several issues. Help us understand which are the most critical through the following questions.

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* 6. Among the **ethical** issues listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Issue of safety and security at workplace
- [ ] Lack of responsibility and accountability
- [ ] Lack of liability (identification)
- [ ] Lack of transparency
- [ ] Infringements of traditional and cultural norms and values
- [ ] Gender inequality
- [ ] Insufficient protection of the minority groups (children, disadvantaged, unfairness, bias and discrimination)
- [ ] Human rights abuse
- [ ] Lack of integrity in the research itself
- [ ] Negative impact on peace and/or human rights
- [ ] Other (please specify)

* 7. Among the issues relative to **data** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Surveillance issue (authorization, transparency, legal mandate, online and offline activity monitoring)
- [ ] Lack of informed consent
- [ ] Lack of control and empowerment about access to data (including personal data)
- [ ] Lack of contestability (lack of options, ability to choose to share your data)
- [ ] Vulnerability of cyber physical systems
- [ ] Cyberwarfare (social control and political manipulation)
- [ ] Data theft (issue of network security)
- [ ] Unbalanced power in data ownership
- [ ] Other (please specify)

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* 8. Among the **legal** issues listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Intellectual property infringement
- [ ] Lack of global governance (not having a unitary body of rules for all kinds of robotic applications)
- [ ] Lack of and lag in regulatory development (lack of clear regulations for free flow of data)
- [ ] Lack of compliance to GDPR
- [ ] GDPR seen as not sufficient
- [ ] Unclear and unharmonized regulations (inconsistent sets of rules for human-machine cooperation)
- [ ] Lack of awareness of the legal rights related to data and technology
- [ ] Other (please specify)

* 9. Among the issues relative to **education and society engagement** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Insufficient public engagement
- [ ] Lack of empowerment
- [ ] Lack of methods for engagement and empowerment
- [ ] Education issues (lack of education resources, shortfall in science knowledgeable people, shortfall of informal science education)
- [ ] Inequality in development (education sector not following trends fast enough)
- [ ] Lack of credibility and authority given by general public to science (diminishing trust)
- [ ] Lack of empowerment of general public
- [ ] Other (please specify)

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* 10. As you may have noticed, we have identified 5 families of issues: socio-economic, ethics, data, legal, education and engagement. Do you think we missed another type of issue?

- ◯ No
- ◯ Yes, the following:

* 11. What do you consider the most pressing issues in each of the following fields related to deployment of robotics?

Please choose at least one in each row.

	Socio-economic	Ethics	Data	Legal	Education and engagement	Not sure
Healthcare	☐	☐	☐	☐	☐	☐
Agile production	☐	☐	☐	☐	☐	☐
Inspection and maintenance of infrastructure	☐	☐	☐	☐	☐	☐
Agri-food	☐	☐	☐	☐	☐	☐

Other (please specify)

Successful deployment of responsible robots: avenues for improvement

The following questions will help us understand what are the key activities needed to improve deployment of responsible robots and enhance cooperation between the robotics community and policymakers.

* 12. What tools would be needed to facilitate the responsible deployment of robots?

Choose all that apply.

- ☐ Reference methods to assess their acceptability
- ☐ Certification procedure for safety
- ☐ Certification procedure for ethical compliance
- ☐ Supervision authorities to monitor manufacturers
- ☐ Technical guidance for the development of responsible robots
- ☐ Other (please specify)

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* 13. What type of stakeholder do you consider as the most impacted by a misbehavior of robots? ("misbehavior" can be either an issue of safety, a breach of regulations, a robot that fails at doing its task, etc.)

Choose all that apply.

- [ ] Expert end-users (users working with the robot)
- [ ] Individuals (users of the robot in their daily lives)
- [ ] Manufacturer of the robot
- [ ] A third party that is not directly using the robot (e.g. patient for surgery, a subcontractor, etc.)
- [ ] Other (please specify)

* 14. How do you rate the current cooperation between the robotics community (robotics innovators from companies and academia as well as citizens/users) and policymakers?

