Artificial intelligence, Data and Robotics ecosystem

https://adra-e.eu/

Call: A human-centred and ethical development of digital and industrial technologies 2021
Topic: Horizon-CL4-2021-Human-01
Type of action: Coordination and Support actions
Grant agreement Nº: 101070336

WP Nº3:	**ADR Awareness Centre**
Deliverable Nº3.1:	**Report on meta-analysis on externalities of acceptability and trustworthiness of ADR**
Lead partner:	**Linköping University**
Version Nº:	**1**
Date:	**28/02/2024**
Dissemination level[1]:	**PU**

[1] **PU:** Public**; CO:** Confidential, only for members of the consortium (including the Commission Services)

Document information	
Deliverable Nº and title:	D3.1 Report on meta-analysis on externalities of acceptability and trustworthiness of ADR
Version Nº:	1.0
Lead beneficiary:	Linköping University (LiU)
Author(s):	Katerina Linden (LiU)
Reviewers:	Fatemeh Ahmadi Zeleti (UoG)
Submission date:	28/02/2024
Due date:	28/02/2024
Type[2]:	R
Dissemination level[3]:	PU

Document history			
Date	Version	Author(s)	Comments
15/10/2023	0.1	Katerina Linden	Outline and structure, developing the first draft
15/01/2024	0.2	Katerina Linden	The second draft, updated with stakeholders' feedback
09/02/2024	0.3	Katerina Linden	Finalizing the version to be submitted for internal review
17/02/2024	0.4	Katerina Linden	Updating the Introduction to explain the iterative methodological approach
22/02/2024	0.5	Fatemeh Ahmadi Zeleti	Feedback provided
28/02/2024	1	Katerina Linden	Finalizing the report

[2] **R**: Report, **DEC:** Websites, patent filling, videos; **DEM:** Demonstrator, pilot, prototype; **OTHER:** Software Tools
[3] **PU:** Public**; CO:** Confidential, only for members of the consortium (including the Commission Services)

This publication has been produced with the assistance of the European Union. The content of this publication is the sole responsibility of the Adra-e consortium and can in no way be taken to reflect the views of the European Union.

The European Union is established in accordance with the Treaty on European Union (Maastricht). There are currently 28 Member States of the Union. It is based on the European Communities and the Member States cooperation in the fields of Common Foreign and Security Policy and Justice and Home Affairs. The five main institutions of the European Union are the European Parliament, the Council of Ministers, the European Commission, the Court of Justice and the Court of Auditors (http://europa.eu/).

Adra-e has received funding from the European Union's Horizon Europe under grant agreement 101070336.

Document summary

This deliverable presents an analysis of the externalities surrounding acceptability and trustworthiness in ADR-supported innovative technologies. Drawing from a diverse collection of business and academic reports, it provides a comprehensive examination of the strengths, weaknesses, opportunities, and threats associated with technology integration.

The study employs a multi-faceted approach, including academic literature analysis, report analysis, stakeholder interviews, a workshop, and a survey. The theoretical foundation rests on two main key pillars. Externalities are analyzed through the lens of the Three Pillars of Sustainability (Purvis et al. 2019). Secondly, the issue of barriers and challenges in the adoption of ADR-driven technologies is addressed using the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer 1990) and the Diffusion of Innovation (DOI) theory (Rogers 1995). The report proposes several useful mappings, such as mapping of stakeholders of ADR adoption, mapping of ADR externalities, and mapping of barriers for ADR adoption. The findings of this meta-analysis are then reformulated as recommendations, which undergo validation by stakeholders.

This deliverable illuminates the intricate interplay among the ADR technology, stakeholders, and societal considerations. It offers actionable insights to inform decision-making and drive sustainable technological integration within organizations, facilitating a balanced and sustainable trajectory in technological progress.

Table of Contents

List of Tables

List of Figures

1. Introduction

Unprecedented advancements in AI, data, and robotics (ADR) are rapidly transforming global economies, societies, and the business landscape. Digital transformation is no longer optional; it is essential for businesses to remain competitive and relevant. Organizations that fail to adapt risk being left behind. An all-inclusive engagement and collaboration are required in education and resources, targeting various stakeholders of ADR adoption, from industries to individuals. To address the challenges of this complex ecosystem, WP3 focuses on providing ADR educational materials, raising awareness of AI trustworthiness, and developing a framework for outreach and collaboration.

This task aims to identify the externalities impacting acceptability and trustworthiness of ADR-driven technologies through a comprehensive meta-analysis of stakeholder analyses and theoretical research. The findings are compiled as recommendations and validated by stakeholders throughout the research process. This report outlines the performed work, describing the research progress and the discoveries made along the way.

1. The Introduction section describes the objectives of the Work Package 3 and this particular deliverable and gives the document outline.
2. The Academic Background section establishes the theoretical foundation by synthesizing academic literature on ADR adoption and acceptance, covering key topics like Technology Acceptance Models, Stakeholder Analysis Approach, Externalities, and SWOT Analysis.
3. The Meta-Analysis Overview section outlines the conceptual framework for examining stakeholders, reports, and externalities related to ADR technology adoption. This section provides valuable insights into the challenges encountered in the process of data collection, categorization, and analysis.
4. The Externalities of Innovative Technologies supported by ADR section presents a detailed mapping of externalities, reorganizing them into a business-focused SWOT Analysis and incorporating stakeholder input from interviews, a survey, and a workshop.
5. The Analysis and Elevating the Discussion to the Meta-Level section critically evaluates the challenges and outcomes associated with the findings, examines barriers to ADR adoption, and discusses potential limitations of the approach.
6. The report concludes with the Recommendations and Takeaways section, offering actionable suggestions for ADR technology producers, implementers, and regulators to facilitate the successful integration of these technologies.
7. The Conclusion section provides a conclusion for the deliverable.

1.1 Approach, Methods and Structure Overview

This report utilizes hybrid qualitative analysis, combining multiple qualitative approaches to achieve methodological triangulation and enhance the validity and credibility of its findings. This deliverable combines Grounded Theory analysis with examinations of established frameworks and previous research, while networking results (interviews, a workshop, a survey) capture individual experiences. This approach was chosen to ensure optimal verification and refinement of findings: primarily, externalities of ADR adoption, with additional ones described later in the report.

This deliverable presents a report on meta-analysis, it describes the meta-analysis process, which is essentially iterative. Each iteration builds upon the previous one, incorporating new data from new sources, aiming to enrich previous findings. This approach emphasizes repeated cycles of data collection, analysis, conclusion drawing, and reanalysis with new perspectives or additional data. As each cycle builds upon the previous one, leading to a more refined and nuanced understanding, the process can be represented by a Gadamerian hermeneutic spiral of interpretation, essential for iterative research methodologies.

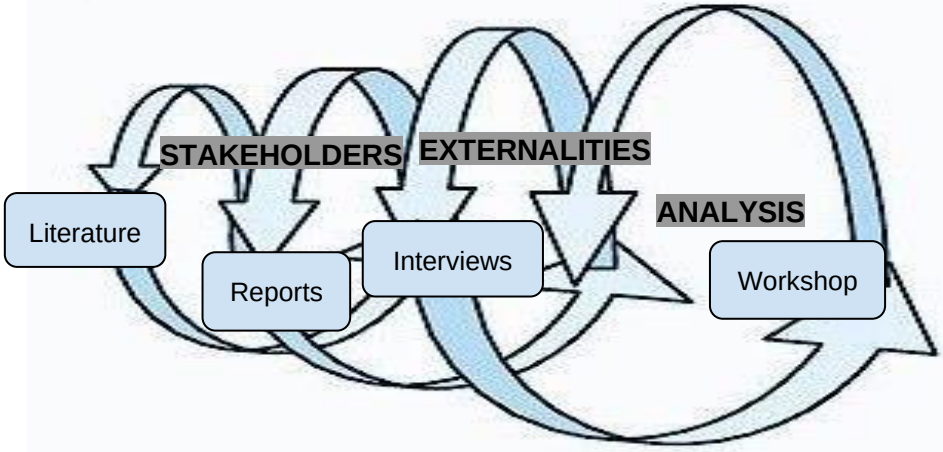


Figure 1: Hermeneutic Spiral of Research Methods

The Hermeneutic Spiral encourages a researcher to constantly question assumptions and interpretations, and it is particularly relevant in qualitative research, as with each layer of analysis, a researcher develops a richer understanding of the meaning behind the data. This approach was crucial for this report, as preliminary findings required verification by stakeholders of ADR adoption, who in turn enriched and contributed new findings. This explains the strong interconnectedness between research stages discussed in this report. Meta-analysis is a multilayered process, reliant on collecting and analyzing data from various sources.

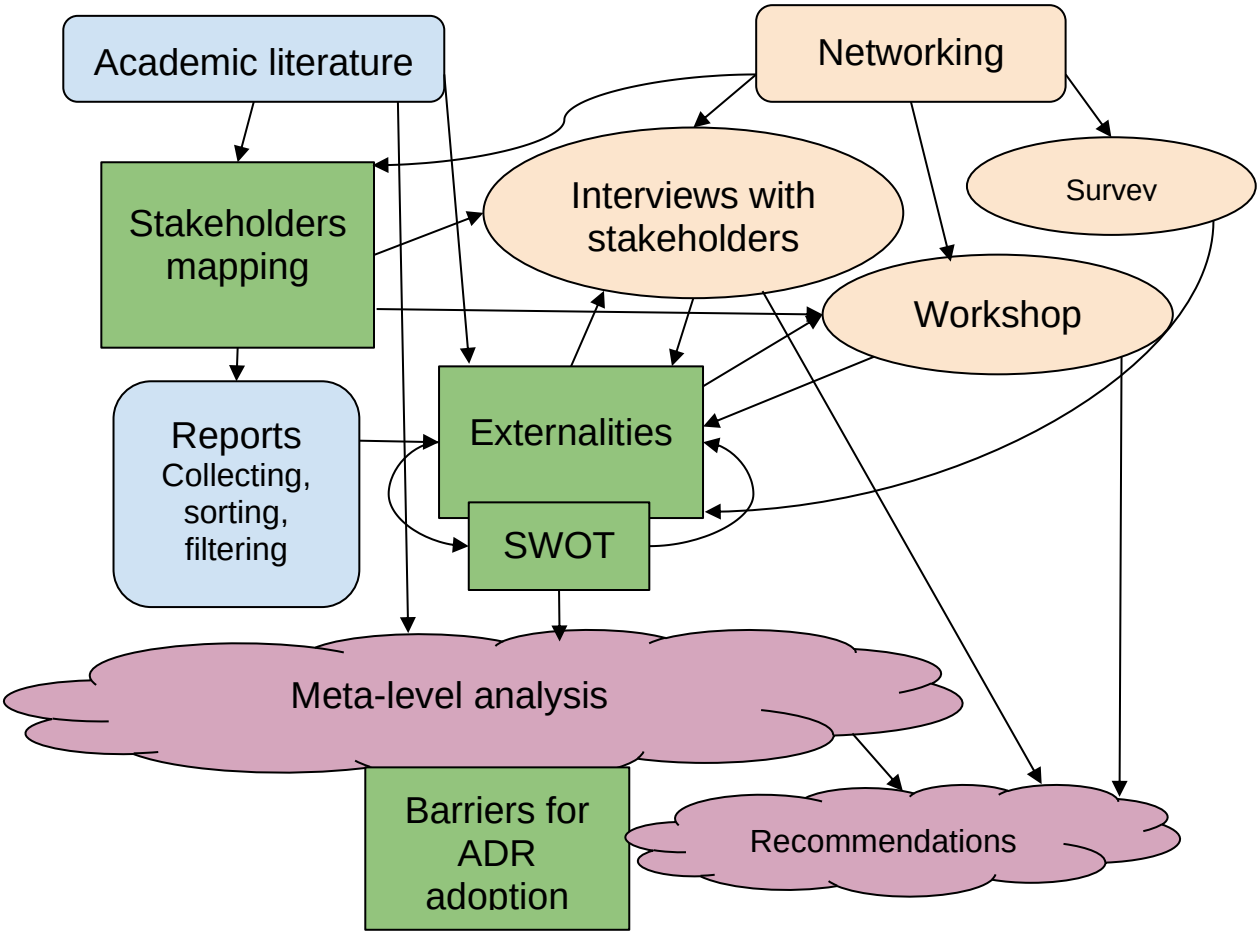


Figure 2: Report Structure and Internal Relations of Sections

This task was structured into steps as follows:

1. Conducted a thorough investigation of existing materials related to the task, reviewed pertinent research papers and analyses (June 2023).
2. Engaged in networking and social media discussions to gain firsthand insights into the stakeholder environment and their perception of ADR externalities; identified key stakeholders involved in the domain (July 2023).
3. Collected analyses and reports focusing on identified stakeholders groups to enable a meta-analysis; developed a framework for summarizing and interrelating the identified reports (August 2023).
4. Conducted a preliminary analysis of the compiled reports; drafted an initial mapping of externalities based on academic resources, networking, and report analyses (September 2023).
5. Conducted initial stakeholder interviews to validate findings and gather additional data; reformulated the externalities mapping as a SWOT analysis for more efficient interviews with business representatives. Updated the framework based on insights from the interviews. Formulated a survey based on the refined framework (October 2023).
6. Engaged in networking and attended various events to connect with stakeholders, seeking feedback, interviews, survey participation, and invitations to a future workshop; continued to refine the externalities mapping based on feedback (November 2023).
7. Organized a workshop to present the initial meta-analysis findings to key stakeholders, seeking their feedback and involvement in formulating recommendations (December 2023).
8. Compiled a semi-final draft of the report (January 2024).
9. Soliciting feedback from reviewers and producing the final report (February 2024).

The deliverable follows the research process, describing its progress and achievements. As illustrated in Figure 2, the fundamental starting points of the work on this analysis, literature research, and networking, allowed for the next step: stakeholder identification. This, in turn, led to the selection of relevant individuals and reports for analysis. The reports formed the basis for the initial externalities formulation, which was then refined through stakeholder communication. Initial interviews revealed the need to transform the externalities into a SWOT framework for business-oriented interviews. Subsequent interviews and stakeholder interaction further refined the externalities analysis. Each new level of interaction resulted in an updated version presented to stakeholders, allowing for continuous improvement and iteration. Ultimately, the accumulated knowledge from the theoretical literature, stakeholder interaction, and the formulated externalities/SWOT mappings enabled the construction of this meta-analysis, the identification of key aspects for consideration, and the development of overall recommendations. This iterative process will be described in the next sections.

2. Academic Background

This section presents all theoretical concepts and theories addressed during the work, describing the perspective in which they were utilized. We prioritize mentioning research papers that synthesize existing studies in fields relevant to ADR development and adoption. The section begins with general papers on ADR development, followed by an overview of technology acceptance models, stakeholder theory, a brief explanation of the theory of externalities, and a SWOT framework.

2.1 Overview of Existing Academic Work related to the Task

While academics have discussed the dangers and benefits of AI for decades (Bellman 1978, Haugeland 1985), the actual economic (Duan et al. 2019) and social (Kopka and Grashof 2022, Dwivedi et al. 2023) effects of the prompt development of ADR technologies have only recently been profoundly explored, and this process is on the rise. Researchers are addressing associated challenges and opportunities within various scientific disciplines, including health sciences

(Nadarzynski et al. 2019. Hua et al. 2024), biology (Albahri et al. 2020), business management (Borges et al. 2021), the public sector (Di Vaio et al. 2022), sustainability (Dubey et al. 2019), media and communications (Sadiku et al. 2021), marketing (Reisenbichler et al. 2022), ethics (Bossman 2016), and psychology (Park and Woo 2022). It has been established that AI-driven digital technologies have strong potential to revolutionize research, disrupt business models, and enhance productivity (Wilson & Daugherty 2018), reduce waste, and enable organizations to become agile to enhance stakeholder experience (Chauhan et al. 2022). A rather limited amount of social sciences research has been devoted to aspects of trust and trustworthiness (Schepman and Rodway 2023), and such works often concentrate on end-users (Méndez-Suárez et al. 2023, Labajová 2023), highlighting the lack of ADR literacy and awareness (Arrieta et al. 2020). These papers served as a preliminary academic background review for this report, enabling an understanding of the challenges, opportunities, and effects that ADR technology development leads to. They also provided a basis for the initial formulation of externalities related to the acceptability and trustworthiness of innovative technologies supported by ADR.

Various nuances of adoption, perceptions, and acceptance of ADR technologies were discussed from personal, industrial, and social points of view, stressing a variety of cultural scenarios and attitudes (Kelly et al. 2023). Research overviews (Radhakrishnan and Chattopadhyay 2020, Gerlich 2023) indicate that the most frequently used theories to assess the acceptability of AI technologies in research papers are TAM and TOE.

2.1.1 Technology Acceptance Models

Several technology acceptance models have been developed by researchers over the years to address specific tasks. Among the most universal ones are TAM, TOE, and DOI (Al-Mamary et al. 2016, Lai, 2017). We delved into the approaches of these models, aiming to identify the optimal one for this particular task. This exploration led to the formulation of a hybrid version based on their principles.

The Technology Acceptance Model (TAM) is the oldest and one of the most widely used theoretical models that explain factors influencing or predicting people's motivation to adopt new technologies (Davis 1986). According to TAM, the acceptance of technology is influenced by perceived ease of use, perceived usefulness, and subjective norm or perceived satisfaction (Davis 1989). Originally, TAM was used to address the general acceptance of computers. However, the rapid development of technologies has seen an expansive use of TAM to examine the diffusion of different new technologies (Marangunić & Granić 2014). The main focus of TAM is individual user acceptance.

The Technology, Organization, and Environment (TOE) framework (Tornatzky & Fleischer 1990) explains the external factors that contribute to decision-making in technology adoption at the organizational level. It consists of three main constructs: technology, organization, and environment. The technology dimension captures the characteristics of the innovation, including its complexity, compatibility, and observability. The organization dimension focuses on organizational factors such as top management support, organizational structure, and organizational culture. The environment dimension encompasses external factors such as market conditions, competitive pressures, and regulatory environments. These parameters align with the objectives of this report, aiding in uncovering the externalities related to the acceptability and trustworthiness of ADR adoption. However, they solely address external factors and do not pay attention to personal individual motivation and behavior as influenced by the social system (Awa et al. 2017).

The Diffusion of Innovation (DOI) theory (Rogers 2003) outlines the social aspects of technology adoption, demonstrating the characteristics of an innovation, the communication channels used to diffuse the innovation, and the features of the social system influencing the rate of adoption. The five key attributes of an innovation are relative advantage, compatibility, complexity, trialability, and observability. This theory specifically addresses the aspects of technology adoption related to a particular social system in which developments take place.

To summarize and compare these models, TOE demonstrates a comprehensive focus on organizational and environmental aspects, whereas TAM accentuates the psychological individual perspective, and DOI is more sociologically oriented. TAM and TOE focus more narrowly on perceived ease of use and usefulness, while DOI focuses on various innovation characteristics. TAM specifically considers user attitudes at a given point in time, while DOI emphasizes the gradual diffusion process over time.

These theoretical frameworks have been applied in academic research on the adoption of ADR technologies, and there are comprehensive overviews dedicated to this specific research area. These overviews address various stakeholders, economic and social issues, and different countries (Turja & Oksanen 2019, Na et al. 2021, Horani & Al-Adwan 2023), among others. For this task, an alternative framework was formulated based on TOE and DOI. It will be presented in the relevant section, Section 5: Analysis and Elevating the Discussion to the Meta Level.

2.1.2 Stakeholder Analysis Approach

The foundational task of this deliverable was to identify stakeholders in ADR adoption since they are the ones whose input was to be collected and analyzed. General papers overviewing different approaches to stakeholder classification in ADR-related projects cover various types of stakeholder engagement (Lima 2020, Lebcir et al. 2021, Miller 2022, Deshpande & Sharp 2022). Previous research exists on stakeholders of AI adoption in public administration (Madan & Ashok 2023), healthcare (Scott et al. 2021), business (Cubric 2020), project management (Miller 2022), and within other specialized fields, but finding general societal stakeholders of ADR adoption mapping appeared to be challenging. Several stakeholder theories provide useful frameworks for understanding and managing stakeholder relationships. Examples include Classical Stakeholder Theory (Freeman 1984), Stakeholder Salience Theory (Preece et al. 2018, Mitchell, Agle, & Wood 1997), and Network Stakeholder Theory (Rowley 1997). The majority of theories distinguish stakeholders based on their levels of power, influence, interests, and benefits, and the choice of a stakeholder theory depends on the context and objectives of the task. After familiarizing with different stakeholder theories, a decision was made to make an alternative stakeholder mapping based on the levels of stakeholders' influence in the technology development and adoption process. The identification of potential stakeholders began with a thorough review of relevant literature, active participation in meetings and events, and a comprehensive understanding of their interests, power, and potential impact. Subsequently, stakeholders were grouped into categories based on their primary interests or roles in the AI adoption process. To map stakeholder relationships, clear stakeholder mapping techniques were employed to illustrate and understand the relationships between stakeholders. This mapping will be presented and explained in subsection 3.1: Identifying Stakeholders in ADR Technology Adoption.

2.1.3 Externalities

The term "externality," common in economics, refers to the unintended effects an economic activity has on unrelated third parties (Stantcheva 2017). These secondary consequences impact individuals, organizations, or groups without their direct involvement in the transaction. Depending on their impact, externalities are classified as positive or negative. Positive externalities offer benefits to third parties without incurring costs, while negative externalities impose costs on them without their consent (Buchanan 1962). Externalities play a crucial role in various economic growth theories.

However, limited research addresses externalities specifically related to ADR adoption. The existing ones solely address externalities of AI usage and cover relevant areas like urbanistics (Yigitcanlar et al. 2021), agriculture (Tzachor et al. 2022), or banking chatbots (Parthiban & Adilb 2023). This report aims to contribute new knowledge by identifying the externalities of ADR adoption and facilitating the development of informed recommendations for their responsible and ethical utilization. For this task, we categorize externalities into three interconnected sectors of the Sustainable Development framework: environment, society, and economy. This framework will be further explored in a dedicated section on the externalities of ADR.

2.1.4 SWOT Analysis

SWOT is a comprehensive and structured strategic planning tool that helps businesses and industries of all sizes to evaluate their business opportunities and gain a comprehensive understanding of an organization's internal and external environment (Silva 2005). SWOT analysis provides way to assess the potential impacts of ADR technologies for business owners. By considering the strengths, weaknesses, opportunities, and threats of ADR technologies, they can gain a clear understanding of the potential impacts and make informed decisions.

While research using SWOT in relation to ADR technologies remains limited, it has been applied in academic literature on AI implementation across various sectors, including business (Koos et al. 2017), healthcare (Mumuni et al. 2023), sustainable development (Palomares et al. 2021), and education (Chhetri 2023). Numerous articles discuss the strengths, weaknesses, opportunities, and threats of AI in general (EasyBA.co 2023). However, no existing work applies SWOT specifically to the combined domain of AI, data, and robotics-driven technologies.

In this task, we employed SWOT analysis as an additional step to identify externalities and facilitate productive discussions with business owners regarding various aspects of ADR adoption, seeking their opinions and feedback. The SWOT matrix and relevant discussions will be presented in subsection 4.2.1 SWOT Analysis and Discussion.

2.2 Developing Strategies and Frameworks for the Task

For this task, several theories described above were used and reframed, creating specific mappings, or cartographies, to assist in visualizing findings. In identifying stakeholders and crafting the stakeholder mapping presented in this document, a step-by-step investigation was conducted. This involved drawing insights from an extensive review of research papers and analyses, along with active engagement in physical networking and social media discussions. This comprehensive approach aimed to gain firsthand insights into the complex landscape of stakeholders involved in the adoption and implementation of ADR technologies within the European Union. The resulting structure positions stakeholders vertically, aligning them based on their relative influence, with those at the apex wielding the most significant power, capable of shaping the landscape for those positioned below.

For externalities identification and mapping, a special cartography was created. The table structures the list of positive and negative externalities of ADR technologies usage for implementers, according to the three pillars of Sustainable Development: Economy, Environment, and Society. Sustainable Development (SD) is a widely accepted framework used by governments, businesses, and civil society organizations worldwide, making it a useful tool for communicating the impacts of ADR technologies and building consensus on how to address them (Vinuesa et al. 2020).

The SWOT matrix used an existing approach without additional modifications. However, for technology acceptance mapping, some alterations were made. The Technology-Organization-Environment (TOE) framework provides a solid foundation for understanding the technological and organizational factors influencing ADR adoption. Still, it lacks consideration of the social and human dimensions of technology adoption, which are increasingly important. The Diffusion of Innovations (DOI) framework is valuable for understanding the early stages of adoption but falls short in addressing long-term strategic aspects of ADR adoption. In this document, we propose an alternative framework that combines the strengths of both the TOE and DOI frameworks to identify issues of trustworthiness and acceptability of ADR-driven technologies. This framework includes four dimensions: Technology, Organization, Environment, and Individual, or Human factors.

The following sections will sequentially present these cartographies and provide associated discussions.

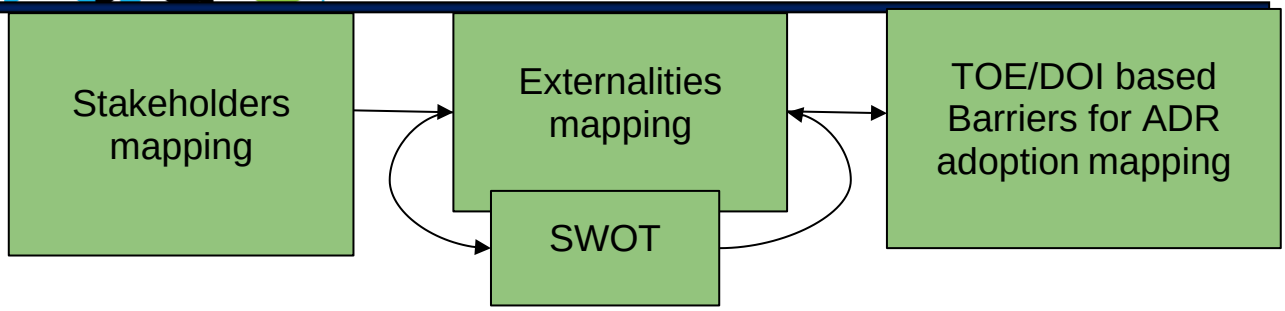


Figure 3: Mappings Created for the Task, Based on Existing Academic Frameworks

3. A Meta-Analysis Overview

A meta-analysis combines the findings from independent studies to provide a quantitative summary of the overall effect of a particular intervention or relationship. In this section, we discuss the approach to the identification of the key stakeholders of ADR adoption and present a mapping of stakeholders used for the further identification of reports and persons to interview. Next, we describe the process of meta-analysis, starting with collecting reports, sorting, and removing irrelevant ones, and then collecting and categorizing data.

3.1 Identifying Stakeholders in ADR Technology Adoption

In crafting the stakeholder mapping presented in this document, a step-by-step investigation was conducted, drawing insights from an extensive review of research papers and analyses, coupled with active engagement in physical networking and social media discussions. This comprehensive approach aimed to gain firsthand insights into the complex landscape of stakeholders involved in the adoption and implementation of ADR technologies within the European Union. Initially, we began with a very detailed structure that separated stakeholders according to their areas of expertise, professional industries, organizational types and sizes, job positions, geographic locations, and various levels of interest in ADR development. Subsequently, we narrowed down the approach as well as the scope of stakeholders to those general groups that consistently mention ADR developments in the content they produce, including press releases, articles, and, most importantly, reports. Crucially, these stakeholders possess the power to influence the development and adoption of ADR technologies. The resulting pyramid structure positions stakeholders vertically, aligning them based on their relative influence. Those at the apex wield the most significant power, capable of shaping the landscape for those positioned below. Structuring stakeholders in a pyramid-like hierarchy, similar to Maslow's Hierarchy of Needs, provided a valuable visual representation for understanding the relevance and impact of different stakeholders within a specific context. This approach helped prioritize stakeholders based on their importance and influence.

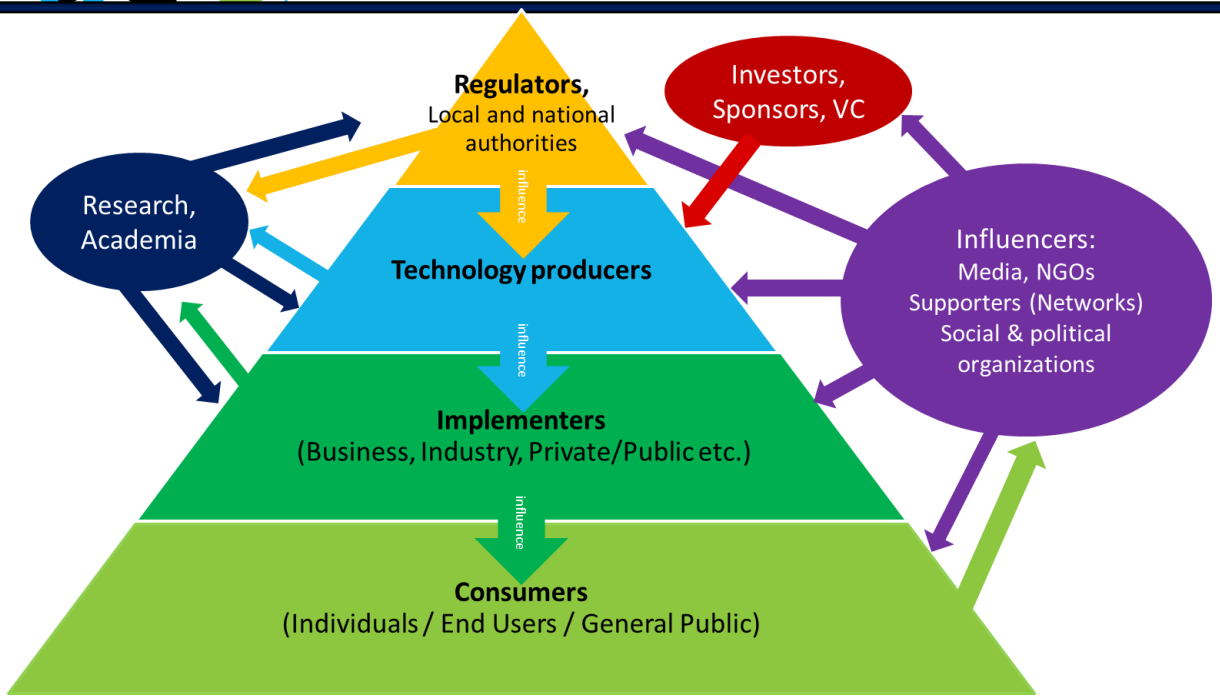


Figure 4: The Stakeholder Mapping Model

Regulators, local and national authorities

At the top of this pyramid, local and national authorities and regulators are positioned, representing the government bodies entrusted with establishing the policies and regulations that govern ADR implementation. They hold the highest level of decision-making power, granting them the authority to control how technologies should be developed and adopted. They are responsible for ensuring the safe and ethical implementation of these technologies, considering public safety, privacy concerns, and potential biases. While their decisions can be influenced by researchers, public opinions, and feedback from technology producers and implementers, they occupy the most influential position, as their actions directly impact all other stakeholders.

Technology producers

Directly below the regulatory bodies are technology producers, the primary catalysts for innovation and development in the AI realm. These are the companies that bring ADR technologies to life, encompassing large corporations, startups, and research institutions. Their decisions regarding product design, development, and deployment have a profound impact on the overall adoption of these technologies. They are responsible for shaping the product's form and functionality, driving innovation, and profoundly impacting society with their creations. Technology producers maintain close ties with academia, regulators, and investors, as each group exerts some degree of control over the quality and content of their products.

Implementers

Beneath technology producers in the stakeholder influence model are technology implementers, comprising a diverse array of businesses and industries, both private and public entities, responsible for transforming technological advancements into real-world applications. They connect technology producers with end users, tailoring solutions to specific needs and environments. Their expertise and understanding of real-world applications play a vital role in ensuring the successful adoption and integration of ADR technologies. They rely heavily on funding, regulations, and technology producers. At the same time, they maintain the closest connection with end users, as their products and services are directly tailored to consumers' needs and preferences.

Consumers

At the foundation of the pyramid lie the ultimate beneficiaries – consumers (who can also be referred to, depending on the context, as individuals, end users, or the public). Their experiences and expectations play a significant role in shaping the direction and success of ADR implementations. This is the largest group of stakeholders, yet they possess the least direct influence. While their feedback is essential for all other groups, they lack the power to directly alter technology production or regulation. Instead, they must channel their message through other organizations and share their opinions.

Research and Academia

This group of stakeholders represents the institutions dedicated to fostering ADR knowledge and skill development. They generate knowledge, acquire insights into the intricacies of technology and society, and produce analyses that are crucial for key decision-makers, including regulators and technology producers. In turn, funding bodies that support academic research and innovation can influence the direction of this research to a certain extent. Moreover, academia imparts education to the upcoming generations of technology users and producers, potentially equipping society with technological literacy and an ethical approach to ADR development.

Influencers

Various types of influencers, representing media, NGOs, supporters (networks), social and political organizations, experts, and opinion leaders are shaping public perception. Media outlets are disseminating information about ADR technologies, shaping public discourse, and influencing perceptions, but they can also perpetuate biases and misinformation, leading to inaccurate or incomplete understandings of ADR. Non-governmental organizations (NGOs) and advocacy groups are increasingly engaged in shaping public perception and influencing ADR development, as they advocate for responsible ADR development, highlighting ethical concerns and promoting policies that protect human rights and prevent bias. Social and political organizations, such as unions, political parties, and community groups, are involved in shaping public perception and influencing ADR adoption, as they raise concerns about the impact of ADR on jobs and society, and advocate for policies that address these concerns. They can also be instrumental in mobilizing public opinion. Aside from that, various experts and opinion leaders, such as celebrities, journalists, and technologists, can reach large audiences and influence public opinion through their endorsements, discussions, and perspectives on ADR.

Investors

Venture capitalists and investors play a crucial role in influencing ADR development through their financial support, strategic guidance, and industry connections. Investors also influence the focus areas of ADR development. Specializing in specific sectors or industries, their decisions guide resources toward applications aligned with their expertise and market trends.

The pyramid design suggests a prioritization scheme where the most critical stakeholders are placed at the top, and those with lowest relevance and impact are positioned at the base. Arrows connecting stakeholders visually convey the trajectories of influence, with the middle arrows denoting primary channels of impact. However, the complex interplay among stakeholders introduces additional trajectories and relationship nuances that warrant separate and in-depth discussion to comprehensively capture the dynamics of the ADR stakeholder ecosystem.

The stakeholder mapping provided a framework for identifying the key players involved in ADR adoption and their respective levels of influence. This understanding is crucial for developing strategies to promote the responsible, ethical, and successful implementation of these transformative technologies.

3.2 Reports: Collecting, Sorting, and Filtering

In order to effectively analyze the adoption of ADR-driven technologies, it was crucial to identify and understand the key stakeholders involved and their respective levels of influence. This stakeholder mapping revealed the types of stakeholders to look for while collecting reports and associated information: regulators, technology producers, influencers, implementers, and consumers. The following research revealed that collecting reports from academia, regulators, and technology producers was relatively straightforward, as these stakeholders have established channels for disseminating their insights. However, obtaining relevant information from implementers proved more challenging, as their reports often encompassed a broader range of topics, irrelevant to the objectives of this document. This issue was addressed later (see Section 4.2 Stakeholders feedback) by conducting interviews and surveys with implementers to gather specific data on ADR adoption. In contrast, the volume of publications, articles, and blog posts generated by influencers posed a challenge in filtering out quality content. While the sheer volume of information was impressive, it required careful evaluation to identify reliable and relevant sources. Finally, obtaining feedback from investors and consumers proved to be the most difficult task. As their direct influence on ADR adoption is more limited, they are not as actively engaged in producing or sharing information on this topic. However, their perspectives would be valuable for a more comprehensive understanding of stakeholder involvement in ADR adoption.

The next step was to identify relevant reports. For this purpose, we used Google search and looked for the following keywords: business, industry, organization, analysis, report, AI, data, robotics, innovation, technologies, digital, digitalization. Reports that appeared in the search needed to be opened or downloaded (sometimes requiring the provision of an email, and the report was sent via email) and then preliminarily inspected for relevance. Marketing materials and advertisements were removed, as well as reports produced by students and pupils. Reports that included the majority of search words but were completely missing AI, data, robotics, digital, or digitalization were also eliminated for lack of relevance. Only reports produced during 2022 and 2023 were taken into account. As a result, 168 reports were selected for further analysis (the full list can be found in the Appendix). After that, the data collection process commenced with the establishment of clear selection criteria to identify relevant reports and sources. These criteria focused on three key dimensions:

- **Relevancy to ADR Adoption:** The reports should address, to some degree, the adoption and implementation of ADR technologies
- **Focus on Externalities**: The reports should mention the potential externalities, or some positive and negative aspects of ADR adoption
- **Quality and Credibility:** The reports should be produced by reputable sources, such as academia, research institutions, regulatory bodies, technology companies, and well-recognized businesses

To efficiently review a vast majority of reports in a shorter time, we utilized the assistance of Atlas.ti, a qualitative data analysis software that allows for AI summarization. As a result of reviewing numerous summaries, reports were assessed to ensure their relevance to the topic of the adoption and externalities of ADR technologies, considering factors such as credibility, clarity, and overall information quality. The quantity of reports reduced to 89, as some were dismissed during this evaluation stage. Following this, the remaining relevant reports underwent a detailed thematic analysis process to collect information related to ADR adoption externalities.

3.3 Identifying Externalities: Data Extraction and Categorization

Thematic analysis served as the primary method for analyzing stakeholder reports and constructing a structured list of externalities. This qualitative research approach involves identifying, analyzing, and interpreting recurring patterns or themes within a body of text (Maxwell 2013). In thematic analysis, the researcher carefully reads the documents and identifies segments or passages that

relate to the research topic. These segments are then coded or labelled with descriptive keywords or phrases that capture the essence of the content. As the researcher continues to read, they discover that certain topics appear repeatedly, indicating the presence of broader themes. These themes represent the core concepts or ideas that emerge from the data. In the context of this document, the sought-after themes were negative and positive effects associated with the adoption of ADR-driven technologies. Throughout the analysis process, similar themes indeed emerged consistently, observed across all types of reports.

Thematic analysis is a flexible and adaptable method that can be used to study a wide range of topics and data sources, including written documents, transcripts of interviews, and visual materials. This aspect was especially relevant for this meta-analysis, as materials often included graphical information and interviews. It is particularly well-suited for exploring complex or nuanced phenomena that may not be readily quantifiable. Based on these qualities, this method was chosen, and it proved suitable for conducting a meta-analysis of existing stakeholder analyses, successfully enabling the identification of recurring topics, specifically the externalities of acceptability and trustworthiness of ADR-driven technologies.

The data extraction and categorization process involved a step-by-step approach to systematically analyze the reports and identify the following:

- **Type of Externality:** Categorized into positive and negative externalities
- **Area of Impact:** Categorized into various areas, such as economy, environment, and society
- **Specific Externality:** Identified the specific externalities mentioned in the report, such as job displacement, bias, or privacy concerns
- **Conduct thematic analysis:** Identified recurring themes in the reports through the systematic categorization of data to identify patterns, including information that indirectly relates to one of the externalities

One of the most significant challenges was to identify a suitable organizing framework for the diverse range of externality parameters. In a result, categorizing externalities into three pillars of Sustainable Development (Purvis et al. 2019) provided the most effective approach. SD is a holistic perspective that encompasses the economic, environmental, and social impacts of development. This framework aligns well with the complex and far-reaching effects of ADR technologies and facilitates a comprehensive analysis. The three pillars of SD are economy, environment, and society.

Economy

This pillar focuses on ensuring that economic growth is sustainable and inclusive. This means that economic growth should not come at the expense of the environment or social well-being. It also means that the benefits of economic growth should be shared equitably among all people.

Environment

This pillar focuses on protecting the environment and ensuring that natural resources are used sustainably. This means protecting air and water quality, reducing greenhouse gas emissions, and conserving biodiversity.

Society

This pillar focuses on promoting social equity and justice. This means ensuring that all people have access to basic needs such as food, water, shelter, and healthcare. It also means protecting human rights and promoting tolerance and understanding.

These three pillars are deeply interconnected. For instance, economic growth can be achieved without compromising environmental integrity when pursued in a sustainable manner.

Simultaneously, environmental protection can yield economic benefits, such as increased tourism revenue (Vinuesa et al. 2020).

SD is a universally adopted framework employed by governments, businesses, and civil society organizations globally (Witteloostuijn 2023). This makes it a valuable tool for communicating the impacts of ADR technologies and fostering consensus among ADR adoption stakeholders on how to address them. Overall, the three pillars of SD provide a comprehensive and nuanced framework for understanding the impacts of ADR technologies. It also highlights how these technologies can be utilized sustainably and benefit society. This information can be utilized to inform decision-making regarding the development and deployment of ADR technologies, ensuring that the positive impacts of new technology implementation outweigh the negative ones.

Data extraction and thematic analysis served as interlinked components of an iterative process. Once the themes, or externalities, were identified and structured according to the SD pillars, it was crucial to engage with experts in the field to ensure that the captured themes and factors related to the externalities of acceptability and trustworthiness were accurate and relevant (see Section 4.2 Stakeholders feedback). Their feedback assisted in refining or confirming findings and propelling the process forward. Subsequently, the extracted, categorized, and stakeholder-validated information was employed to create a comprehensive map of externalities associated with ADR adoption. This visual representation effectively visualized the distribution of externalities across various areas of impact, as will be presented and discussed in the subsequent section.

4. Externalities of Innovative Technologies supported by ADR

Externalities hold significant importance for various economic growth theories and business management practices. However, as of now, no academic research has been undertaken to evaluate the externalities of AI, data, and robotics-driven technology adoption. To effectively identify and classify externalities related to the acceptability and trustworthiness of innovative ADR-supported technologies, a comprehensive data analysis process was undertaken, and its findings will be presented below.

4.1 Mapping Externalities: An Overview

The following table summarizes the findings, or mapping, of externalities that occur during the adoption process of ADR-driven technologies. This analysis is grounded in academic resources, networking, and report analyses. The findings are further validated through interactions with stakeholders, which helped confirm the structure presented below and gather additional data. It primarily focuses on one group of stakeholders: implementers. These stakeholders are extensively discussed in reports developed by academia and regulators, as they play a critical role in the technology adoption process, directly impacting end users. Moreover, implementers are a group of stakeholders who provide the most feedback. Nevertheless, these externalities impact all stakeholders as they encompass a broad spectrum of sustainable development aspects, covering countries (economy), territories (environment), and societies (society) at large. Each stakeholder group shares a responsibility in maximizing positive externalities and minimizing negative externalities of ADR adoption.