Very insufficient	Insufficient	Sufficient	Good	Very Good
○	○	○	○	○

Comment here if necessary:

* 15. Which are the most important parties for cooperation among the robotics community from the policymaking point of view?

Choose two most important parties.

- [ ] Robot developers
- [ ] End-users
- [ ] Researchers
- [ ] Training institutions
- [ ] Other (please specify)

* 16. What are the current shortcomings of the cooperation between policymakers and the robotics community?

Choose two biggest shortcomings.

- [ ] Lack of communication
- [ ] Lack of transparency
- [ ] Lack of technical knowledge of policymakers
- [ ] Lack of interest from either side
- [ ] There are no shortcomings
- [ ] Other (please specify)

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* 17. What should be done to foster better cooperation?

Choose two most important activities.

- [ ] Increase knowledge/awareness among policymakers to foster cooperation with robotics community
- [ ] Establish systematic cooperation models (e.g., cooperation networks)
- [ ] Organise seminars between the parties
- [ ] Establish more specific positions at the government level (e.g., chief data officers)
- [ ] Increase investments and funding of robotics research and development
- [ ] Other (please specify)

18. If you have any additional input regarding the topics covered in the survey, please feel free to comment here.

19. If you are interested in receiving more information and participating in the further activities of Robotics4EU project, please leave your email address here.

Your email will be used only to contact you for purposes within this project, we will never give away your email to anyone else or use it for commercial purposes.

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Robotics Community Survey

Robotics4EU: Boosting Wider Adoption of Robotics in Europe

The results of this survey will provide analytical support to the project implementation and identify the greatest challenges, bottlenecks and needs in enabling wider adoption of (AI-based) robotics in the areas of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production specifically from the policymaking point of view.

As you have been identified as a relevant actor for the development of robotics, your input is considered very valuable for the Robotics4EU project. It will take approximately **15 minutes** to complete the survey.

The information provided by you in this questionnaire will be used for research purposes. It will not be used in a manner which would allow identification of your individual responses. All the data will be used in compliance with General Data Protection Regulation (GDPR).

By completing this survey, you are consenting to participate in this study.
Please click "Next" to begin the survey.

The research is carried out in the context of the European H2020 project Robotics4EU (Robotics with and for Society – Boosting Widespread Adoption of Robotics in Europe) funded by the EU grant #101017283. Only the researchers involved in the Robotics4EU project at the following organizations will have access to the answers of the survey: Civitta Eesti AS (Estonia), Laboratoire national de métrologie et d'essais (France).

* 1. What is your country?

Choose one of the options below.

- Estonia
- Latvia
- Lithuania
- Poland
- Denmark
- Sweden
- Norway
- Italy
- Spain
- Portugal
- Switzerland
- Germany
- France
- Belgium
- Netherlands
- Other (please specify)

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* 2. What are your links with robotics?

Please indicate what type of organisation or position you represent. You may choose several if applicable.

- [ ] Technical center
- [ ] Public research center
- [ ] University or training center
- [ ] Private research center
- [ ] Robot manufacturer
- [ ] Industrial association of robot developers
- [ ] Decision-maker in a company buying and/or using robots
- [ ] Robot integrator
- [ ] Robot operator
- [ ] Association of robot users
- [ ] Insurance company for robotic products
- [ ] Individual buying and/or using robots
- [ ] You have no link with robotics
- [ ] Other link to robotics (please specify)

* 3. What is, on the whole, your level of familiarity with robotics?

- ( ) Not familiar at all (you have never used a robot, you do not design robots, etc.)
- ( ) Quite familiar (you have general ideas about robotics and are quite familiar with the domain)
- ( ) Fully familiar (you use robots at work, you develop robots, etc.)

* 4. In what field(s) do you interact with robotics?

- [ ] Healthcare
- [ ] Agile production
- [ ] Inspection and maintenance of infrastructure
- [ ] Agrifood
- [ ] I don't interact with robotics.
- [ ] Other (please specify)

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Issues regarding the successful deployment of responsible robots

Robotics4EU partners have identified several issues. Help us understand which are the most critical through the following questions.