Table 1: Positive and Negative Externalities of ADR-driven technologies adoption, structured by the Three Pillars of Sustainable Development

Pillar	Positive Externalities	Negative Externalities
Economy	• Economic growth • New business models, new markets, new jobs • Improved customer satisfaction & loyalty	• Job displacement • Income inequality • Economic disparities (digital divide) • Legal and ethical issues with long-term effects
Environment	• Improved resource management (energy, water, waste) • Sustainability (agriculture, industries) • Environmental monitoring, climate change mitigation • Natural disaster response	• Considerable energy consumption • Potential electronic waste
Society • **Science & innovation driven areas** **(Healthcare, agriculture, transportation, etc.)**	• More discoveries, innovations • Improved speed, optimization and accuracy of work, etc. • Improved general quality of life	• Overreliance on technology, reduced human judgment • Unequal access to innovations, digital divide • Ethical & legal issues, lack of accountability & transparency
• **Accessibility**	Inclusivity	Digital divide, discrimination
• **Security**	Safety increase Reducing human errors	Privacy issues, data breaches, algorithmic bias, vulnerabilities, malfunctions etc.

Pillar	Positive Externalities	Negative Externalities
• **Trust**	Improved collaboration & user experience, decision-making, problem solving	Usage errors (systemic racism, disinformation), misusage with mean intentions etc.

As it can be seen, there is a considerable amount of both positive and negative externalities that must be taken into account when implementing ADR-driven technologies.

Economy

On the positive side, ADR technologies hold the key to driving economic growth by enhancing productivity, optimizing resource allocation, and fostering innovation. Automation and AI can streamline processes, reduce costs, and drive efficiency, leading to increased output and profitability. Additionally, ADR-enabled applications can create new market opportunities and generate economic activity in various sectors. Beyond economic growth, ADR has the potential to spawn entirely new business models and create a surge of employment opportunities. AI-powered platforms can facilitate new forms of collaboration, communication, and service delivery, giving rise to innovative businesses that redefine industry norms. ADR can automate routine tasks, freeing up human workers to focus on more complex and strategic roles, generating new employment opportunities. Moreover, ADR technologies empower businesses to personalize customer experiences, leading to improved customer satisfaction and loyalty, which further contributes to economic prosperity.

However, the transformative impact of ADR-driven innovations also brings forward potential challenges to economic development. Job displacement, a critical social concern, emerges as ADR automation eliminates certain tasks, potentially impacting low-skilled workers. This may lead to income inequality between more and less technically adept groups, further widening the digital divide in societies. The uneven playing field for those with access to these advanced technologies and those without, coupled with the emergence of unforeseen legal and ethical issues that may arise from such inequality, poses a risk of long-term negative consequences that are difficult to predict.

Environment

Next, the environmental externalities associated with ADR adoption are important to take into account in order to ensure that progress is achieved in harmony with sustainability principles. On the positive side, ADR technologies hold the key to optimizing resource utilization in energy, water, and waste management. Smart grids powered by ADR can balance energy demand and supply, reducing reliance on fossil fuels and integrating renewable energy sources more effectively. Similarly, ADR-enabled water management systems can optimize water usage and detect leakages, contributing to water conservation efforts. Precision farming utilizing ADR technologies are aiming to optimize fertilizer application, reduce water consumption, enhance crop yields, and minimize the environmental impact of agriculture. Similarly, ADR can optimize industrial processes and contribute significantly to environmental monitoring and climate change mitigation. Moreover, ADR plays a crucial role in climate change mitigation efforts, developing carbon capture technologies, and simulating climate models for informed decision-making.

Despite these promising benefits, ADR technologies also raise concerns about their environmental footprint. The manufacturing, operation, and maintenance of ADR systems necessitate substantial energy consumption, potentially contributing to greenhouse gas emissions and energy demands. The rapid advancement of ADR technologies leads to a growing stockpile of electronic waste, posing environmental risks from hazardous materials and improper disposal. To address these negative environmental externalities, a responsible and sustainable approach to ADR development and deployment is paramount.

Society

On a societal level, there are many potential positive developments coming together with a wider ADR-technologies adoption, especially in the fields directly rooted in innovations, such as health and science, leading to breakthrough discoveries. Personalized treatment plans, remote monitoring systems, and early disease detection capabilities can transform healthcare practices, while AI-powered tutors and immersive learning experiences can revolutionize education. ADR can also bridge cultural divides and foster inclusivity through language translation tools and virtual communities.
However, these transformative benefits are accompanied by potential social challenges that demand careful consideration. The collection and analysis of vast amounts of personal data by ADR systems raise concerns about privacy violations and the potential for discrimination. Algorithmic biases, embedded in the data or the algorithms themselves, can perpetuate inequalities and lead to unfair outcomes, particularly in areas like hiring, loan applications, and criminal justice. Moreover, the increasing sophistication of ADR technologies raises the specter of misuse for social manipulation, suppression of dissent, or even physical harm. The lack of transparency and explainability in ADR systems raises concerns about accountability and ethical decision-making.

It is crucial to carefully consider these externalities and adopt responsible practices to mitigate negative impacts and maximize positive outcomes. All stakeholders described in section 3 of this document must pay attention to these issues and take actions in order to ensure that ADR technologies contribute to a sustainable and equitable future.

4.1.1 Exploring Acceptance and Trust: Uncovering Externalities in ADR-Driven Innovations

As it can be seen from the externalities mapping, the adoption of ADR-driven innovative technologies carries the promise of positive benefits, ranging from advancements in health and education to sustainable resource management and economic growth. However, beneath the surface of these potential advantages lie two critical externalities that have the power to shape the general outcomes of ADR implementation: the externalities of security and trust. The successful realization of benefits in healthcare, research, education, and many other sectors hinges on the effective management of these two externalities. Security is a paramount concern in the adoption of ADR-driven technologies. Instances of data breaches, algorithmic biases, technical malfunctions can undermine the functionality of ADR systems, leading to unpredictable and potentially negative consequences. The impacts on economy, environment and society can be compromised if the foundation of security is not robust. This is the reason why negative externalities of security have the potential to erode trust in ADR technologies, creating a barrier to their acceptance.

Trust, as a cornerstone of the acceptability of ADR-driven technologies, is interlinked with security. Lack of transparency and accountability, coupled with non-ethical approaches, can contribute to a deficit of trust among users. The importance of trust cannot be overstated, as the acceptance of ADR-driven technologies is contingent upon people's confidence in their safety. Without trust, the adoption of these technologies is hindered, as individuals may be reluctant to rely on systems they perceive as untrustworthy. It is imperative to recognize that the externalities demonstrated in this

externalities mapping are all inherent to the adoption of ADR-driven technologies. The potential benefits for economy, environment and society outlined in the table are contingent on successfully navigating negative externalities of security and trust.

To summarize, the significance of the externalities of acceptability and trustworthiness of ADR-driven innovative technologies can be visualized through two distinct paths that every technology adopter and implementer must navigate when contemplating their use. Individuals either wholeheartedly embrace these technologies, recognizing their value and trusting their capabilities, thus actively employing them. Alternatively, they may develop doubts about the safety and trustworthiness of these technologies, leading to reluctance and ultimately, a decision against their utilization.

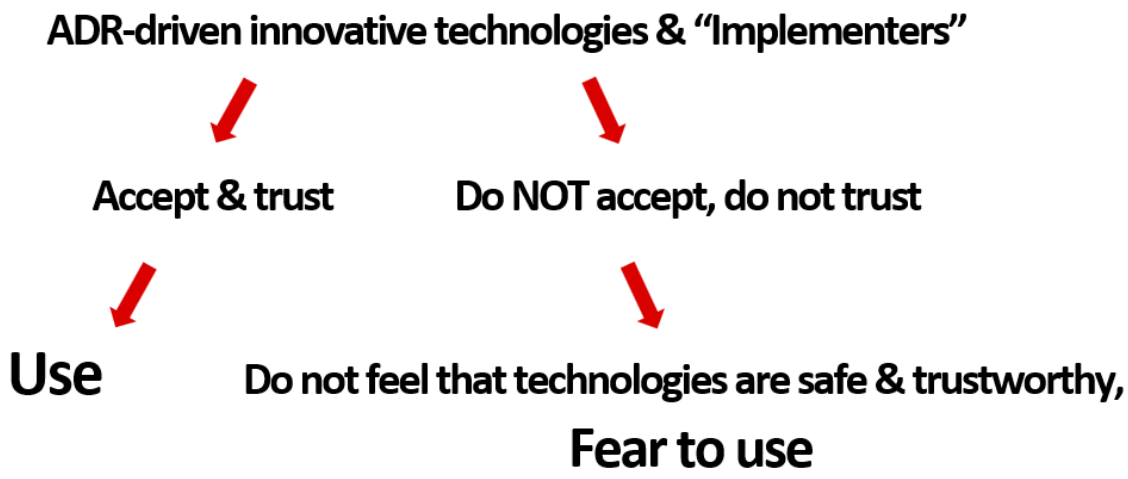


Figure 5: Two paths of ADR adoption

In essence, the adoption and acceptance of ADR-driven technologies are intricately tied to the mitigation of negative externalities related to trust and security. Society's willingness to embrace these technologies depends on the assurance that they are safe, transparent, and accountable. A failure to address the negative externalities of security and trust can result in a lack of acceptance, leading to a scenario where the potential benefits of ADR-driven technologies remain unrealized.

4.2 Reorganizing Externalities into a Business-Focused SWOT Analysis

The three pillars of Sustainable Development provided a comprehensive framework for analyzing the externalities of ADR technologies, allowing for a deep exploration of their economic, environmental, and social impacts. However, to facilitate a more engaging and effective discussion with business owners, the list of Positive and Negative Externalities of ADR-driven technologies adoption was transformed into a SWOT analysis. Initial interviews with stakeholders revealed that the initial approach of asking for opinions on positive and negative externalities proved ineffective, as many stakeholders were unfamiliar with these concepts and struggled to provide meaningful insights. In contrast, when presented with the task of drafting a SWOT analysis, stakeholders immediately demonstrated comprehension and engagement. SWOT analysis is a widely recognized framework used by governments, businesses, and civil society organizations worldwide. Presenting the findings in this format made the potential impacts of ADR technologies more clear and concise for stakeholders, particularly technology developers and implementers, who could readily grasp the key considerations and provide valuable feedback. By examining the strengths, weaknesses, opportunities, and threats associated with ADR technologies, stakeholders also gained a better understanding of the potential risks and rewards of adopting these technologies. As a result, the SWOT analysis facilitated more informed and productive discussions with business owners.

Additionally, the discussion helped to identify areas of agreement and disagreement, which can inform future decision-making.

4.2.1 SWOT Analysis and Discussion

Table 2: SWOT Matrix

INTERNAL FACTORS

STRENGTHS +	WEAKNESSES –
• Increased efficiency and productivity • Improved decision-making • Improvement of data privacy and security • Reduced costs • Competitive advantage	• Privacy and safety risks • Costs, complexity, integration and interoperability challenges • Lack of awareness and understanding, lack of acceptability and trust • Difficulty educating, attracting and retaining talents • Ethical and social concerns

EXTERNAL FACTORS

OPPORTUNITIES +	THREATS –
• Developing new products, services • Creating new jobs, markets, new business models • Addressing global challenges (climate change, healthcare, etc.) • Improving the quality of life through improved healthcare, education, and transportation etc. • Enhancing customer experiences	• Social and ethical Issues: job displacement and ADR-driven discrimination can lead to social resistance to technology • Psychological Issues: fear of AI and Robots may affect the success of implementation efforts • Economic issues: disparities among European countries can impact the pace of technology adoption • Cybersecurity and privacy risks • Biases, Misinformation, and disinformation • Bad Practices: poorly implemented or developed, ADR technologies s can create reputational and legal risks, and eventually loss of public trust.

The comparison between the SWOT analysis and the Positive and Negative Externalities of ADR technologies adoption mapping reveals distinct perspectives on the implications of ADR adoption. SWOT analysis provides a more pragmatic framework, particularly valuable for business owners, to assess the potential impacts of ADR technologies. By evaluating strengths, weaknesses, opportunities, and threats, this approach offers a structured method for understanding the strategic landscape of ADR implementation. This method enabled us to collect feedback from technology developers and implementers more efficiently, ensuring we shared the same language and mindset

during the interviews. In contrast, the Positive and Negative Externalities mapping delves into the broader societal effects of ADR adoption, presenting a more academic approach and aiming to uncover both beneficial and adverse consequences beyond the immediate business context. However, the mapping revealed certain disparities when compared to the SWOT analysis.

In the SWOT analysis, environmental concerns regarding ADR adoption often went unnoticed among business owners. Issues such as considerable energy consumption and potential electronic waste were not deemed critical in their considerations. Similarly, positive externalities related to environmental improvement were acknowledged primarily by those directly engaged in addressing global challenges, while others overlooked these aspects.

Conversely, economic implications received substantial attention in both mappings. SWOT analysis highlighted economic strengths and opportunities, such as cost reduction, productivity improvement, and the emergence of new business models and jobs. These align closely with the positive externalities identified for the economy in the Externalities of ADR-driven technologies adoption mapping.

Social issues emerged as a common theme in both analyses, with concerns over discrimination, inequality, security, and privacy risks raised consistently by business owners. These factors were recognized as weaknesses and threats to ADR adoption, reflecting potential risks to reputation and trust.

Notably, the SWOT analysis captured specific economic weaknesses of ADR implementation, including high implementation costs and the challenge of talent acquisition and skill development. These aspects were absent from the externalities mapping but proved valuable for understanding the underlying reasons affecting the acceptability and trustworthiness of ADR technologies.

Overall, the SWOT analysis facilitated the collection of practical feedback from stakeholders, providing insights into the interconnectedness of threats and negative externalities with issues of acceptability and trustworthiness. These findings laid the groundwork for theoretical discussions on best practices, barriers, challenges, and outcomes, paving the way for a deeper analysis of the multifaceted dimensions of ADR adoption in Section 5.

4.3 Gathering Stakeholder Input

The next significant task of this research was to confirm the importance of the identified overarching externalities. This was achieved through a meta-analysis of stakeholders' reports, followed by interviews and a survey, with a focus on stakeholders' perceptions of acceptability and trustworthiness. Discussions were held regarding potential solutions aimed at facilitating a more efficient process of ADR adoption. Finally, validation by stakeholders culminated in a workshop, where the initial meta-analysis findings were presented to key stakeholders, seeking their feedback and involvement in formulating recommendations. Each method will be presented below, providing a description of the process and its outcomes.

4.3.1 Interviews

The next significant task in this research was to confirm the importance of the identified overarching externalities. This was achieved through a meta-analysis of stakeholders' reports, interviews, and a survey, with a focus on stakeholders' perceptions of acceptability and trustworthiness. Discussions were held regarding potential solutions aimed at facilitating a more efficient process of ADR adoption. Finally, validation by stakeholders culminated in a workshop, where the initial meta-analysis findings were presented to key stakeholders, seeking their feedback and involvement in formulating

recommendations. Each method will be presented below, providing a description of the process and its outcomes.

To gather firsthand insights and perspectives, interviews were conducted with representatives from various groups of stakeholders involved in ADR adoption and implementation. The selection of stakeholders followed the previously established mapping, aiming to include individuals from the following groups: regulators, technology producers, technology implementers, researchers, and influencers. However, two stakeholder groups, investors and consumers, were excluded from the interview process. Investors were deemed difficult to reach for research inquiries, while consumers represent a diverse and broad group with varying perspectives, requiring a separate study with a tailored methodological approach.

The final interview participants were chosen through a combination of purposive sampling (Robinson 2013) and direct outreach via social media platforms, public events, and personal networks. While 55 individuals were approached, only 15 agreed to participate in the interviews. A total of 15 interviews were conducted, involving three representatives from regulators, two technology producers, four technology implementers (from private businesses), four representatives from supporting organizations (or influencers), and two academics. Notably, a significant number of researchers and academics were consulted throughout the research process, contributing to a more balanced representation of perspectives.

The interviews were conducted through various channels, including phone, Zoom, Teams, and in-person meetings. Each interview lasted approximately 30 minutes and followed an open format. A semi-structured interview technique was employed to facilitate data collection. This approach allowed for open-ended questions, enabling the interviewer to delve deeper into relevant aspects based on the respondent's answers. While the core question remained consistent (inquiring about the status of ADR technology adoption in the interviewee's company or industry, and exploring SWOT analysis and potential solutions), the interview format remained flexible, allowing the interviewee to express their feelings and opinions freely.

The interview questions were tailored to the specific background and expertise of each interviewee. The general conversation flow began by assessing the respondent's awareness of ADR technologies. If they were already familiar with ADR, the discussion delved into the specific strengths, weaknesses, opportunities, and threats associated with its adoption. For those with limited exposure to ADR, the conversation focused on their initial impressions, potential adoption plans, and concerns regarding the technology.

To begin, interviewees were asked to provide their own SWOT analysis of ADR. This open-ended approach allowed them to identify the aspects that resonated most with their experiences and perceptions. Next, the interviewer introduced the concept of externalities, highlighting the potential positive and negative impacts of ADR on various aspects, including the economy, environment, and society. This discussion provided an opportunity for interviewees to reflect on the broader consequences of ADR adoption and its potential implications for different stakeholders.

Throughout the interviews, the interviewer actively listened to the respondent's perspectives, prompting further elaboration and exploring their motivations, concerns, and interests related to ADR adoption. At the conclusion of each interview, participants were asked if they would consent to having their name and company name included in the research report. Four interviewees chose to remain anonymous.

Interviews did not reveal significant differences among stakeholder groups in identifying SWOT parameters, with increased efficiency and competitive advantage consistently emerging as the most prominent strengths mentioned. The discussion of weaknesses in ADR implementation and development revealed a common concern regarding the associated costs and complexity. Specifically, technology implementers expressed frustration with the challenges of managing data, including collecting, interpreting, using, and ensuring compliance with data regulations and privacy

concerns. Additionally, representatives from supporting organizations unanimously highlighted the lack of awareness and understanding of ADR technologies as a significant weakness, often leading to mistrust and hindering adoption.

Regarding opportunities, perspectives varied depending on the stakeholder group. Technology producers were enthusiastic about the prospect of creating new products and services, while government representatives emphasized the potential to generate new jobs and markets. Network representatives and academics focused on the potential to address global challenges and improve quality of life. Technology implementers primarily expressed interest in enhancing customer experience through ADR solutions.

The most extensively discussed topic during the interviews was the potential threats associated with ADR adoption, taking up the majority of the discussion time. Representatives of all stakeholder groups expressed significant concerns about security and privacy risks, with the possibility of data breaches and the potential for biased outcomes being particularly alarming. Technology implementers specifically expressed apprehension about the potential for negative experiences linked to LLM biases, ethical issues, and data breaches, which could lead to reputational and legal risks. Regulator representatives focused on the issue of unequal access to ADR technologies and the potential for a digital divide, emphasizing the need to prevent job displacement and ensure adequate employee reskilling. Academics raised concerns about the long-term psychological and social impacts of ADR, such as AI anxiety and AI-driven discrimination, which may lead to individual resistance towards ADR adoption.

Unlike SWOT, the mapping of externalities, when introduced during the interviews, did not elicit profound discussions or arguments. As a relatively abstract and theoretical concept, related to the economy, environment, and society, it did not evoke strong emotional responses from interviewees. The proposed framework for categorizing externalities was generally accepted by all participants.

While the majority of industry representatives were familiar with the main negative externalities associated with data and security issues, many were unaware of externalities related to sustainability, i.e. environmental and climate change monitoring, the potential electronic waste and energy overconsumption associated with ADR adoption. They expressed interest in learning more about these potential negative externalities from researchers, reflecting the general lack of comprehensive knowledge regarding the full spectrum of positive and negative impacts of ADR adoption. This gap in understanding stems from the fact that these effects often manifest over time and may not be fully evident in the early stages of adoption. As a result, stakeholders are eager to gain a better understanding of the potential long-term implications of ADR adoption and learn what to expect.

The list of people who were interviewed as well as the interview questions can be found in the Appendix.

4.3.2 Survey

To complement the existing findings and gain firsthand insights from technology implementers across the European Union, a survey was conducted in October-November 2023 (see full details in Appendix). The survey questions were based on information gathered from background research (media publications, academic papers), analysis of stakeholder reports, and interviews with stakeholders.

The primary objective of the survey was to examine the factors influencing the attitude of technology implementers, entrepreneurs, and business owners towards the use of ADR-driven technologies. The results were expected to contribute to a more comprehensive understanding of the variables affecting the trustworthiness and acceptability of ADR-driven technologies, and their potential impact on adoption and dissemination. One of the main objectives of the survey was to determine the level

of digital maturity of companies in the EU. Specific objectives included assessing the state of knowledge, barriers, and preparedness for digital transformation among enterprises, and identifying emerging trends in ADR-driven technologies in the EU.

The survey consisted of 27 questions of various formats: the first half focused on gathering opinions from business owners on an entrepreneurial level, as the decision-makers responsible for the digital development of their organizations. The second part explored their perspectives on a personal level. The externalities defined in the beginning of this section were adapted for the survey and presented to participants as positive and negative aspects of ADR technology implementation.

Specifically, the survey aimed to determine:

- Level of knowledge of AI, data, and robotics among businesses
- Current level of digital development in different companies across various European Union countries
- Barriers and challenges associated with implementing ADR-driven solutions
- Organizational readiness for technological advancement and change
- Extent of ongoing ADR implementation efforts
- Key drivers of ADR development
- Critical ADR transformation needs for technology implementers in the EU

The survey faced a significant challenge in getting a good response rate to the distributed survey link. A reluctance among entrepreneurs to participate was evident, with many ignoring the survey invitations. For larger companies, another level of difficulty arose in reaching the right decision-maker to obtain permission for their company's involvement in the report. Additionally, motivating entrepreneurs not involved in digital solutions implementation to participate proved challenging.

The survey was disseminated through various channels, including Adra social media, websites and the newsletter, as well as newsletters and social media reposts from numerous Adra partners, LiU social media, thematic groups on Facebook and LinkedIn related to business development in the EU (36 social media groups in total). Direct connections with business owners were also utilized, inviting them to complete the survey and share the link with potentially interested parties. Over 300 personal messages were sent via email and social media to business owners.

Despite these efforts, the survey yielded a response rate of approximately 10%, with 38 completed responses. This low response rate limits the generalizability of the findings to the entire EU. Additionally, the majority of responses originated from two countries (Sweden and Croatia), and the sample primarily represented small and medium-sized enterprises (SMEs), including some one-person businesses. Moreover, the majority of respondents works in computer software and education companies. These limitations can be attributed to the specific nature of the researcher's network, as individuals with stronger connections to the researcher tended to respond more frequently.

Nevertheless, the survey results provide some valuable insights into the attitudes and perceptions of technology implementers and business owners towards ADR-driven technologies. Careful analysis of the data can help identify key trends and inform future research and initiatives in this field.

Survey Findings

A majority of respondents (81%) indicated that they currently use AI tools in their organizations, and 59% stated that they employ data for machine learning. Moreover, 67% of respondents deemed ADR-driven technologies highly beneficial for their company's success. While these results indicate a widespread adoption of ADR technologies, it's important to note that the survey may not have captured the perspectives of business owners who are not familiar with or do not use ADR

technologies. This could be due to a lack of awareness or interest in the technology. To ensure a more comprehensive representation, researchers may need to engage in preliminary conversations with these individuals to understand their needs and concerns. In some cases, this approach worked (talking, explaining, motivating), as demonstrated by 4% of respondents who stated that they do not use AI in their company, yet they did participate in the survey.

The survey findings suggest that ADR technologies are gaining recognition among business owners, particularly in the context of staying competitive. A significant portion of respondents (70%) indicated that they will need an AI strategy in their company to keep pace with their competitors. In some cases, as interviews with stakeholders have previously revealed, business owners who are currently not utilizing ADR-driven technologies are interested in them, while not understanding the benefits or nuances of implementation, barely because they know that their competitors are planning to do so, this is confirmed by the survey, as 70% of all respondents stated that they will need an AI strategy in their company to keep up with their competitors.

The survey also explored the future plans of business owners regarding ADR adoption. Notably, 86% of respondents expressed a need for their organizations to implement more AI, data, and robotics-driven solutions. Moreover, 92% anticipated increasing their AI usage within the next year. These findings prove that there is a general awareness of importance and the upcoming widespread development of these technologies, as business owners realize they need to work with them, but not everyone understand how to do it. Interestingly, to the question “Do you believe that it is understandable and clear how AI technologies are working and how they are going to be used?”, 35% of respondents said “yes”, and 41% said “no”. It is especially important considering that the majority of survey participants belong to the education and software development industries, and are familiar to the ADR technologies to some degree.

This gap in understanding underscores the need for increased education and transparency around ADR technologies. It is crucial to ensure that technology implementers know precisely what they are doing and how to do it. As proof of this point, 84% of respondents believe that people must receive specialized education on how to use AI. None of the respondents believed that AI would eventually disappear, making such training unnecessary.

When asked to pick from the list the main challenges for AI adoption for your organization, the absolute majority of respondents choose data-related issues (lack of data, challenges in collection and analysis), concerns about biases, errors, and limitations of generative AI, and a shortage of skilled personnel. These challenges pose significant hurdles for the technology implementers seeking to use AI effectively. Data management is fundamental for ADR development, as well as crucial for ethical and legal reasons, and the presence of errors or biases in AI models can erode trust and undermine the value of AI-driven solutions. The lack of skilled AI professionals further complicates the process of implementing and maintaining AI systems.

The top three main reasons why business owners would like to implement ADR technologies in the company were increasing efficiency and sustainability, gaining a competitive advantage, and potential profit and cost savings. Interestingly, relatively few respondents were motivated by the potential to create new jobs and business models or to address global challenges, such as healthcare, environmental issues, and waste management. This may reflect the priorities of the majority of respondents, who were primarily SMEs focused on business growth or survival. Larger organizations with more resources may be better positioned to consider tthe world-scale challenges. Interestingly and quite promisingly, 70% of respondents (regardless of the size and specifics of their company) claim that they follow up on the AI Act requirements and other upcoming regulations. They are actively preparing their organizations to respond to these regulations in the correct manner.

Regarding negative aspects associated with ADR implementation, cybersecurity and privacy risks, bias and misinformation, and bad practices related to legal, reputational, and trust risks were the top three concerns. These concerns align closely with the main challenges identified earlier. Only a small percentage of respondents (about 13% on average) expressed concern about potential job displacement, psychological impacts, or increasing digital divides. These more abstract and long-term effect problems may be perceived as less immediate concerns compared to the tangible challenges of data management, algorithmic biases, and skilled personnel shortages.

A significant portion of respondents (41%) expressed concerns about the potential impact of AI on workplace ethics, while 95% acknowledged the possibility of AI-related usage errors, such as wrong facts, disinformation, or poor automated decisions. On a scale of one to five, indicating their level of trust in AI tools, 43% provided a "three," indicating moderate trust, while 43% selected "four," suggesting a slightly higher level of trust. Notably, no respondents chose the highest rating of "five," which would signify full trust. This suggests that while there is a degree of trust in these technologies, individuals are not yet ready to fully trust them. These reservations stem from genuine concerns regarding the functionality, technology, ethics, and implementation of AI systems. The task titled "AI Trust Label" (Work Package 3, task 3.3) addresses these concerns in detail.

Overall, while ADR adoption faces challenges, the survey findings suggest a positive trajectory for the technology. Business owners recognize the potential benefits of AI and are planning to increase their usage in the coming years. However, to ensure successful implementation, it's essential to address the identified challenges, such as data management, algorithmic fairness, and skilled labor availability. Moreover, to achieve these objectives more quickly and contribute to a more efficient, sustainable, and equitable society, knowledge about ADR technologies should become more widespread and accessible.

4.3.3 Workshop

The workshop, titled "Acceptability and Trustworthiness of AI, Data, and Robotics-Driven Technologies: A Case Study of European Businesses," was held virtually via Zoom on December 15, 2023. The event brought together experts and stakeholders from academia, business, support networks, and government to learn about the initiatives undertaken by these stakeholders from different parts of Europe to promote the adoption of ADR-driven technology. They discussed trustworthiness, ethical considerations, practical challenges, regulatory issues, and real-world use cases surrounding ADR technologies. For more details, please refer to the Workshop Description & Agenda in the Appendix.

The workshop commenced with an overview of the meta-analysis findings presented in this document. The presentation highlighted the key factors influencing ADR adoption in EU businesses, as well as the externalities of ADR adoption.

Following the presentation, a panel of experts engaged in a discussion, addressing the workshop's challenge questions and exploring potential solutions to the identified externalities. The panelists shared their insights from various perspectives, covering topics such as ethical considerations in AI development, regulatory frameworks for ADR, and the role of education and public awareness in fostering trust in ADR technologies.

Next, a facilitated panel discussion was conducted, inviting participants to actively engage in brainstorming practical recommendations for democratizing ADR technologies in Europe. The discussion centered on the following key questions:

- What steps are needed to ensure that ADR technologies are developed and deployed in a way that is inclusive and accessible to all citizens across Europe?
- How can we foster a culture of trust and understanding between technology developers, policymakers, and the general public when it comes to ADR adoption?

- What specific roles can the European Commission play in promoting the responsible and equitable development of ADR technologies?

The panel discussion generated several insights and actionable recommendations, that can be summarize as following:

1. **Prioritize transparency and explainability:** ADR technology developers should strive to make their solutions understandable to a broad audience, addressing potential biases and ethical concerns.
2. **Embrace user-centered design:** Actively involve users in the design and development process to ensure that ADR solutions meet their needs and expectations.
3. **Foster collaboration across stakeholders:** Encourage collaboration among academia, industry, government, and civil society to share knowledge, expertise, and resources.
4. **Implement robust risk assessment and mitigation:** Thoroughly evaluate potential risks associated with ADR technologies and implement appropriate safeguards to protect individuals and society.
5. **Prioritize data privacy and security:** Emphasize data protection measures to safeguard sensitive information and prevent unauthorized access or misuse.
6. **Educate and train employees:** Provide adequate training to individuals involved in ADR implementation, covering ethical considerations, data privacy practices, and responsible AI principles.
7. **Develop clear regulatory frameworks:** Establish clear regulatory guidelines and ethical frameworks to ensure responsible ADR development and adoption.
8. **Invest in multidisciplinary research and development:** Support research initiatives that integrate expertise from diverse fields, such as humanities, social sciences, and engineering, to address societal challenges effectively.
9. **Promote public awareness and education:** Launch targeted public awareness campaigns to educate the public about the benefits and responsible use of ADR technologies.
10. **Foster international collaboration:** Collaborate with stakeholders from other countries to develop harmonized regulations and promote responsible ADR adoption globally.

In addition to the panel discussion, the workshop included an open forum for participants to ask questions and engage in further discussions. More than 90 people joined the discussion online and some of them sent valuable questions and feedback during the workshop. The exchange of ideas and diverse viewpoints contributed to a productive event.

The workshop successfully achieved its objectives of disseminating the meta-analysis findings, gathering valuable feedback from stakeholders, and collaboratively formulating actionable recommendations. The feedback from the experts and participants provided insights into addressing the externalities of ADR adoption, including:

1. Enhancing data quality and transparency: Improving access to high-quality data and ensuring transparency in data collection, processing, and usage are crucial for building trust in ADR systems.
2. Promoting human oversight and explainability: Implementing robust human oversight mechanisms and ensuring the explainability of AI decisions are essential to mitigate biases and ensure accountability.
3. Addressing ethical considerations: Carefully considering ethical implications throughout the development and deployment of ADR technologies is paramount to building societal acceptance.
4. Aligning with regulatory frameworks: Adhering to relevant regulatory frameworks and fostering collaboration between industry and regulators are essential for responsible ADR adoption.
5. Raising awareness and promoting education: Enhancing public understanding of ADR technologies and promoting digital literacy are critical for building trust and acceptance.

The workshop highlighted the importance of multidisciplinary and multistakeholder collaboration, emphasizing the need for effective communication and collaboration between technology experts, policymakers, and the general public. Participants acknowledged the need to involve individuals from humanities, communication, and social sciences to demystify AI technology and promote its positive impact on society. One of the key takeaways from the workshop was the recognition of the lack of public engagement in ADR development and adoption. Participants emphasized the need to actively seek feedback from the public and ensure that ADR solutions are designed and presented in a way that is understandable and beneficial to society. The issue of funding was also raised, with participants acknowledging the need to provide incentives for individuals to participate in ADR research and provide feedback. This could involve monetary rewards or other tangible benefits to encourage public engagement and ensure that ADR technologies are developed with societal needs in mind.

The workshop concluded with a renewed commitment to fostering responsible ADR adoption and addressing the externalities associated with it. The collaborative approach adopted during the event will be crucial in shaping the future of ADR technologies and ensuring their positive impact on society.

The collaborative approach adopted during the workshop exemplifies an activity that can play a pivotal role in shaping responsible ADR development and ensuring the positive impact of these technologies on society. The workshop's discussions significantly contributed to refining the recommendations that will be detailed in Section 6 of this document, “Recommendations and takeaways”.

5. Analysis and Elevating the Discussion to the Meta Level

The previous sections have provided a comprehensive overview of the positive and negative externalities of ADR adoption. This section will concentrate on these externalities at a meta-level, revealing the interconnectedness of various factors, such as education, economy, politics, legal, social, and psychological aspects in the discourse surrounding ADR adoption. The successful integration of ADR technologies requires a holistic approach that considers the diverse perspectives and interests of stakeholders, examining the challenges and outcomes associated with the adoption of ADR-driven technologies. One must take into account various barriers on the way towards technology adoption. A number of theoretical frameworks that deal with these issues were introduced in the Theoretical Background section (Section 2). Here, in the second part of this section, we will provide an overview of all existing barriers to ADR adoption for implementers based on the Technology, Organization, and Environment (TOE) model, together with one critical element taken from the Diffusion of Innovation (DOI) model: individual barriers, or human characteristics. In the final part of this section, we address the possible limitations of this analysis approach and ways to improve and develop such types of research further.

5.1 Challenges and Issues Related to Presented Findings on Externalities of ADR Adoption

The development and implementation of ADR-supported technologies in European businesses and organizations have undeniable potential to transform industries and society. ADR adoption brings forth a multitude of positive externalities across various domains. Economically, it facilitates cost reduction, productivity improvement, and the emergence of new business models and job opportunities, contributing to efficiency gains and enhancing competitiveness in international markets. Socially, it holds great promise for progress, as ADR technologies can address various societal challenges in healthcare, education, and environmental sustainability, ultimately leading to an improved quality of life (Vinuesa et al. 2020, Sparrow & Howard 2020, Cowls et al. 2021).This progress begins with enhancements to day-to-day activities, such as automating repetitive tasks,

providing personalized services, and improving decision-making, and extends to addressing global challenges such as climate change and conflict resolution.

However, alongside the positive externalities, ADR adoption also poses significant challenges and risks. It is imperative to consider various areas where bad practices can lead to negative effects, thereby making technology less acceptable and trustworthy, ultimately resulting in people being more reluctant to use it. This section will cover several such areas, drawing on reports, academic literature, and stakeholder discussions. These areas encompass technological, economic, legal, social, ethical, psychological, political, and cultural issues, all of which must be taken into account by all stakeholders involved in ADR adoption and implementation.

Economic Considerations

Economically, the initial costs associated with ADR implementation, along with the ongoing need for updates and maintenance, can impose significant strain on resources, particularly for small and medium-sized enterprises. Consequently, larger corporations often take the lead in ADR adoption, further solidifying their competitive advantage and further widening the gap between them and smaller businesses (Inuwa-Dutse 2023). This exacerbates the issue of the digital divide, which is already apparent between the Global North and the Global South (WEF 2023). The growing disparity not only enriches already affluent and technologically advanced entities but also perpetuates the economic exclusion of those with fewer resources (EU Digital Decade Report 2023). Economic considerations underscore the importance of balancing innovation and inclusivity to ensure equal access and distribution of benefits (McKinsey, The economic potential of generative AI: The next productivity frontier 2023, Chandramouli 2022). Unequal access to ADR technologies and digital infrastructure can exacerbate existing inequalities, further marginalizing vulnerable populations (Božić 2023).

Moreover, there is a significant concern regarding the allocation of financial resources. The bulk of investments tend to focus on enhancing the quality and advancement of ADR technologies, under the assumption that these improvements will naturally drive adoption and lead to economic gains. However, as Trine Platou, Project Manager at TAILOR Network (Trustworthy AI Support), has pointed out during the Workshop (see Appendices: Zoom Workshop), there is a critical responsibility to ensure that resources are allocated to essential areas that genuinely foster prosperity, and this responsibility primarily falls on governments, who are custodians of taxpayer funds. It is crucial to align the allocation of resources with societal needs and priorities, addressing problems that are perceived as crucial by the general public and prioritizing solutions that contribute to a better society. While investing heavily in highly advanced technology development may seem promising, it often comes at the expense of other vital sectors, such as publicly funded healthcare and education systems, as Trine has exemplified in the case of Sweden. This disparity can lead to the perception among the public that resources are being diverted away from essential services, such as nursing or education, thereby worsening both the economic conditions of the workers and the overall quality of these systems. This nuance highlights the importance of maintaining a long-term perspective and ensuring that investments align with broader societal goals and priorities, rather than solely focusing on high-tech advancements with limited visibility and tangible benefits for the general public.

Technological Considerations

Currently, the risks associated with generative AI, namely its tendencies toward unpredictability, inaccuracy, and bias, are widely acknowledged by all technology implementers. All interviews conducted with ADR implementers confirmed that their primary concern revolves around the security of their data. For example, as ADR technologies become more advanced, data that was previously considered harmless can now be utilized for prediction and detection, thereby posing a potential threat to users' privacy. Another significant issue for ADR implementers is how to prepare their data for use. In many cases, the data is unstructured or fragmented, and business owners are unsure how to manage it. For instance, the Chief Technical Officer of Frank Valiant communication agency highlighted data transfer security as one of the most pressing and unresolved challenges at present.

Technological developments may be particularly difficult to predict and control. While AI and robotics have the potential to enhance safety in certain contexts, they also introduce new risks, such as cybersecurity vulnerabilities and potential system malfunctions (Ansari et al. 2022). Furthermore, advancements in ADR technologies necessitate robust infrastructures, including high-speed internet connectivity, data storage facilities, and cybersecurity measures, to support their effective deployment. Ensuring the scalability, reliability, and security of ADR technologies is crucial for their sustainable impact on society (Run:AI The 2023 State Of AI Infrastructure Study report).

Legal Considerations

Legal dilemmas and jurisdictional issues arise concerning data ownership and liability, highlighting the need for harmonization of laws and regulations. The urgency of legal harmonization is evident in the rapid development of regulations such as the GDPR and the AI Act. However, striking a balance between effective regulation and the agility to adapt to the ever-evolving technological landscape is crucial. These regulations empower individuals with greater control over their personal data, necessitating stricter data usage practices by businesses. Additionally, businesses must be prepared to address requests for data access, rectification, erasure, or restriction of processing.

Organizations must continuously ensure that their ADR processes comply with evolving privacy regulations. Copyright infringement issues, particularly in cases involving visual materials or music compilations, remain controversial and challenging for regulators, as well as for original content creators (Stanford: Artificial Intelligence Index Report 2023). Moreover, besides formulating and rolling out the rules for public use, there is a need for education on how to utilize regulations. Education should be targeted towards legal workers, organizations, businesses, and end-users. This requires a collaborative effort from all stakeholders involved in ADR implementation, ranging from regulators to end-users, who must stay informed about these rapid developments to protect their rights.

Political Considerations

ADR adoption involves power dynamics and geopolitical considerations, which have implications for national sovereignty, security, and global governance structures. For governments, rapid ADR development offers a strategic advantage, particularly in cybersecurity and the military, bolstering a state's position in the international order (Horowitz et al. 2018). However, it also fuels an AI race, where different parts of the world are aiming to dominate the market and reap the benefits first, potentially compromising quality and safety in favor of speed. Political instabilities and conflicts can disrupt the supply chain of ADR technologies, making it challenging for businesses to develop and deploy ADR solutions. Additionally, aggressive nation-states, criminal groups, and other malicious actors may exploit these technologies to accelerate the creation of malicious software and deepfake content, posing threats to epistemic security (Weise & Metz 2023). Addressing these challenges requires communication, negotiation, and collaboration.

ADR adoption necessitates collaborative efforts among governments, industry, academia and civil society to establish norms, standards and regulatory frameworks that promote ethical technology development and international cooperation. For example, China's significant developments in AI and robotics implementation in recent years have been noteworthy. In 2021, China installed more industrial robots than the rest of the world combined (Stanford: Artificial Intelligence Index Report 2023). China's emerging AI governance framework has potential to reshape how the technology is built and deployed both within China and internationally, influencing Chinese technology exports as well as global AI research networks (Sheehan 2023). Nevertheless, China's regulations and innovations are often viewed through the lens of geopolitical competition in the West; instead, they deserve careful analysis to understand their impact on China's ADR development and their potential lessons for policymakers worldwide. Despite foundational disagreements on specific regulations, countries still can learn from each other regarding the underlying structures and technical feasibility of different regulatory approaches.

Furthermore, it's important to acknowledge that political instability and changing regulations can negatively impact the social acceptance of ADR technologies overall. Concerns about government surveillance or control through using these technologies could lead to resistance to their adoption. By fostering a robust AI ecosystem, Europe can reduce its reliance on external technologies and pave the way for local innovations.

Social Considerations

With the rapid advancement of AI technologies, there is an increasing need for continuous learning and adaptation, both at the individual and societal levels. This includes upskilling the workforce, updating educational curricula, and fostering public understanding of ADR. The most significant concerns among the general public revolve around the impact of ADR technologies on employment (de Acypreste & Paraná 2022, OECD Report 2023) and inequality (International Monetary Fund Report 2024). The risk to employment from automation has been extensively studied (Frey & Osborne 2017), with research indicating that certain industries, such as advertising and marketing, business support and logistics, agriculture engineering and science, are more likely to experience greater displacement due to technological change. Therefore, it is crucial to develop and implement reskilling and upskilling programs to mitigate the potential impact of ADR on the labor force (McKinsey, The state of AI in 2022).

Efforts to prepare workers for the challenges ahead can help them benefit from new opportunities created by advancements in technology-driven automation systems (McKinsey 2017, Strich et al. 2021). It's important to ensure that these educational programs are effective by explaining to employees and the general public that Human-in-the-loop systems will still be necessary. Organizations can aim to complement human work reasonably with machines when adopting ADR, thereby creating alternative job opportunities. This would involve providing specific additional skills training to adapt individual workers to novel technology, understand ADR technology, interpret the output of algorithms, and anticipate possible biases and failure modes of ADR systems. Organizations adopting ADR should prioritize reskilling their workforce now to prevent job displacement in the near future, thus mitigating socioeconomic disparities.