* 5. Among the **socio-economic issues** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Fear of technological unemployment
- [ ] Loss of worker autonomy
- [ ] Rising inequality in earnings
- [ ] Rising skill gaps and skill depreciation
- [ ] Uneven distribution of wealth
- [ ] Insufficient protection of worker rights (gig-economy, platform economy etc.)
- [ ] Policy issues (subsidies, institutions, political agenda, digitalisation strategy)
- [ ] Regional and geographical disparity
- [ ] Digital divide
- [ ] Environmental harm (harmful materials, greater energy consumption, harm to animals)
- [ ] Other (please specify)

* 6. Among the **ethical issues** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Issue of safety and security at workplace
- [ ] Lack of responsibility and accountability
- [ ] Lack of liability (identification)
- [ ] Lack of transparency
- [ ] Infringements of traditional and cultural norms and values
- [ ] Gender inequality
- [ ] Insufficient protection of the minority groups (children, disadvantaged, unfairness, bias and discrimination)
- [ ] Human rights abuse
- [ ] Lack of integrity in the research itself
- [ ] Negative impact on peace and/or human rights
- [ ] Other (please specify)

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* 7. Among the **issues relative to data** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Surveillance issue (authorization, transparency, legal mandate, online and offline activity monitoring)
- [ ] Lack of informed consent
- [ ] Lack of control and empowerment about access to data (including personal data)
- [ ] Lack of contestability (lack of options, ability to choose to share your data)
- [ ] Vulnerability of cyber physical systems
- [ ] Cyberwarfare (social control and political manipulation)
- [ ] Data theft (issue of network security)
- [ ] Unbalanced power in data ownership
- [ ] Other (please specify)

* 8. Among the **legal issues** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Intellectual property infringement
- [ ] Lack of global governance (not having a unitary body of rules for all kinds of robotic applications)
- [ ] Lack of and lag in regulatory development (lack of clear regulations for free flow of data)
- [ ] Lack of compliance to GDPR
- [ ] GDPR seen as not sufficient
- [ ] Unclear and unharmonized regulations (inconsistent sets of rules for human-machine cooperation)
- [ ] Lack of awareness of the legal rights related to data and technology
- [ ] Other (please specify)

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* 9. Among the **issues relative to education and society engagement** listed below, what do you think are the 3 most impactful?

Select 3 items from the list.

- [ ] Insufficient public engagement
- [ ] Lack of empowerment
- [ ] Lack of methods for engagement and empowerment
- [ ] Education issues (lack of education resources, shortfall in science knowledgeable people, shortfall of informal science education)
- [ ] Inequality in development (education sector not following trends fast enough)
- [ ] Lack of credibility and authority given by general public to science (diminishing trust)
- [ ] Lack of empowerment of general public
- [ ] Other (please specify)

* 10. As you may have noticed, we have identified 5 families of issues: socio-economic, ethics, data, legal, education and engagement. Do you think we missed another type of issue?

- ( ) No
- ( ) Yes (please specify)

* 11. In your field of expertise, what type of stakeholder do you consider as the mos impacted by a misbehavior of robots? ("misbehavior" can be either an issue of safety, a breach of regulations, a robot that fails at doing its task, etc.)

- ( ) Expert end-users (users working with the robot)
- ( ) Individuals (users of the robot in their daily lives)
- ( ) Manufacturer of the robot
- ( ) A third party that is not directly using the robot (e.g. a patient for surgery, a subcontractor, etc.)
- ( ) Other stakeholder, please specify:

* 12. Are you yourself potentially impacted by robots' misbehaviors?

- ( ) No
- ( ) Yes: Please describe your experience, or the type of impact/risk

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Successful deployment of responsible robots: avenues for improvement

The following questions will help us understand what are the key activities for the deployment of responsible robots.

* 13. Who is the actor whose efforts will have the most influence on the acceptabilit of robotics?