Ethical Considerations

Disinformation, algorithmic biases, and discrimination pose threats to fairness and justice, highlighting the importance of diversity and inclusivity in ADR development (European Union Agency for Fundamental Rights Report 2022; Council of Europe 2018). Some technological developments are inherently unethical and have the potential to disrupt or slow down the development and implementation of ADR. Many ethical concerns revolve around the potential for AI technologies to manipulate and disseminate false information. Technological capabilities can be maliciously exploited to produce convincingly realistic fake content, such as images, audio clips, and videos that can deceive audiences. Detecting such deceptive creations remains a challenge for both human discernment and AI algorithms. For instance, deepfakes are already used to create fake news or to impersonate people, negatively impacting public trust in AI technologies (Nishimura 2023).

Over-reliance on ADR systems, especially in critical domains like healthcare or transportation, can diminish human judgment and decision-making skills, potentially leading to errors or suboptimal outcomes (e.g., wrong facts, systemic racism, political disinformation), as well as risks of fraud and deception (Belenguer 2022, Passi & Vorvoreanu 2022). As ADR continues to evolve, a robust ethical framework and societal values must underpin its development and application. This approach ensures that technological progress respects privacy, promotes fairness and prevents harm. The lack of clear ethical guidelines and accountability mechanisms for AI and robotic systems can result in questionable practices or actions without appropriate oversight, undermining public trust in technology and its developers (Bostrom & Yudkowsky 2011, TechTarget 2021).

To address these issues, academics who we interviewed proposed establishing certification bodies designed to emphasize enduring governance criteria, such as ethics training for AI developers, and

to adjust technical criteria as technology evolves (Cihon et al. 2021). Another problem is how to ensure trust in these certification bodies, as the most rising ethical concern among potential ADR implementers is the lack of transparency and explanation behind AI-driven decision-making. It is imperative to decipher the rationale behind AI's choices, not only for internal understanding but also for communicating these decisions to others. Explainable ADR enables both technical staff and executives to understand how ADR systems arrive at decisions, thereby mitigating potential risks and vulnerabilities to the company. Additionally, businesses must be aware of additional ethical risks, such as the unforeseen consequences of AI decisions, the misuse of personal data, and the looming threat of algorithmic bias. These challenges underscore the complexity of integrating such technologies while adhering to ethical standards, urging businesses to navigate this terrain with care and conscientiousness, and must be investigated by experts from different disciplines.

Psychological Considerations

ADR systems are often complex and opaque, making it difficult for users to understand how they work. This lack of transparency can lead to feelings of uncertainty and anxiety. Additionally, the reliance on ADR technologies raises questions about human autonomy and agency, prompting reflections on the balance between technological advancement and human values. ADR technologies should be designed with human-centric principles to enhance user trust and long-term well-being. While research shows that AI can improve work-related mental health (Wei & Li 2022), there are documented issues as well. Fear of ADR, officially known as AI anxiety, may hinder people's motivation and cooperation, affecting the success of technology adoption (Ernst & Young 2023).

There are other psychological issues that need to be considered when developing and implementing ADR technologies. These include stress due to the loss of control, social isolation, and insomnia (OpenAccessGovernment 2023). Certain innovations may have negative psychological effects on those who adopt them, leading to long-lasting detrimental cognitive effects and changes in their cognitive abilities and thought processes that could potentially impact their future ability to innovate (Plamondon Bair 2022). Moreover, some innovations may also affect individuals' ability to socialize (Bowman & Banks 2019). These aspects require further profound and careful research to understand their full implications.

Cultural Considerations

At the foundation of social concepts, psychological issues, and many ethical aspects lies culture. Understanding local culture is essential for comprehending how people adapt to innovations, including ADR. Numerous examples illustrate the impact of cultural bias on economic choices. If local culture is not sufficiently receptive to unique ideas, the generation of creative investment ideas may be hindered (Tubadji & Nijkamp 2016). Moreover, even if a novel idea manages to overcome cultural barriers and come to fruition, its adoption, replication and dissemination will still be influenced by the extent to which local social and business networks are interconnected, a factor that is also culturally dependent (Verdier and Zenou 2017). Common narratives in Western media about machines potentially outsmarting and surpassing humans contribute to a broader cultural perception of technology as a threatening entity that endangers us (Wired 2018). With extensive media discussions about the threats of machines replacing or displacing human employees, Westerners are conditioned to perceive machines as a threat, leading to fear or dislike of them (Oxford Commission on AI & Good Governance Report 2020). Therefore, addressing the social, ethical and policy issues of ADR technology requires a multifaceted approach. Effective collaboration across cultures necessitates an understanding of cultural norms, values, practices, and biases. Encouraging the media to present accurate and balanced portrayals of ADR can help prevent the potential spread of misinformation in the future. Additionally, involving ethicists and AI experts in research and public debate can elevate the sophistication of media coverage on AI, mitigating uncertainty and potentially averting some of the undesired social outcomes (Yam et al. 2023).

To conclude, our analysis highlights the interconnectedness of various dimensions — economic, technological, legal, political, social, educational, ethical, psychological, and cultural — in the discourse surrounding the adoption of ADR-driven technologies. These disruptive technologies act as catalysts for societal transformation, shaping the future of work, governance, and human interaction. Successfully integrating ADR technologies requires a holistic approach that takes into account the diverse perspectives and interests of stakeholders. By addressing multidimensional challenges and opportunities, stakeholders can navigate the evolving landscape of ADR-driven technologies, fostering positive societal change while mitigating potential risks and negative externalities. Ultimately, the future of ADR transcends mere technological advancement; it represents a narrative intertwined with human values, ethics, and societal choices. ADR will significantly influence our collective actions and decisions, underscoring the importance of informed and thoughtful engagement with this transformative technology.

5.2 Barriers for ADR Adoption Mapping

ADR technologies possess immense potential to revolutionize various aspects of our lives, yet these transformations must be approached cautiously to mitigate potential harm. Despite their promise, the effective integration of these technologies into organizations encounters numerous challenges that impede their widespread adoption. This subsection aims to describe the primary barriers to the organizational integration of ADR technologies, drawing upon insights from both the Technology-Organization-Environment (TOE) framework and the Diffusion of Innovation (DOI) framework.

The TOE framework, widely utilized in research, offers a comprehensive analytical framework for examining the adoption and assimilation of various technological innovations within organizations. It operates at the organizational level, providing a perspective that encompasses organizational dynamics while disregarding individual characteristics such as personal attitudes. On the other hand, the DOI theory emphasizes the role of individual characteristics, portraying innovation adoption as a social process. Additionally, it outlines internal and external organizational factors, which align closely with the technological and organizational contexts of the TOE framework, albeit without considering environmental barriers addressed by TOE. Together, these frameworks provide a comprehensive overview of the factors influencing the adoption of innovative technologies in organizations, ensuring that the human element is not overlooked. This mapping is developed in order to systematically visualize potential issues and facilitate targeted recommendations in Section 6, Recommendations and Takeaways.

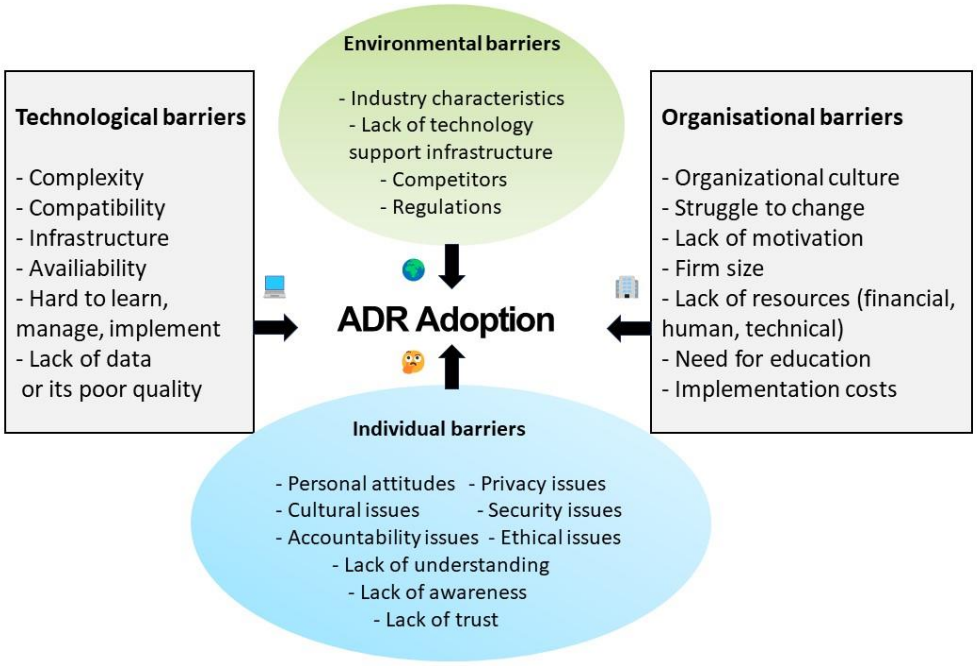


Figure 6: Barriers to ADR Adoption

Technological Barriers to ADR Adoption

The complexity and sophistication of ADR technologies pose considerable challenges for ADR adoption. These technologies often require specialized expertise and resources to understand, manage, and implement effectively. From a technological perspective, having the correct IT infrastructure is one of the key success factors in the adoption of ADR. Additionally, the availability of high-quality data is crucial for training and utilizing ADR systems accurately. A lack of access to quality training data is crucial, especially when an organization is just starting ADR adoption. Organizations may face difficulties in acquiring and maintaining the necessary data, particularly in areas with limited data infrastructure.

Organizational Barriers to ADR Adoption

Organizational constraints such as organizational culture (i.e., degree of centralization, formalization, traditionalism) or lack of skills and human resources to deploy ADR will influence how they approach ADR adoption. Industrial-era structures in organizations make them not agile enough for fast change. A lack of top management support can hinder the allocation of resources and expertise necessary for successful implementation. Creating, deploying, maintaining, and interpreting ADR systems as well as the knowledge of how to integrate them into existing business processes requires skills that are currently in shortage. Moreover, organizational cultures that resist change may impede the adoption of new technologies, as employees may be hesitant to abandon existing practices and embrace new methods. Additionally, small firms may struggle to keep pace with the rapidly evolving landscape of ADR technologies, lacking the financial and human resources to invest time and effort in these advancements.

Environmental Barriers to ADR Adoption

External factors, such as market conditions, competitors, and relationships with the government, also impact ADR adoption. For instance, global economic downturns may make organizations more cautious about investing in new technologies, while regulatory uncertainties can create obstacles to the deployment of ADR systems. Many smaller companies would look for technology support infrastructure to implement and may be hesitant if they do not see a good quality partner. Additionally, the competitive landscape within an industry can influence ADR adoption, as organizations may be hesitant to adopt new technologies if their competitors are not yet doing so.

Individual Barriers to ADR Adoption

The strategic and tactical focus of ADR adoption is largely dependent on personal qualities of various decision actors, which reflect their attitudes, perceptions, motivations, fears, and other individual differences. Human factors, such as personal attitudes, cultural issues, and concerns about privacy and ethics, can also hinder the adoption of ADR technologies. Individual reaction can be different in different situations, depending on a variety of sometimes subjective factors. Personality is formed by the social, geographical, and cultural environment of an individual, and it can often explain the vastly different perceptions and reactions to the same event by two different people. Some individuals may harbor reservations about the potential impact of ADR on employment, privacy, and societal well-being. Some people have strong individual opinions, some rely on superior influencers, or peer group opinions. In a thorough study, Park and Woo (2022) discovered that the adoption of AI-powered applications was predicted by personality traits. They highlighted psychological factors like inner motivation and performance expectation, practicality, perceived ease of use. Factors related to personal values including optimism about science, anthropocentrism, ideology, and trust in government were significantly associated with the acceptance of AI. Additionally, subjective norms, culture, technological efficiency, confidence, and hedonic variables also have an impact on people's adoption of AI technologies (Kaya et al. 2022). Such complexity of factors cannot be approached in a straightforward manner and requires more research within social sciences.

5.3 Trust and Acceptance: the Cornerstones of ADR Adoption

Public perception of ADR technologies is often shaped by limited understanding and concerns about potential job displacement, privacy breaches, mistrust in technology, and ethical implications. Addressing public concerns is crucial through discussion and open communication and trying to understand the underlying reasons of these worries. Trustworthiness, a cornerstone of ADR technology adoption, is contingent upon responsible development and ethical implementation (for examples, see the TAILOR Network (Trustworthy AI Support), https://tailor-network.eu/). Concerns regarding AI trust adoption are further addressed in the AI Trust Label task 3.3. In this particular subsection we will address another kind of trust, basic human trust, one of the most important individual barriers on a path towards ADR adoption, based on feelings, and how this kind of trust leads to acceptance.

Ultimately, trust is a large determinant for the adoption of ADR technologies (Robinson 2020). Factors influencing trust are grounded in awareness, knowledge, and culture. Notably, the length of time it takes for an invention to be adopted depends on how long people have known about it, with the resistance naturally going away with time (Arrow et al. 2017). In different cultures, levels of trust and acceptance of robots and AI solutions vary significantly, depending on the extent of informational exposure to them, whether in physical presence or mediated through television and literature (Yam et al. 2023). Cultural resistance can be a significant barrier to implementing large-scale organizational changes like ADR adoption. This challenge often stems from a lack of understanding among business owners about how ADR technologies can benefit their businesses. For successful adoption, business owners need both information about the potential benefits and a willingness to seriously consider that information, moving beyond seeing it as mere advertising. The ideal innovation adoption process follows a logical progression: receiving new information, trusting the source, and then accepting the technology. However, cultural factors can disrupt this process, particularly at the information delivery stage. In some cultures, recommendations from trusted individuals hold more weight than objectively presented information, regardless of its quality or detail.

As Miriam Koch, a Communications and Industrial Interaction Expert at HLRS (USTUTT), confirms, individual and cultural differences in accepting ADR technologies exist even within the EU. For business owners to consider adopting an ADR solution, they must first understand its benefits. However, communication strategies must adapt to the owner's country of origin. In some cultures,

organizational authority fosters initial trust and acceptance. In others, personal connections are key, requiring information from trusted individuals and recommendations. Different cultures, and even social groups within them, value different organizations as trustworthy.

Miriam supports proposals for a unified ADR solution certification institution within the EU, believing it would increase trust among technology implementers, as this approach can streamline information access, simplify navigation, and enhance transparency by consolidating offerings in a single platform. Users could then easily evaluate available options, facilitating trust-building. However, it is crucial to acknowledge the diverse trust landscapes across the EU. While a centralized authority might resonate in some regions, others prioritize local connections and place greater trust in familiar organizations or individuals. This trust, often non-rational and unpredictable, remains a crucial factor to consider.

Successful ADR integration requires understanding technical, organizational, environmental, and individual adoption barriers. Public perception of ADR technologies influences their acceptance by businesses and organizations. It is important to ensure that the public has a good understanding of these technologies and that their concerns are addressed. By following the expert's advice and addressing these challenges trust can be fostered, leading to acceptance, so technology implementers can harness the transformative potential of ADR to drive innovation, enhance efficiency, and improve their competitive edge.

5.4 Analysis Approach: Possible Limitations

The meta-analysis presented in this document has been built as an iterative process based on a variety of methods, including academic literature review, analysis of stakeholders' reports, interviews with stakeholders, a workshop with stakeholders, and a survey. This methodological triangulation allowed to obtain richer insights and a nuanced understanding of the potential positive and negative externalities of ADR adoption, as well as to identify best or bad practices, barriers and challenges, or issues, related to economic, technological, legal, social, ethical, psychological, political and other aspects that have a potential to influence and to be influenced in result of ADR adoption.

This approach included data triangulation, as multiple data sources were used, such as papers, reports, various documents, interviews, a survey, and observations from interactions with stakeholders, to study the same phenomenon. Collecting data from different sources empowered this deliverable with corroborated findings and enhanced the credibility of the results. Theory triangulation by using multiple theoretical perspectives allowed to interpret the findings in a more comprehensive way and ensure that the proposed interpretations are well-grounded.

A thorough research literature review was conducted to identify and analyze existing previous research related to the adoption and acceptance of ADR, technology acceptance models, stakeholder analysis approach, and SWOT analysis. This process involved evaluating academic journals, books, and other scholarly publications to identify relevant findings and insights. The literature review provided a foundation for understanding the theoretical underpinnings as well as creating the original mappings presented in this document.

To gain a broader perspective on ADR adoption trends and challenges, online reports from industry experts, academia, government agencies, and non-profit organizations were analyzed. These reports provided valuable insights into the real-world experiences of organizations that have implemented ADR technologies or are aiming to help the implementers. The analysis of online reports complemented the academic literature review by providing a more practical and up-to-date understanding of the field and served as a basis for the externalities mapping.

To gain a deeper understanding of the perspectives of stakeholders involved in ADR adoption, semi-structured interviews were conducted with a diverse group of stakeholders, including regulators, technology developers, technology implementers, policymakers, network representatives, and academics. The interviews allowed for an in-depth exploration of the challenges, opportunities, and

ethical considerations associated with ADR adoption. The insights gained from interviews enriched the analysis by providing a more personalized and nuanced understanding of the field.

A workshop with a panel of experts who represented various types of stakeholders of ADR adoption was organized to facilitate a collaborative discussion on the potential positive and negative externalities of ADR adoption. The workshop provided a platform for sharing perspectives, identifying areas of consensus and disagreement, and exploring potential solutions to challenges. The insights generated from the workshop helped to refine the analysis, brainstorm possible recommendations for the better ADR adoption, and to identify key areas for further work.

A survey was conducted to gather quantitative data on the perceptions and experiences of individuals representing ADR technology implementers and ADR technology developers, involved in ADR adoption. The survey questions focused on topics such as the perceived benefits and risks of ADR, the challenges faced during adoption, and the ethical considerations associated with these technologies. The survey data provided additional context and support for the findings derived from the other methods.

Despite the strengths of the mixed-methods approach employed in this study, there are some limitations that should be acknowledged.

Limitations

Limited Research Timeframe: It is important to acknowledge that the majority of this research was conducted within a limited timeframe of six months. This constrained timeline inevitably limited the scope and depth of the analysis, as it restricted the extent to which stakeholders could be engaged, data could be gathered, and perspectives could be incorporated. A more comprehensive assessment would require a more extensive engagement with a broader range of stakeholders, including those from diverse backgrounds, expertise, and geographic locations.

Limited Amount of Stakeholders Involved: The research process did not encompass direct engagement with all relevant stakeholder groups, particularly those representing large industry players, manufacturers, big IT companies, certifying bodies, investors, and end customers. As a result, the analysis may not fully reflect the perspectives and experiences of these critical stakeholders. While insights gleaned from public resources and publications did provide valuable information, the direct engagement with these stakeholders would have enriched the analysis with firsthand accounts, diverse perspectives, and a deeper understanding of the challenges and opportunities they face in the context of ADR adoption.

Unbalanced Representation within the European Union: The analysis primarily draws on examples and insights from the most technologically developed countries within the EU (Global North and Central Europe), where ADR technologies are more mature and widely adopted, and representatives of academia and business have more motivation in sharing their insights. The potential impact of ADR in less technologically advanced countries deserves further exploration.

Limited Long-Term Perspective: The analysis focuses on the short-term impacts of ADR adoption, while overlooking potential long-term consequences and societal disruptions that may arise 10-30 years from now. A longer-term analysis is essential to assess the full impact of these technologies.

Necessity of Continuous Monitoring and Evaluation: The rapid pace of technological advancement and the dynamic nature of ADR adoption make it crucial to continuously monitor and evaluate the potential impact of these technologies. Effective governance frameworks and regulatory structures are needed to address emerging challenges and ensure responsible innovation, as well as continuous follow-up research and analysis.

In the future, long-term research involving more researchers from different parts of the European Union and expanding the scope of stakeholder engagement could lead to a more nuanced and comprehensive understanding of the potential positive and negative externalities of ADR adoption.

This would enable more informed decision-making and the development of effective strategies to address the concerns of all groups of stakeholders, mitigate potential risks, maximize benefits, and ensure that ADR adoption is undertaken in a responsible and equitable manner.

In addition to extending the research team, the research timeline, and broadening stakeholder engagement, future studies could also benefit from employing more rigorous and in-depth methodologies, such as longitudinal studies, ethnographic research, and mixed-methods approaches. These methods could yield richer insights into the complex dynamics of ADR adoption and its impact on different individuals, organizations, and societies. By acknowledging all the above-mentioned limitations, we can strive for a more comprehensive and nuanced understanding of the potential impact of ADR-driven technologies. As these disruptive technologies continue to evolve, it is important to remain vigilant in addressing the challenges and opportunities associated with these powerful tools.

6. Recommendations and Takeaways

The previous section provided an overview of overarching potentially challenging areas related to the externalities of ADR adoption, which must be navigated carefully to avoid the harm of negative externalities. These findings were presented to the stakeholders of ADR adoption during the research interviews, alongside the question: how can the process of ADR adoption be made easier? What will improve the acceptability rate of ADR technologies, making people believe that ADR will help their businesses and daily lives more? These questions sparked many interesting replies and discussions, often echoing each other. To summarize the most frequently mentioned proposals, we list some of the most popular recommendations on how to enhance the acceptability and trustworthiness of ADR while leveraging these technologies. The majority of these recommendations are for technology developers and policymakers, as perceived by those we interviewed and in line with the proposed stakeholders mapping (see Figure 4: The Stakeholder Mapping Model), as they have the strongest influence in the process of ADR adoption. While there are significant variations by industry, geography, competitive intensity, organization size, competence, and other factors, these general recommendations for improving ADR adoption can be applied in the majority of cases. Importantly, they are based purely on feedback from representatives of stakeholder groups provided during interviews and the workshop, representing real, current voices of regulators, technology implementers and developers, academics, and support networks.

Prioritize Transparency and Explainability through Involvement, Embrace User-Centered Design

Technology developers should strive to make their ADR-driven solutions understandable and inclusive, addressing potential biases and ethical concerns. This can be achieved by involving users at different levels of the technology development, including early in the design process, and considering different perspectives and experiences. By actively involving customers in the design and development process, technology developers will gain valuable insights into user preferences, pain points, and workflow requirements, leading to the creation of more intuitive and user-friendly interfaces. The ultimate goal of such interaction is to develop a standardized process that avoids discrimination and enables a fair, transparent, and understandable human-centered application of ADR systems in business. This approach not only enhances user satisfaction but also increases the likelihood of successful adoption and utilization of ADR-driven technologies, resulting in solutions that deliver tangible value and drive positive outcomes for both users and organizations.

Implement Robust Risk Assessment and Mitigation, Prioritize Data Privacy and Security

Technology developers and technology implementers must thoroughly evaluate potential risks associated with ADR-driven technologies and implement appropriate safeguards to protect individuals and society. By mitigating risks, such as data breaches, algorithmic biases, and various unintended consequences, organizations should aim to proactively identify and address

vulnerabilities before they escalate into significant issues. Especially, by emphasizing data protection measures, such as encryption, access controls, and anonymization techniques, aiming to safeguard sensitive information and prevent unauthorized access or misuse, technology developers can ensure that sensitive information remains confidential and is only accessed by authorized personnel. This approach also fosters trust and confidence in ADR-driven technologies, which are essential for their widespread adoption. Moreover, implementing appropriate safeguards based on the findings of risk assessments will help companies establish a solid foundation for ethical and responsible ADR practices.

Educate and Train Employees, Avoid Job Displacement

Educating and training employees is crucial for successful ADR implementation as it ensures that personnel are equipped with the necessary knowledge and skills to effectively utilize the novel technology while adhering to ethical standards and data privacy regulations. Together governments, academia, and businesses should collaborate in developing comprehensive skills development and reskilling programs. This proactive approach not only enhances employee competency but also fosters innovation in the workforce, addresses the evolving demands of the job market, and empowers individuals to adapt to technological advancements and contribute to organizational success, driving overall economic growth and societal development.

Foster Collaboration Across Stakeholders, Encourage Productive Dialogue

Active collaboration among academia, industry, government, and civil society facilitates the exchange of knowledge, expertise, and resources, enabling stakeholders to leverage each other's strengths and address complex challenges more effectively. Such a collaborative approach would not only promote innovation but also ensure that ADR-driven solutions are developed with a comprehensive understanding of societal needs and global implications. Furthermore, by encouraging collaboration, stakeholders can pool together their resources and expertise to tackle common goals and drive meaningful progress in the development and adoption of ADR technologies, ultimately leading to more impactful and sustainable outcomes for society as a whole.

Develop Clear Regulatory Frameworks, Establish Certification Bodies

Regulatory guidelines and ethical frameworks will provide guidance and oversight for the responsible development and adoption of ADR technologies. By following them, businesses can navigate the complexities of ADR implementation with confidence, ensuring that ethical principles are upheld and potential risks are mitigated. The establishment of certification bodies for ADR-driven solutions could help to develop a standardized process, providing a centralized system that offers information about requirements and regulations, helping to make technology developers more transparent for customers and promoting trust among users. This clarity will foster an environment of accountability and compliance, ultimately contributing to the safe and ethical advancement of ADR technologies while safeguarding individual rights and societal well-being.

Invest in Multidisciplinary Research and Development

By integrating expertise from diverse fields like humanities, social sciences, and engineering, researchers can approach ADR development holistically, considering technical aspects together with ethical, cultural, and social factors. This multidisciplinary approach will facilitate innovation that aligns with human values and addresses complex societal challenges, ultimately leading to the responsible and beneficial integration of ADR technologies into various domains of society. Also, collaboration and inclusion of ethicists and AI experts in both research and public debate will make media coverage of ADR more sophisticated in its content, thereby helping to mitigate the lack of certainty, complexity of language, and potentially averting some of the possible undesired social outcomes.

Promote Public Awareness and Education to Enhance AI Literacy

The public must be educated about the benefits and responsible use of ADR technologies. Many end-users are unaware of the prevalence of AI in their daily lives, which leads to misconceptions and overestimation of risks. By providing the media with information relevant to the public, such as showcasing positive examples of ADR adoption, familiarizing the public with robots and other ADR solutions for daily life through repeated media representation, launching various public awareness campaigns, and developing educational materials, governments and academia can enhance AI literacy and empower individuals with knowledge to make informed decisions about the adoption and utilization of ADR-driven technologies. Fostering public discussion and accurate and balanced media coverage of ADR can help prevent the spread of misinformation, further contributing to public understanding and trust in these technologies. Additionally, investing in digital literacy programs will not only facilitate the adoption of ADR technologies but also contribute to socio-economic development by enhancing digital skills and connectivity among underserved populations.

Foster International Collaboration, Strive for Digital Inclusion

Collaboration with stakeholders from other countries will facilitate smoother cross-border transactions, help to develop harmonized regulations, and promote responsible ADR adoption globally. International collaboration provides opportunities to leverage diverse perspectives and expertise, leading to more comprehensive and robust solutions to common challenges in ADR technologies development and deployment. It allows for the sharing of best practices and lessons learned across different countries and regions, promoting more efficient and effective approaches to ADR implementation. Moreover, these initiatives have the potential to bridge the international digital divide and ensure equitable access to ADR technologies, including providing affordable internet access and investing in infrastructure. By bridging the digital divide, nations, communities, and individuals can be empowered to participate fully in the digital economy and take advantage of ADR solutions for their benefit. By networking and learning from others on a global scale, stakeholders can tap into a wealth of knowledge and experiences, accelerating progress and fostering innovation in the field of ADR.

This list of recommendations is not exhaustive but rather provides the overview of the most often mentioned proposals heard from stakeholders of ADR adoption during interviews, various conferences, meetings, and meetups. To achieve any of these goals, a complex multistakeholder approach is necessary. Importantly, each of these recommendations has one ultimate purpose: to improve acceptability and trust in ADR-driven technologies, which is crucial, as the widespread adoption of ADR is contingent upon ensuring public acceptance. ADR technologies hold immense promise for societal improvement, but their success hinges on addressing critical concerns regarding trust, security, and ethics. By prioritizing collaboration, user involvement, data security, research, education, and regulations, stakeholders can harness the transformative power of ADR while fostering a trustworthy and equitable society.

7. Conclusion

This deliverable explores the externalities impacting the acceptability and trustworthiness of ADR-driven technologies. Through a comprehensive meta-analysis of stakeholder analyses and theoretical research, validated by stakeholder involvement, it identifies key findings and outlines the next steps for WP3.

A detailed mapping of externalities, reorganized into a business-focused SWOT analysis and validated by stakeholders, provides a deeper understanding of what is needed for ADR technologies to be widely adopted by different businesses and organizations. It also highlights issues related to acceptability and trustworthiness. The meta-analysis critically evaluates the challenges and examines barriers associated with ADR adoption, considering factors like economics, technology, politics, psychology, and culture.

This deliverable provides recommendations for improvement of the ADR adoption, with key recommendations including raising awareness and promoting education, as well as promoting human oversight and explainability. These objectives are crucial for WP3 and are addressed in detail by the "ADR Awareness Centre" (Work Package 3, task 3.1), which aims to develop a framework for outreach and awareness of ADR, and the "AI Trust Label" (Work Package 3, task 3.3) that helps improve public trust in and acceptance of AI products and services.

Overall, this deliverable emphasizes the importance of multidisciplinary and multistakeholder collaboration. Effective communication and collaboration will be the next steps for WP3, aligning with the objectives of Adra and Adra-e, as they aim to create an inclusive, sustainable, and effective European ADR ecosystem by providing communication tools and channels for knowledge sharing. An all-inclusive approach to education, resources, fair and feasible AI regulation, and international technology standardization is crucial for success at the European and global levels. Adra and Adra-e and hence this report contribute to the successful implementation of this goal.

8. Appendices

List of Reports:

Organization	Title	Focus/sector	Region	Link
Applied AI	AI Act Impact Survey	Private - startups & VC	EU	Downloaded pdf
Accenture	From AI compliance to competitive advantage, performance report	Public	Global	https://www.accenture.com/content/dam/accenture/final/a-com-migration/r3-3/pdf/pdf-179/accenture-responsible-by-design-report.pdf#zoom=40
Accenture	A new era of generative AI for everyone	Public	Global	https://www.accenture.com/content/dam/accenture/final/accenture-com/document/Accenture-A-New-Era-of-Generative-AI-for-Everyone.pdf#zoom=40
AI Accelerator Institute	Generative AI 2023 Report	Public	Global/US	https://www.aiacceleratorinstitute.com/generative-ai-2023-report/
AI Sweden	Impact Report 2022	General	Nordic	https://www.ai.se/en/about-0/impact-report-2022
AI Watch	AI Watch, road to the adoption of artificial intelligence by the public sector	Public	EU	https://op.europa.eu/en/publication-detail/-/publication/34251428-dc12-11ec-a534-01aa75ed71a1/language-en/format-PDF/source-258140019
Analytics Insight	"Generative AI 2023" Report for AI Industry	General	Global	https://dealroom.co/uploaded/2023/01/Dealroom-deep-tech-report-2023-europe.pdf
AppliedAI	Generative AI in the European Startup Landscape 2024	Public - startups	EU	https://aihubtest-bucket.s3.eu-north-1.amazonaws.com/public/storage/resources/7u09rGhojsSKxtbl0nVN5RnR2heMo6S5Fkp4PuKk.pdf
ARGONNE NATIONAL LABORATORY	ADVANCED RESEARCH DIRECTIONS ON AI FOR SCIENCE, ENERGY, AND SECURITY	Public	US	https://www.anl.gov/sites/www/files/2023-06/AI4SESReport-2023-v6.pdf
Atomico	State of European Tech 2022	Private - startups & VC	EU	Downloaded pdf
CapGemini	Connecting the dots: data sharing in the public sector	Public	Global	Downloaded pdf
Codingscape	Codingscape Enterprise AI Report 2023	Public	Global	https://codingscape.com/blog/codingscape-enterprise-ai-report-2023
Concentric.ai	Concentric AI Data Risk Report for Q1 2023	Public	Global	https://concentric.ai/pdf/concentric-data-risk-report/
CUJO AI Labs	Device Intelligence Report 2023	Public	Global/US	https://cujo.com/resources/device-intelligence-report-2023/
Data Science Salon	The State of AI in the Enterprise Report 2023	Public	global	https://www.datascience.salon/state-of-ai-in-the-enterprise-2023-report/
Databricks	2023 State of Data and AI report by Databricks Lakehouse	Public	Global	https://pages.databricks.com/rs/094-YMS-629/images/databricks-2023-state-of-data-report-06072023-v2_0.pdf?utm_source=databricks&utm_medium=email&utm_campaign=7018Y000001FhVkQAK&mkt_tok=MDk0LVlNUy02MjkAAAGM3su3ZZk8FFi9EULts-MGAcDujjT1lhfG2Qli4QUKKM2dQt2soOZd722tybVZSPOFaAMham00M5HpNG8zXE6wYRKSwadLCffRpV3fxJI3KBgwPtOD
Dealroom	The European Deep Tech Report 2023 Edition	Public	EU	https://dealroom.co/uploaded/2023/01/Dealroom-deep-tech-report-2023-europe.pdf

Organization	Title	Focus/sector	Region	Link
Deloitte	State of AI in the Enterprise, 5th Edition report	Private	Global	Downloaded pdf
Deloitte	The Government and Public Services AI Dossier	Public	Global	https://www2.deloitte.com/content/dam/Deloitte/us/Documents/deloitte-analytics/us-ai-institute-government-and-public-dossier.pdf
DIGG	Slutrapport Uppdrag att främja offentlig förvaltnings förmåga att använda AI	Public	Sweden	Downloaded pdf
DigitalScience	The State of Open Data 2023	Public	Global	https://digitalscience.figshare.com/articles/report/The_State_of_Open_Data_2023/24428194
Edge	2023 Edge AI Technology Report	Public	Global/US	https://www.wevolver.com/article/2023-edge-ai-technology-report
EDUCAUSE	2022 EDUCAUSE Horizon Report | Teaching and Learning Edition	Public - education	Global	https://library.educause.edu/resources/2022/4/2022-educause-horizon-report-teaching-and-learning-edition
European Commission	Science research and innovation performance of the EU	Public - science	EU	Downloaded pdf
European Commission	Digital Economy and Society Index Report 2022	General	EU	Downloaded pdf
European Commission	AI Watch - Evolution of the EU market share of Robotics 2023	Public - robotics	EU	https://op.europa.eu/en/publication-detail/-/publication/ef3d5e99-dd97-11ed-a05c-01aa75ed71a1/language-en
European Commission	AI Watch. Artificial Intelligence for the Public Sector 2023	Public	EU	https://publications.jrc.ec.europa.eu/repository/handle/JRC133826
European Commission	2030 Digital Decade: Report on the state of the Digital Decade 2023	Public	Global	Downloaded pdf
European Commission	Digital Decade Country Report 2023	Public	EU	https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4619
European Investment Bank	Artificial intelligence, blockchain and the future of Europe.	Public	EU	https://www.eib.org/attachments/thematic/artificial_intelligence_blockchain_and_the_future_of_europe_report_en.pdf
European Parlament	Analysis exploring risks and opportunities linked to the use of collaborative industrial robots in Europe 2023.	Public - robotics	EU	https://www.europarl.europa.eu/RegData/etudes/STUD/2023/740259/EPRS_STU(2023)740259(ANN01)_EN.pdf
European Parliament	REPORT on artificial intelligence in a digital age. 2022	General	EU	https://www.europarl.europa.eu/doceo/document/A-9-2022-0088_EN.html
European Parliament	Artificial intelligence in healthcare: Applications, risks, and ethical and societal impacts	General - health	EU	https://www.europarl.europa.eu/RegData/etudes/STUD/2022/729512/EPRS_STU(2022)729512_EN.pdf
Forbes	Top AI Statistics And Trends In 2023	Public	global	https://www.forbes.com/advisor/in/business/ai-statistics/
FTI Consulting	2023 Privacy and AI Governance Report	Public	Global/US	Downloaded pdf
Google	2023 State of Data and AI Trends Report (by Databricks Lakehouse)	Public	Global	https://cloud.google.com/resources/2023-data-ai-trends
Google/Boston Consulting Group	Accelerating Climate Action with AI Report	Public - sustainability	Global/US	https://www.gstatic.com/gumdrop/sustainability/accelerating-climate-action-ai.pdf

Organization	Title	Focus/sector	Region	Link
Government of Denmark	National Strategy for Artifcial Intelligence Ministry of Finance and Ministry of Industry, Business and Financial Afairs			https://en.digst.dk/media/19337/305755_gb_version_final-a.pdf
Influencer Marketing Hub	(AI) Marketing Benchmark Report: 2023	Public	Global/US	https://influencermarketinghub.com/ai-marketing-benchmark-report/
Info-Tech Research Group	Tech trends 2023 report	General	Global	Downloaded pdf
insideBIGDATA	Generative AI Report	Public	Global/US	https://insidebigdata.com/2023/11/21/generative-ai-report-11-21-2023/
intercom.com	The State of AI in Customer Service: 2023 Report	Public	Global	https://www.intercom.com/blog/state-of-ai-in-customer-service-2023-report/
INTERNATIONAL MONETARY FUND	ARTIFICIAL INTELLIGENCE 2023: What AI means for economics	Public - finance	global	Downloaded pdf
Ipsos	Artificial Intelligence: Key insights, data and tables 2023	Public	Global/US	https://www.ipsos.com/en-us/artificial-intelligence-key-insights-data-and-tables
Jasper	The AI in Business Trend Report 2023	General	Global	https://www.jasper.ai/the-prompt/ai-business-trend-report
JRC	AI watch - European Landscape on the Use of Artificial Intelligence by the Public Sector	Public	EU	Downloaded pdf
Massachusetts Institute of Technology	Achieving Individual — and Organizational — Value With AI 2022	Public	Global/US	https://web-assets.bcg.com/b8/55/97a0dcbe42cab65ed77794cc9dfe/achieving-individual-and-organizational-value-with-ai.pdf
McKinsey	five-insights-about-harnessing-data-and-ai-from-leaders-at-the-frontier	Private	Global	Downloaded pdf
McKinsey	The economic potential of generative AI: The next productivity frontier 2023	Private	Global	Downloaded pdf
McKinsey	AN AI NATION? Harnessing the opportunity of artificial intelligence in Denmark	Public	EU	https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Europe/Harnessing%20the%20opportunity%20of%20artificial%20intelligence%20in%20Denmark/An-AI-nation-Harnessing-the-opportunity-of-AI-in-Denmark.pdf
McKinsey	The state of AI in 2023: Generative AI's breakout year	Public	Global	https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year
McKinsey	The state of AI in 2022—and a half decade in review	Public	Global	https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2022-and-a-half-decade-in-review
Naspers	Artificial intelligence 2023 report	Public	Global	https://www.naspersreport2023.com/artificial-intelligence.php
NewVantage Partners	2023-Data-Analytics-Survey-Report	Private	Global/US	Downloaded pdf
Nordic Cooperation	The Nordic AI and data ecosystem 2022	Public	Sweden	https://norden.diva-portal.org/smash/record.jsf?aq2=%5B%5B%5D%5D&c=2&af=%5B%5D&searchType=SIMPLE&sortOrder2=title_sort_asc&query=The+Nordic+AI&language=en&pid=diva2%3A1667628&aq=%5B%5B%5D%5D&sf=all&aqe=%5B%5D&sortOrder=author_sort_asc&onlyFullText=false&noOfRows=50&dswid=1465

Organization	Title	Focus/sector	Region	Link
Nvidia	State of AI in Financial Services: 2023 Trends	Public - finance	Global	https://resources.nvidia.com/en-us-state-ai-report
OECD	The Digital Transformation of SMEs	Private - startups	Global	https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_bdb9256a-en#page3
OECD	Artificial intelligence and jobs: An urgent need to act	Public	global	https://www.oecd.org/employment-outlook/2023/
Oxford Insights	Government AI Readiness Index 2021	Public - government	Global	https://www.oxfordinsights.com/government-ai-readiness-index2021
Pluralsight	Technology trends 2023-2024: AI and Big Data Analytics	Public	Global	https://indatalabs.com/wp-content/uploads/2022/11/technology-trends-2023-2024-ai-and-big-data-analytics.pdf
PwC	Sizing the prize, What's the real value of AI for your business and how can you capitalise?	Private	Global/US	https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html
ResearchAndMarkets.com	Global AI as a Service Market Report 2023	General	US	https://www.researchandmarkets.com/reports/4519596/ai-as-a-service-market-by-offering-saas-paas?utm_source=GNE&utm_medium=PressRelease&utm_code=8d9gsc&utm_campaign=1853364+-+Global+AI+as+a+Service+Market+Report+2023%3a+Growth+in+Importance+of+Data-driven+Decision-making+in+Business+Fuels+the+Sector&utm_exec=jamu273prd
Retool	Retool's State of AI Report 2023	Public	global	https://retool.com/reports/state-of-ai-2023
Scale AI	2023 AI Readiness Report	Public	Global	https://go.scale.com/hubfs/Scale-Zeitgeist-AI-Readiness-Report-2023.pdf
Scaleai	AI for Healthcare: The White Paper	Public - health	Canada	Downloaded pdf
Siemens	Sustainability Report 2022	Public - sustainability	EU	https://assets.new.siemens.com/siemens/assets/api/uuid:c1088e4f-4d7f-4fa5-8e8e-33398ecf5361/sustainability-report-fy2022.pdf
Silo AI	The Nordic State of AI, The 2022 Report	Private	Nordic	Downloaded pdf
Snowflake	Four essential trends redefining the way modern companies succeed with AI, automation, and more	Public	Global	Downloaded pdf
Stanford	2022-AI-Index-Report	General	Global	Downloaded pdf
State of AI	State of AI Report 2022	General/technical	Global	Downloaded pdf
StateofAI	State of AI Report 2023	Public	Global/US	https://www.stateof.ai/2023-report-launch
Statistics Sweden	AI-use in business enterpises and the government sector	Public - government	Sweden	https://www.scb.se/contentassets/ea0e9cccd58343e7a07fe4c055f8fad2/nv0116_2022a01_br_nvftbr2301.pdf
Swedish Agency for Growth Policy Analysis	AI-politik_för_konkurrenskraft	Private/policy	Sweden	Downloaded pdf
Swedish Agency for Growth Policy Analysis	Drivers of AI adoption	Private	Sweden	Downloaded pdf
Swedish Agency for Growth Policy Analysis	Varför AI_ förutsättningar, möjligheter och hinder för företag att använda AI	Private	Sweden	Downloaded pdf