- ◯ Robot developers
- ◯ Policy-makers
- ◯ End-users
- ◯ Researchers
- ◯ Training institutions
- ◯ Other (please specify)

14. How can they concretely influence ? (optional)

* 15. For you, what are the most important criteria of excellence for a robot?

Rank these items in order of importance with 1 being most important and 6 least important.

- ≡ Functional efficiency
- ≡ Quality of the actions performed
- ≡ Productiveness
- ≡ Ease of use
- ≡ Capacity to make its actions understandable
- ≡ Harmlessness for users

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16. Do you think some important excellence criteria were missing from the previous question? Please specify (optional)

* 17. Are you aware of the regulations that apply to your own field of expertise in robotics?

- ◯ Yes, I am fully aware of them
- ◯ I am partially aware of them
- ◯ No, I am not aware of them

* 18. What tools would be needed to facilitate the responsible deployment of robots?

Choose as many options as relevant.

- ☐ Reference methods to assess their acceptability
- ☐ Certification procedure for safety
- ☐ Certification procedure for ethical compliance
- ☐ Supervision authorities to monitor manufacturers
- ☐ Technical guidance for the development of responsible robots
- ☐ Other (please specify)

19. If you have any additional input regarding the topics covered in the survey, please feel free to comment here.

20. If you are interested in receiving more information and participating in the further activities of Robotics4EU project, please leave your email address here.

Your email will be used only to contact you for purposes within this project, we will never give away your email to anyone else or use it for commercial purposes.

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Appendix E. Interview guide

General instructions for the interviewer:

- Maximum duration of the interview: 30 minutes
- Process of the interview: either the notes are taken by the interviewer during the interview, or the interview is recorded (with the explicit oral consent of the interviewee at the beginning of the interview) for an offline processing. The recordings are stored locally on the interviewer's computer only for the duration of the notes writing.
- The notes are anonymized, and the document containing the notes does not present any personally identifiable information. The interviewee is informed of the type of data that will be stored about himself/herself (country, gender and type of organization). The interviewer does a presentation of Robotics4EU project (context and goals), and the specific objective of the interview.
- At the end of the interview, the interviewee is offered to receive invitations for future events of Robotics4EU, which implies, upon his/her acceptance, that his/her email address will be transferred to the other partners. The list of email addresses (most of which being explicit about the individual's identity) are kept separately from the interview results to prevent linking the identity of the interviewee to his/her responses.

Question 1. Do you think that robots are already "acceptable" for an integration in society?

This question is voluntarily vague, general, to initiate a critical approach by the interviewee, to trigger questions on his or her side. Here, we expect the interviewee to tackle the notion of acceptability by firstly explaining the coverage of such a notion for him or her, which is in fact the main focus of the interviews.

Question 2. In your opinion, what are the vectors for an efficient adoption of robots?

We want the interviewee to identify ways current issues can be overcome. By discussing the potential boosters (vectors) for the adoption, we expected the interview to confirm/infirm the potential bottlenecks Robotics4EU partners identified in the D1.2.2 deliverable. Naturally, the interviewer does not provide a full list of issues (which would bias the approach), but can provide examples of issues (legal, ethics, etc.).

Question 3. What types of robots are critical in terms of adoption by society?

The interviewee is expected to identify if there are specific areas of robotics that need to be carefully tackled by the robotics community (at large, including policy-makers and developers), so as to facilitate adoption. Interviewees could answer by mentioning either robotics domains (defence, industry, etc.), or robot functions (safety checking, high-speed operations, interactivity, etc.), or robot's types (mobile robots, social robots, etc.).

Question 4. Are we ready, as a whole community, to integrate robots in our lives? (daily life, economic life, etc.)

This question echoes, in some sort, the first question of the interview. It is voluntarily large and vague, and is meant to: first, trigger reactions in the interviewee, and secondly to offer the possibility for the interviewee to add some nuance to his or her position, or even to express an opinion that may contradict his or her previous statements. To increase the emergence of strong expressions of opinions, the interviewee was encouraged to decide between either "Yes, we are ready", and "No, we are not ready".

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