Organization	Title	Focus/sector	Region	Link
The Economist	Staying ahead of the curve The business case for responsible AI A report by The Economist Intelligence Unit	Public	Global	https://pages.eiu.com/rs/753-RIQ-438/images/EIUStayingAheadOfTheCurve.pdf
The United States Government	AI for Science, Energy, and Security, 2022	Public	Global/US	https://www.anl.gov/sites/www/files/2023-06/AI4SESReport-2023-v6.pdf
The University of Queensland, Australia	Trust in Artificial Intelligence. A global study 2023	Public	Global	https://assets.kpmg.com/content/dam/kpmg/au/pdf/2023/trust-in-ai-global-insights-2023.pdf
Twilio Segment	The Growth Report 2023: AI edition	Public	Global	https://segment.com/pdfs/Twilio-Segment-Growth-Report-2023.pdf
U.S. Department of Education	Artificial Intelligence and the Future of Teaching and Learning Insights and Recommendations May 2023	Public - education	Global/US	https://www2.ed.gov/documents/ai-report/ai-report.pdf
United Nations	E-Government Survey 2022	Public - government	Global	Downloaded pdf
United Nations	Interim Report: Governing AI for Humanity	Public	global	https://www.un.org/sites/un2.un.org/files/ai_advisory_body_interim_report.pdf
USA National Science and Technology Council	National Artificial Intelligence Research and Development Strategic Plan 2023	Public	US	https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf
WASP-HS	AI, Sustainability and Agenda 2030 Report, 2023	Public - sustainability	EU	https://wasp-hs.org/wp-content/uploads/2023/12/AI-sustainability-and-agenda-2030-Report.pdf
WASP-HS	AI, Education and Children Report 2023	Public - education	EU	https://wasp-hs.org/wp-content/uploads/2023/09/AI-Education-and-Children-Report-2023.pdf
WAVESTONE	2024 Data and AI Leadership Executive Survey	Public	Global	https://www.wavestone.com/app/uploads/2023/12/DataAI-ExecutiveLeadershipSurveyFinalAsset.pdf
WEKA	2023 Global Trends in AI	Public	Global	https://www.weka.io/resources/analyst-report/2023-global-trends-in-ai/
Wevolver	2023 Edge AI Technology Report	Public	Global	https://brainchip.com/2023-edge-ai-technology-report/
www.run.ai	The annual State of AI Infrastructure survey from Run:ai	Public	Global	https://www.run.ai/2023

List of Interviewees:

1. Jovita Tautkevičiūtė, Lithuania (Regulators + Influencers), Senior Consultant at Civitta, Responsible Robotics Policy Lab, Robotics4EU, specializing in policy recommendations

2. Sylwia Stefaniak, Poland (Regulators + Academia), Expert at the Ministry of Digital Affairs

3. Liza Ocklenburg, Germany (Technology Producers), Product Manager at CloudSME, Head of the emGORA workspace, Coordinator of DIGITbrain

4. Jimmy Johansson, Sweden (Technology Producers), CTO at Frank Valiant digital communication agency

5. Michael Adler, Sweden (Technology Implementers), Business Innovation Director at Ramsay Santé Innovation Hub

6. Niki Lazaridou, Sweden-Greece (Technology Implementers), Photographer specializing in fashion photography, commercial and editorial work, model portfolio, and portraits

7. Miriam Koch, Germany (Influencers), Communication Coordinator at HLRS (EuroCC, CASTIEL, and FF4EuroHPC projects)

8. Trine Platou, Sweden (Influencers), Project Manager at TAILOR Network (Trustworthy AI support)

9. Karolina Ivaldi, Poland (Influencers), Agencja Rozwoju Mazowsza S.A., Deputy Director, activities for the development of digital services for SMEs

10. Argyro Amidi, Greece (Infuencers), AI Law Expert

11. Mattias Tiger, Sweden (Academia), Deputy Lab Leader of the Reasoning and Learning (ReaL) lab, at Linköping University's AI division (AIICS)

12. Caroline Lancelot Miltgen, France (Academia), Social and Behavior Scientist, Expert in AI & Ethics

13. Press Secretary for the Chairman of the Municipal Executive Board from Sweden (Regulators + Technology Implementers) (/anonymously)

14. Medium size software company from Slovenia (Technology Implementers) (/anonymously)

15. Medium size marketing agency from Finland (Technology Implementers) (/anonymously)

Interview Questions

Section 1: Introduction and Awareness

1. Can you provide a brief overview of your role and experience with ADR technologies?
2. How familiar are you with ADR technologies? What are your initial impressions of these technologies?
3. What factors have influenced your understanding and perception of ADR technologies?

Section 2: SWOT Analysis

1. Can you describe the **strengths** you perceive in ADR technologies?
2. What do you consider to be the main **weaknesses** or challenges associated with ADR technology adoption?
3. What **opportunities** do you see for ADR technologies to enhance business operations or societal outcomes?
4. What potential **threats** or risks do you anticipate with the adoption of ADR technologies?

Section 3: Externalities

1. What are your thoughts on the mapping of externalities of ADR technology adoption presented?
2. Do you agree with these potential positive externalities of ADR technologies?
3. Are these the potential negative externalities of ADR technology adoption that you are concerned about?

Section 4: Adoption and Integration

1. Does your organization currently use ADR technologies? If so, how extensively are they used and in what domains?
2. What factors have influenced your decision to adopt or not adopt ADR technologies?
3. What challenges or obstacles have you faced in implementing ADR technologies?
4. How do you plan to integrate ADR technologies into your organization's operations or processes?

Section 5: Future Outlook and Recommendations

1. How do you envision the future of ADR technologies in your industry or sector?
2. What recommendations would you offer to other stakeholders regarding the adoption and responsible use of ADR technologies?
3. What research or initiatives do you see as being important for advancing the responsible development and adoption of ADR technologies?

Additional Questions (depending on stakeholder group)

- For regulators: What regulatory frameworks or guidance are needed to promote the safe and responsible adoption of ADR technologies?
- For technology producers: What steps are being taken to ensure the transparency and explainability of ADR systems?
- For technology implementers: How are you addressing the challenges of data management, privacy compliance, and bias mitigation in ADR implementations?

- For supporting organizations: What role can you play in educating and raising awareness about ADR technologies among stakeholders?
- For researchers: What research priorities would you identify to address the potential societal and ethical implications of ADR adoption?

Consent for Public Participation

1. Would you be willing to have your name and company name included in the research report?

ZOOM WORKSHOP

Acceptability and Trustworthiness of AI, Data, and Robotics-Driven Technologies: A Case Study of European Businesses

DECEMBER 15 FRIDAY, 10:00-11:40 (CET)

European companies should utilize more AI, Data, and Robotics (ADR) solutions, but how can this goal be achieved? Our research at Linköping University suggests that for successful adoption of these technologies, companies must first be aware of their existence, trust them, and be willing to explore their use.

The practical focus of this webinar is to examine the approaches and methods employed in Europe by various stakeholders to achieve this goal.

The "cases" mentioned in the workshop title refer to the speakers who represent diverse stakeholders of ADR adoption, including academia, business, support networks, and government. During this online event, we aim to learn about the initiatives undertaken by these stakeholders from different parts of Europe to promote ADR technology adoption. We will gain insights into their experiences, challenges, and achievements. We will engage in discussions on critical issues and address questions from the audience. While diverse perspectives are encouraged, we will prioritize a discussion on trustworthiness and acceptance of ADR technologies.

Moderator: Katerina Linden

Agenda:

Introduction (5 minutes)

- Welcome and Introduction to the Workshop
- Brief Overview of the Workshop's Purpose and Goals, presentation of the Work Task

Speaker Introductions (5 minutes)

- Introduction of each Speaker and their Background
- Brief Overview of how their background contributes to a more comprehensive understanding of Acceptability and Trustworthiness, posing a question to the speakers:

Main question: ***How, from your professional standpoint, do you in your area work towards establishing trust and acceptance in AI, Data, and Robotics among businesses/organizations/individuals? What are your struggles and what are your achievements?***

Individual Speaker Presentations (40 minutes)

Sylwia Stefaniak, Expert, Ministry of Digital Affairs, Poland (10 minutes)

Liza Ocklenburg, CloudSME, Germany (10 minutes)

Jovita Tautkevičiūtė, Senior Consultant at Civitta, Responsible Robotics Policy Task lead at Robotics4EU, Lithuania (10 minutes)

Trine Platou, Project Manager, TAILOR Network of Excellence Centres on Trustworthy AI, Sweden (10 minutes)

Simone Grassini, Associate Professor of Psychology at the University of Bergen, Norway (10 minutes)

Break (10 minutes)

Facilitated Panel Discussion aka Virtual Workshop (25 minutes)

Main question: What steps are needed to democratize ADR technologies in Europe? Let's brainstorm some very practical recommendations (including the ones for the European Commission!) to support this goal.

Audience Q&A (10 minutes)

- Open the floor for additional questions from the online audience
- Panelists provide responses to audience questions

Closing Remarks (5 minutes)

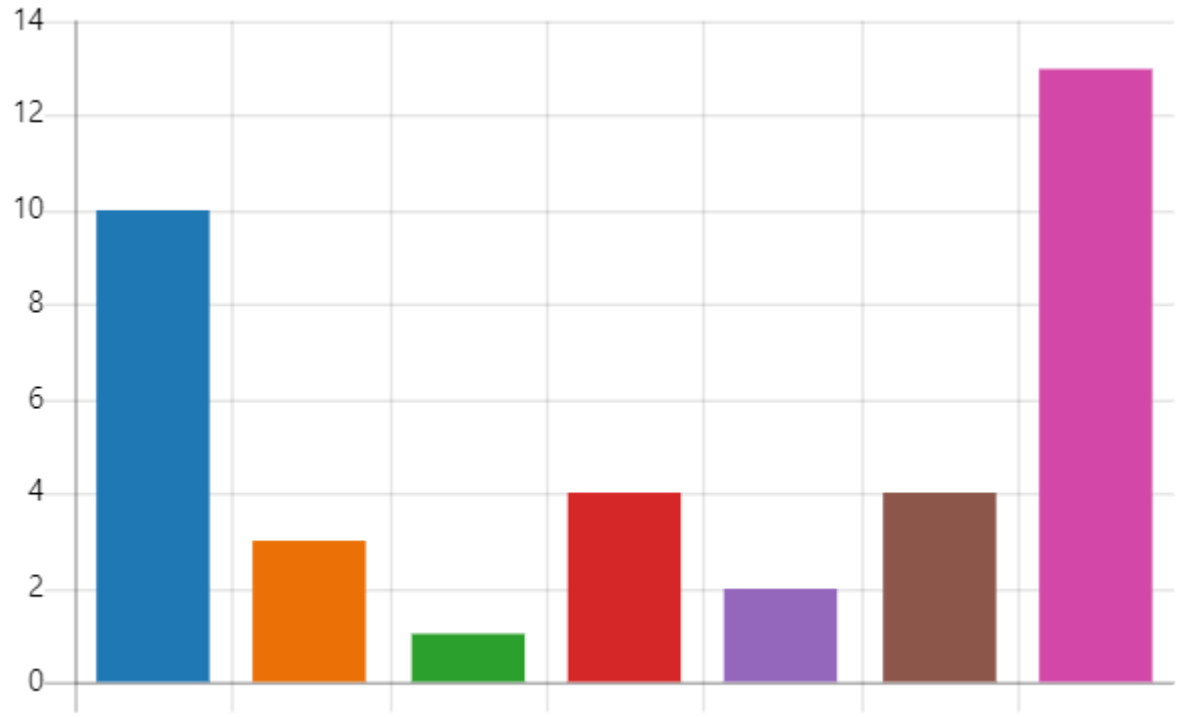
- Summary of Key Takeaways and Insights
- Acknowledgment and Thanks to Speakers and Participants

Total length: 1h40m

AI, Data, Robotics-driven technologies in Europe
Research survey results breakdown
37Responses27:21Average time to completeActiveStatus25/01/2024Date

1.
How many employees work at your company?

<200	10
201-500	3
501-1K	1
1,001-5K	4
5,001-10K	2
>10K	4
Other	13

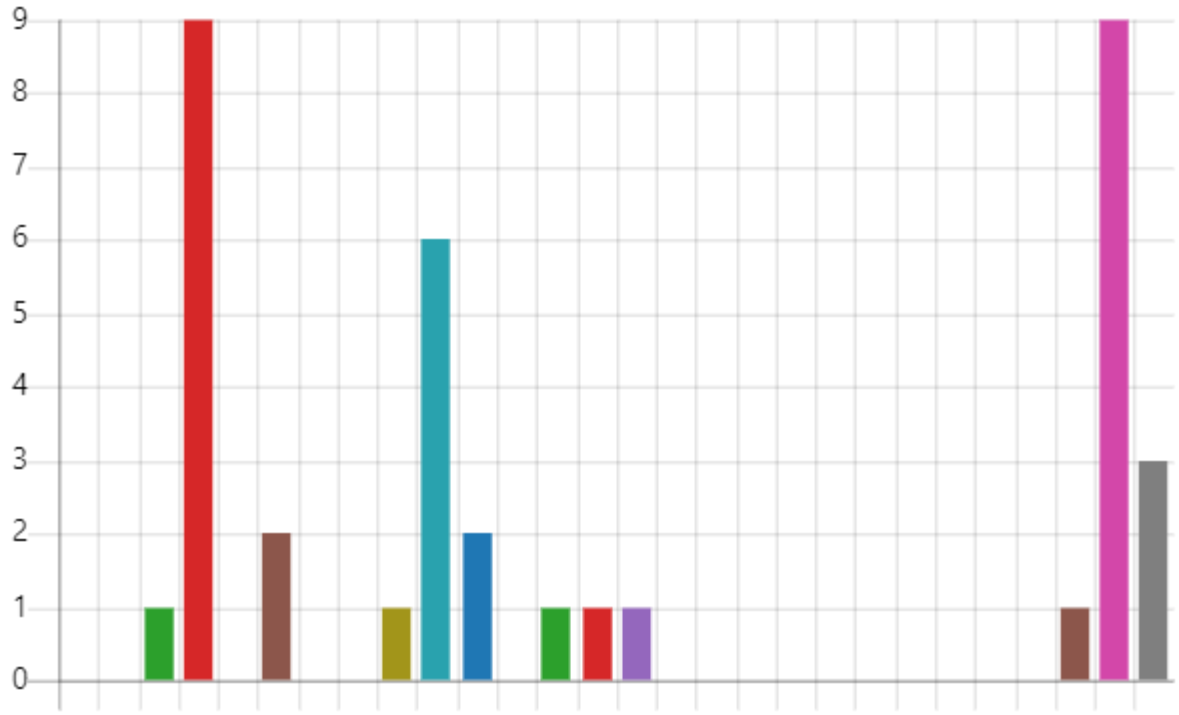


2.
In which country is your company situated?

Austria	0
Belgium	0
Bulgaria	1

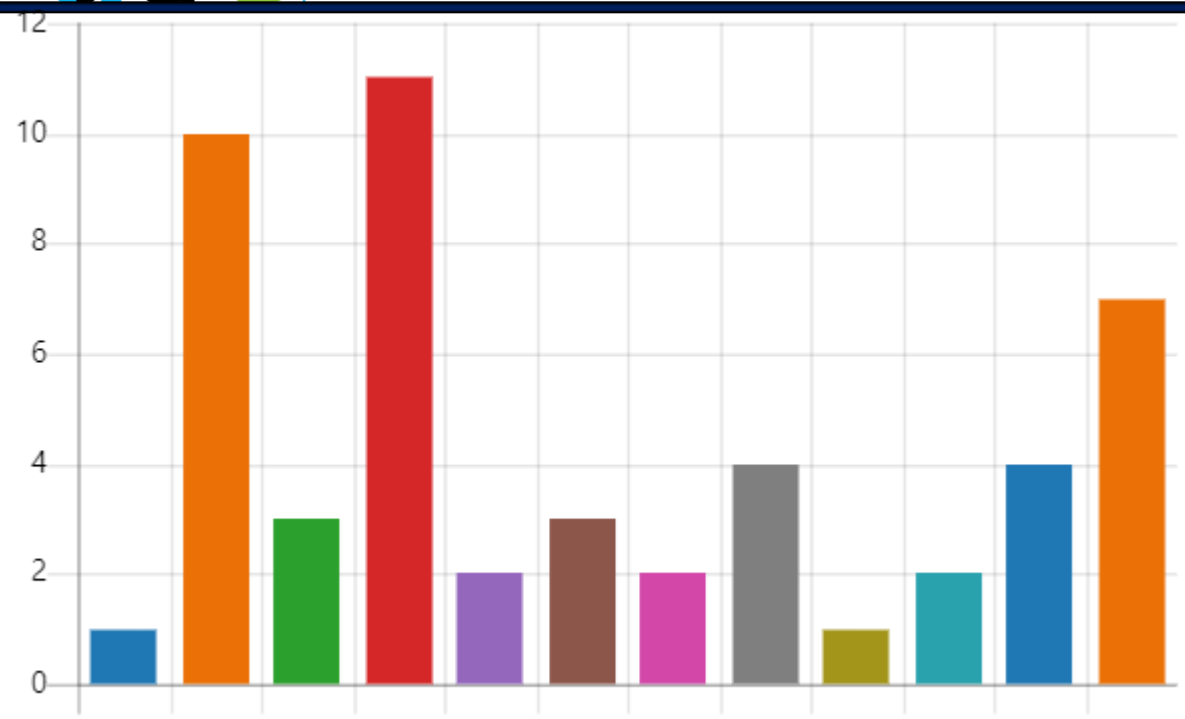
Croatia	9
Republic of Cyprus	0
Czech Republic	2
Denmark	0
Estonia	0
Finland	1
France	6
Germany	2
Greece	0
Hungary	1
Ireland	1
Italy	1
Latvia	0
Lithuania	0
Luxembourg	0
Malta	0
Netherlands	0
Poland	0
Portugal	0
Romania	0
Slovakia	0
Slovenia	0
Spain	1
Sweden	9

Other	3



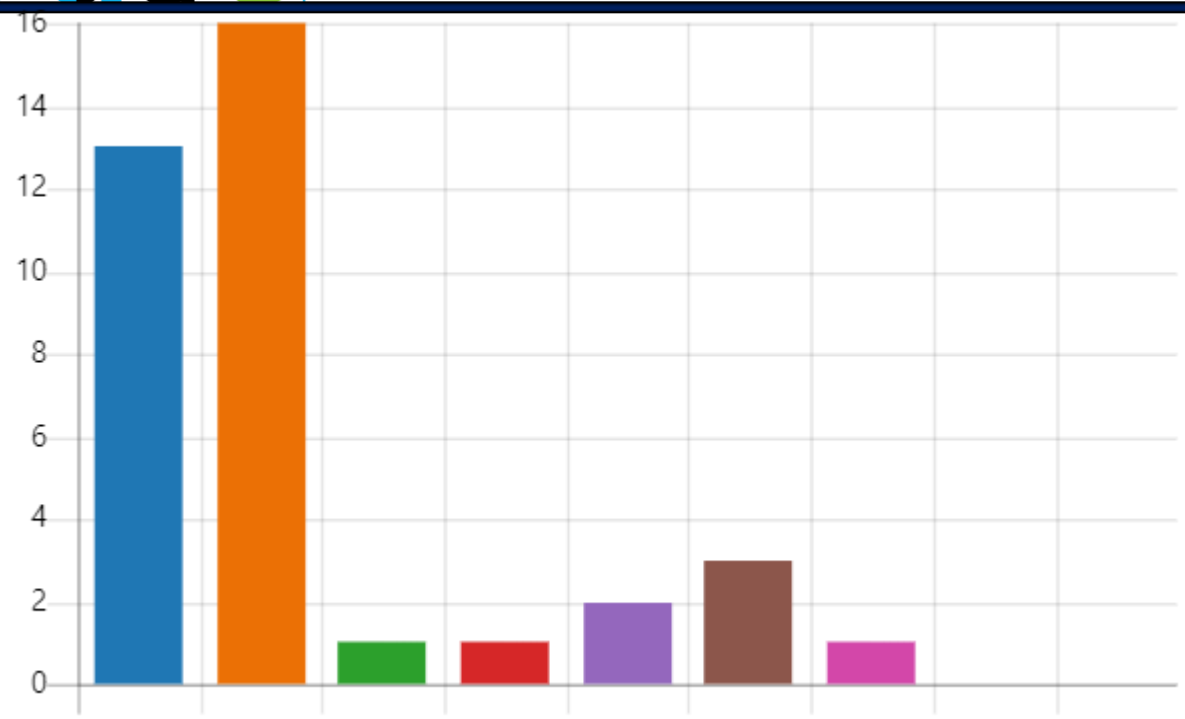
3.
In which industry does your company operate?

Computer hardware	1
Computer software	10
Cybersecurity	3
Education	11
Healthcare	2
Manufacturing	3
Banking/Finance	2
Transportation	4
Retail	1
Government	2
Media & Communications	4
Other	7



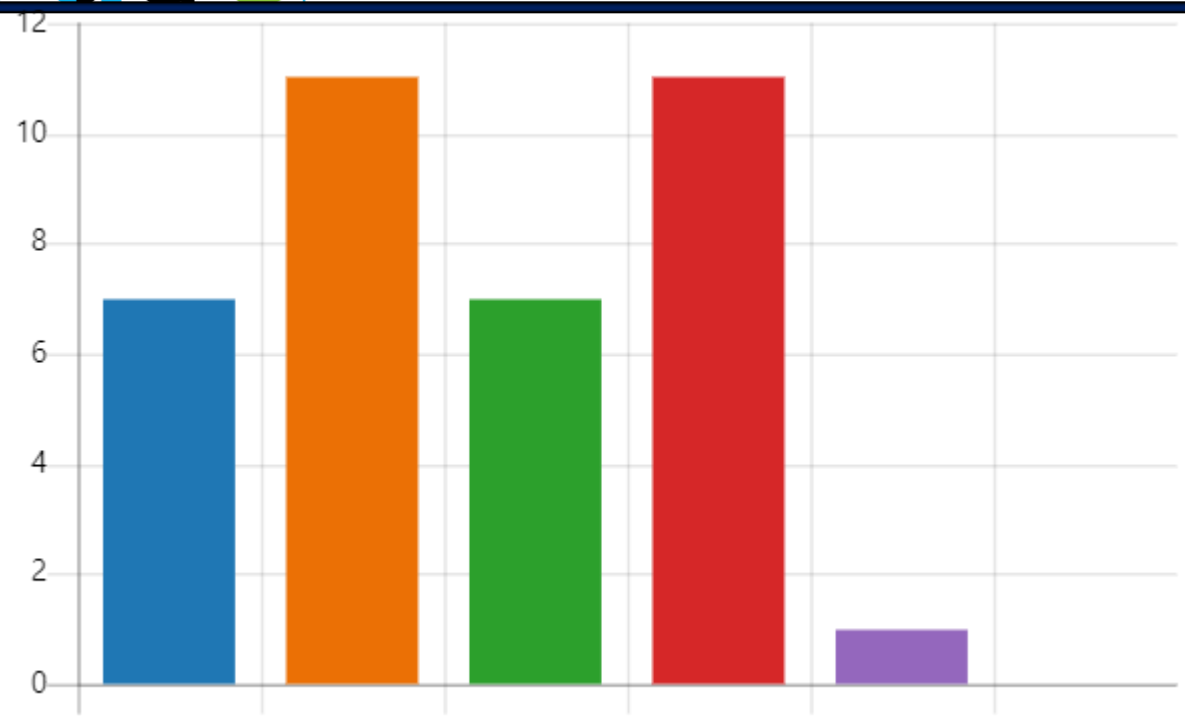
4.
What type of company best describes your business?

Public	13
Private	16
Partnership	1
Nonprofit	1
Corporation	2
Limited Liability Company (LLC)	3
Family-Owned Business	1
State-Owned Enterprise (SOE)	0
Other	0



5.
How aware are you of the AI, data and robotics-driven technologies in your company?

We know everything!	7
We know more than our competitors	11
We know enough	7
We know a little	11
We are not following up with these developments	1
Other	0



6.
Do you use any AI tools in your company?

Yes	30
No	4
I do not know	3
Other	0

7.
Do you collect data for machine learning in your company?

Yes	22
No	14

I do not know	1
Other	0

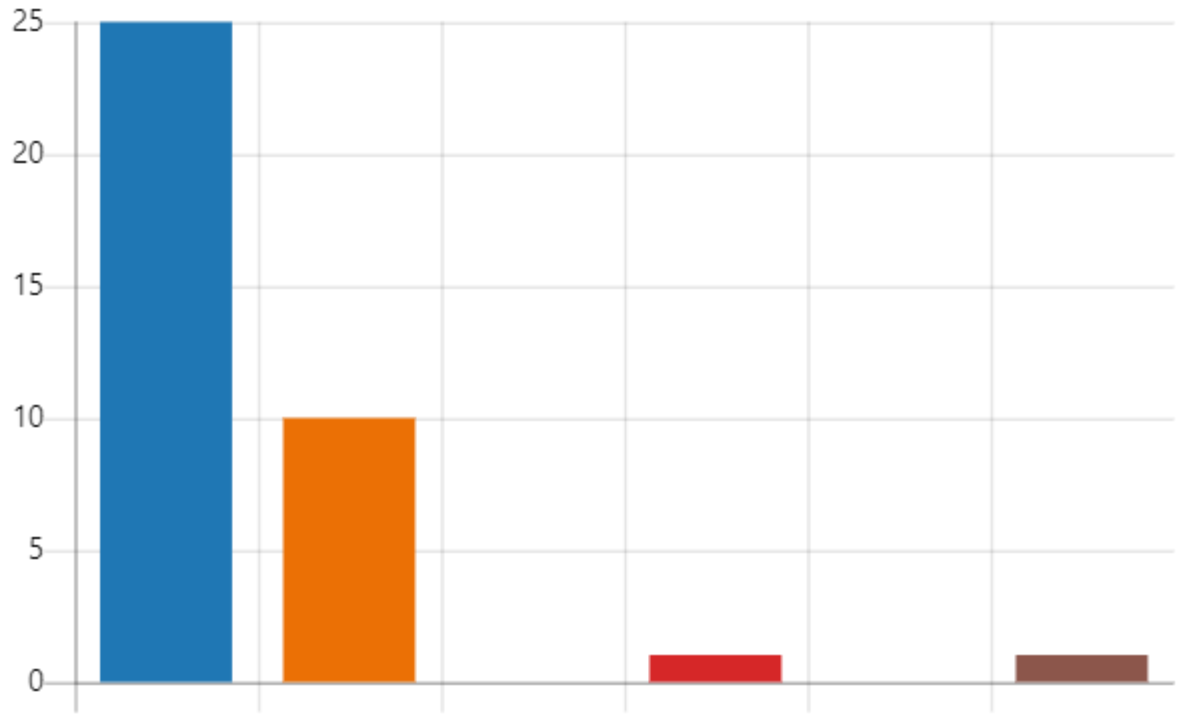
8.
Do you use any industrial robots in your company?

Yes	11
No	24
I do not know	1
Other	1

9.
Are AI-driven technologies useful for your company's success and growth?

Yes, very useful!	25
They can help to some degree	10
They can not change much	0

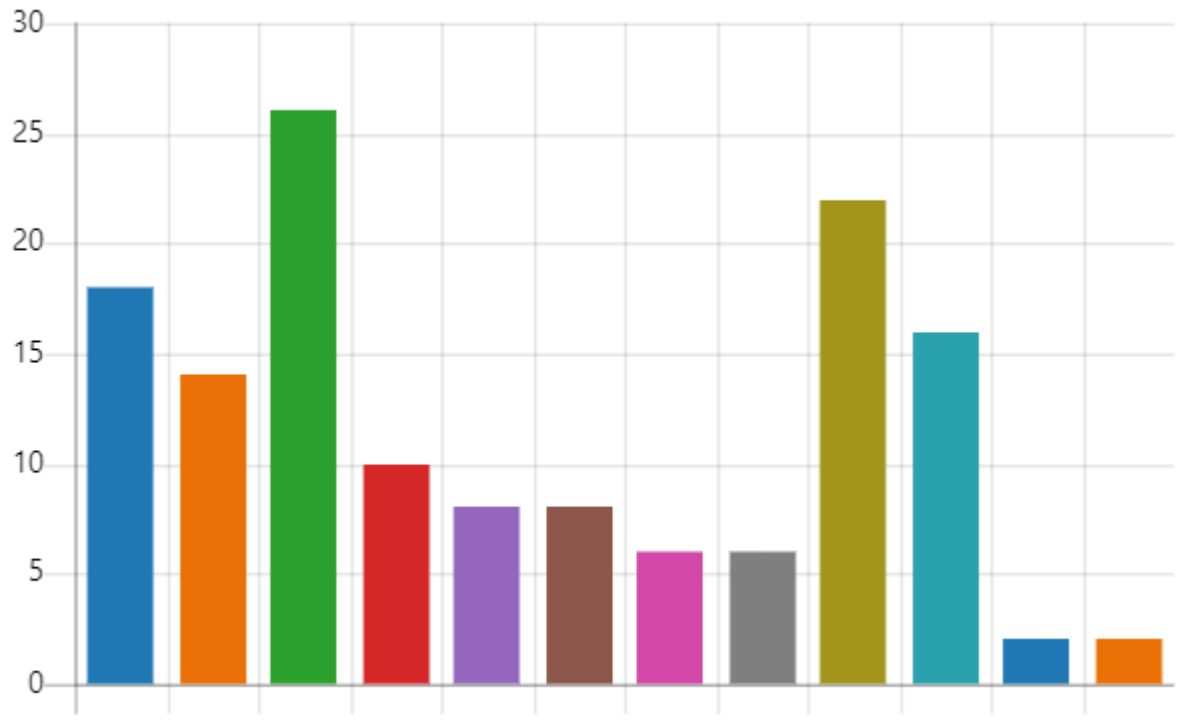
They can not change anything at all	1
I do not know	0
Other	1



10.
Why do you use AI in your company? (Check all that apply)

To reduce costs	18
To increase revenue	14
To speed up work	26
To create content for daily work	10
To reach new customers	8
To increase personalisation	8
To write software	6
Out of curiosity	6
To improve current products and services	22
To inspire the creation of new products and services	16

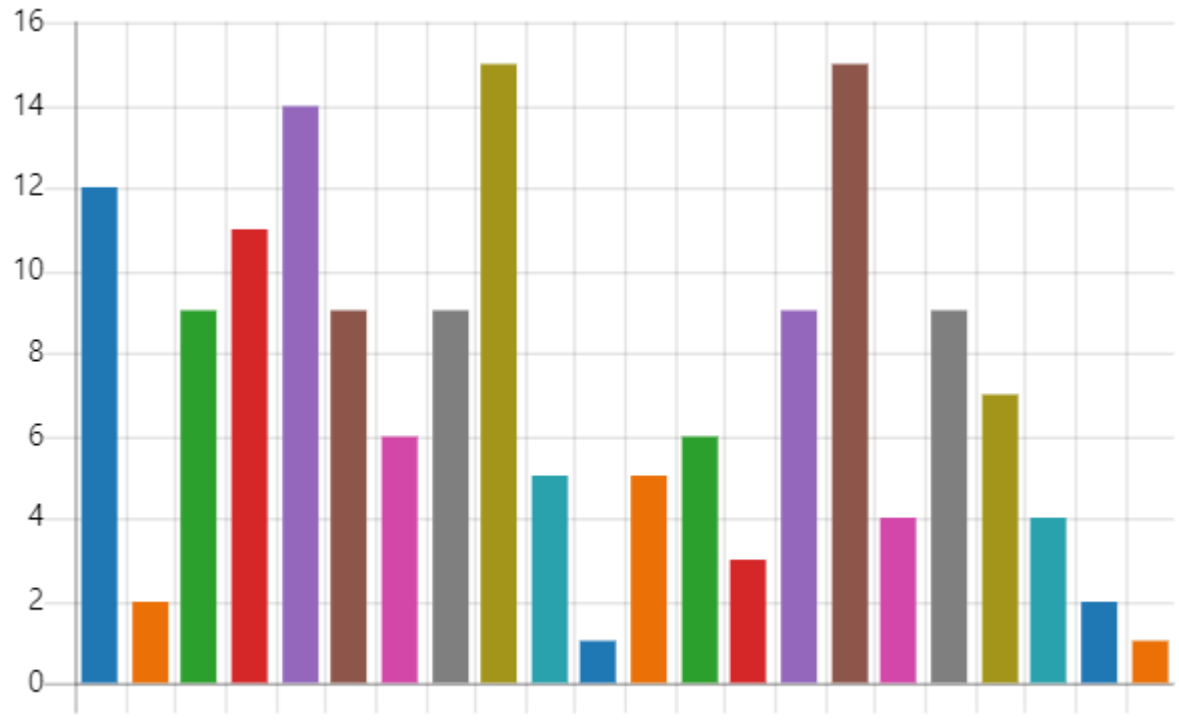
We do not use AI in our company	2
Other	2



11.
What are the main challenges for AI adoption for your organization? (Check all that apply)

High cost of investment	12
High risks related to relocation of resources	2
Lack of awareness of return/benefit on investment	9
Organizational barriers, decision process	11
Lack of appropriately qualified personnel	14
Employee reluctance to change	9
Fear of digital threats	6
Technological barriers/unprepared infrastructure	9
Data issues (lack of data, problems with collecting or analysing)	15
Low level of employee confidence in new digital technologies	5
Board's low level of confidence in new digital technologies	1

Finding the right partner (dependence on 3rd parties)	5
Unclear business strategy/roadmap	6
Unclear use case	3
Security issues	9
Biases, errors, and limitations of generative AI	15
Compute resources (getting access to GPU resources, waiting time)	4
Regulatory compliance	9
Cultural challenges	7
No AI-adoption challenges	4
We do not implement AI	2
Other	1



12.
Is there a need for your organization to implement **more** of AI, data and robotics-driven solutions?

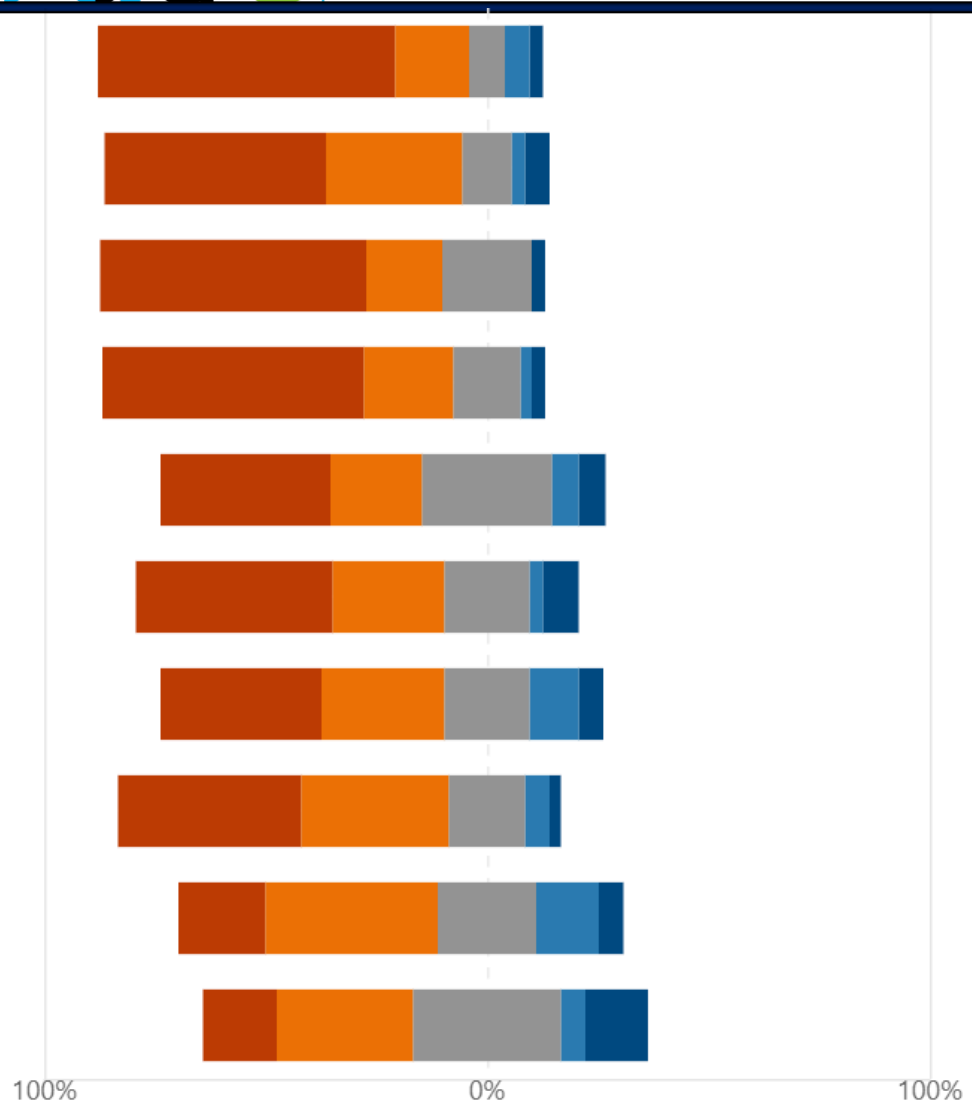
Yes, there is a need	32
No, we use exactly as much as needed	2

We do not have the need to use ADR solutions	1
I do not know	1
Other	1

13.

Rate the importance of these positive aspects of ADR-technologies implementation for your company

Extremely important
Somewhat important
Neutral
Not really important
Absolutely not important
Increasing efficiency and sustainability
Improving decision-making, reducing human mistakes
Competitive advantage
Potential profit & cost savings
Improving data privacy & security
Potential scientific innovations
Solving global challenges (climate change, healthcare, education etc.)
Improving customer experiences
Creating new jobs, new business models, new markets
Improving resourse management (energy, water, waste)



14.

Rate the importance of these negative aspects of ADR-technologies implementation for your organisation

Extremely important – Absolutely not important

Ethical problems

Dangers of automated decision-making, reduced human judgement

AI-driven discrimination of some groups of people

Potential job displacement

Cyber security and privacy risks

Increasing bias and misinformation

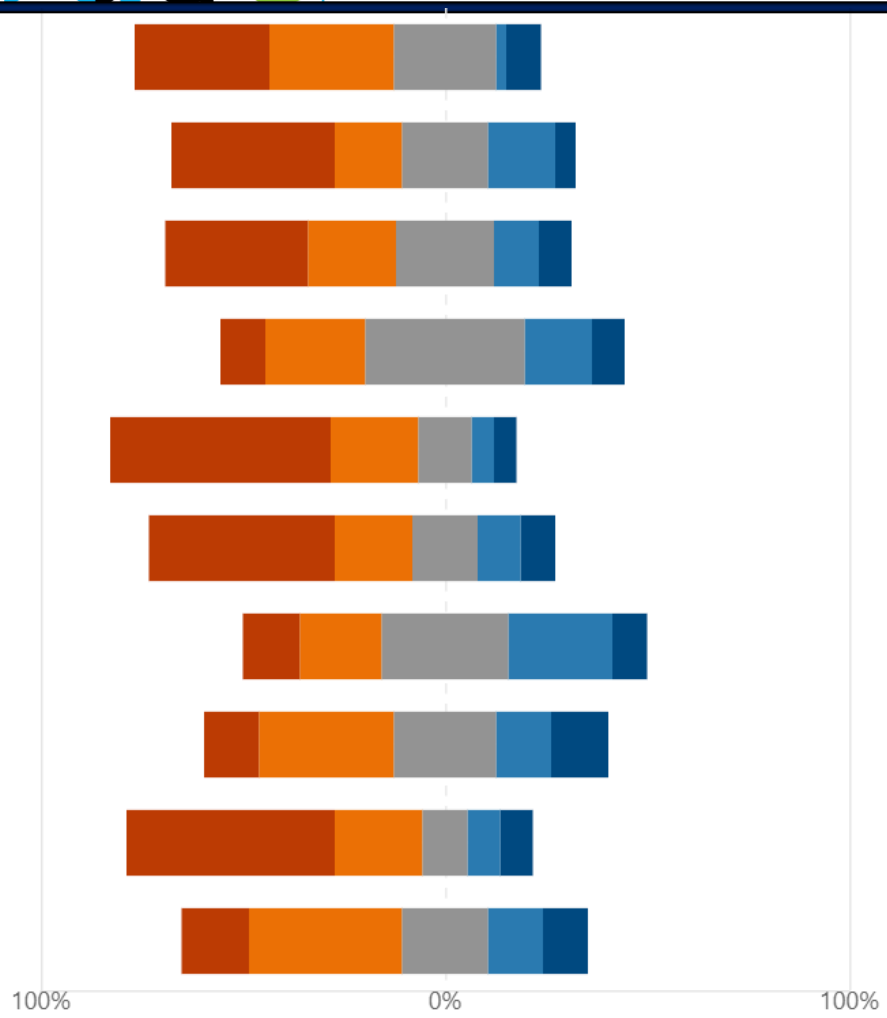
Psychological problems related to dealing with artificial assistants

Increasing gap between the rich and the poor due to the limited access to ADR technologies

Dangers of bad usage practices leading to data breaches, reputational, legal, and trust risks

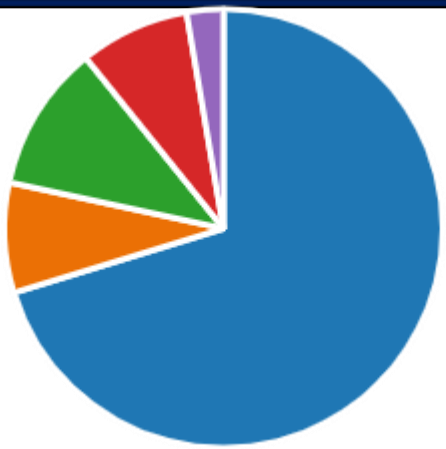
Adding extra energy consumption and electronic waste

Dangers of bad usage practices leading to data breaches, reputational, legal, and trust risks



15.
Do you think that without an AI strategy your company will struggle to keep up with competitors?

Yes	26
No	3
I do not know	4
Maybe	3
Other	1

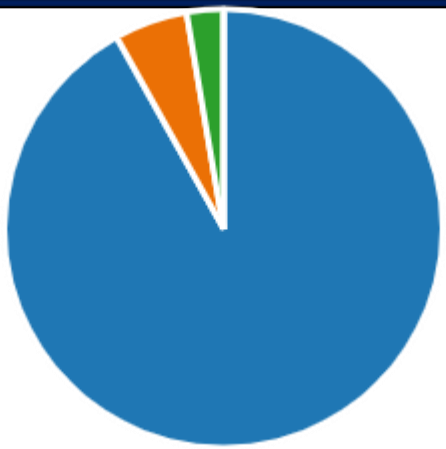


16.
Does your organization follow up on the AI act requirements and other upcoming regulations?

Yes	26
No	6
I do not know	4
Other	1

17.
Do you believe that your company will increase its use of AI within the next year?

Yes	34
No	2
I do not know	1
Other	0

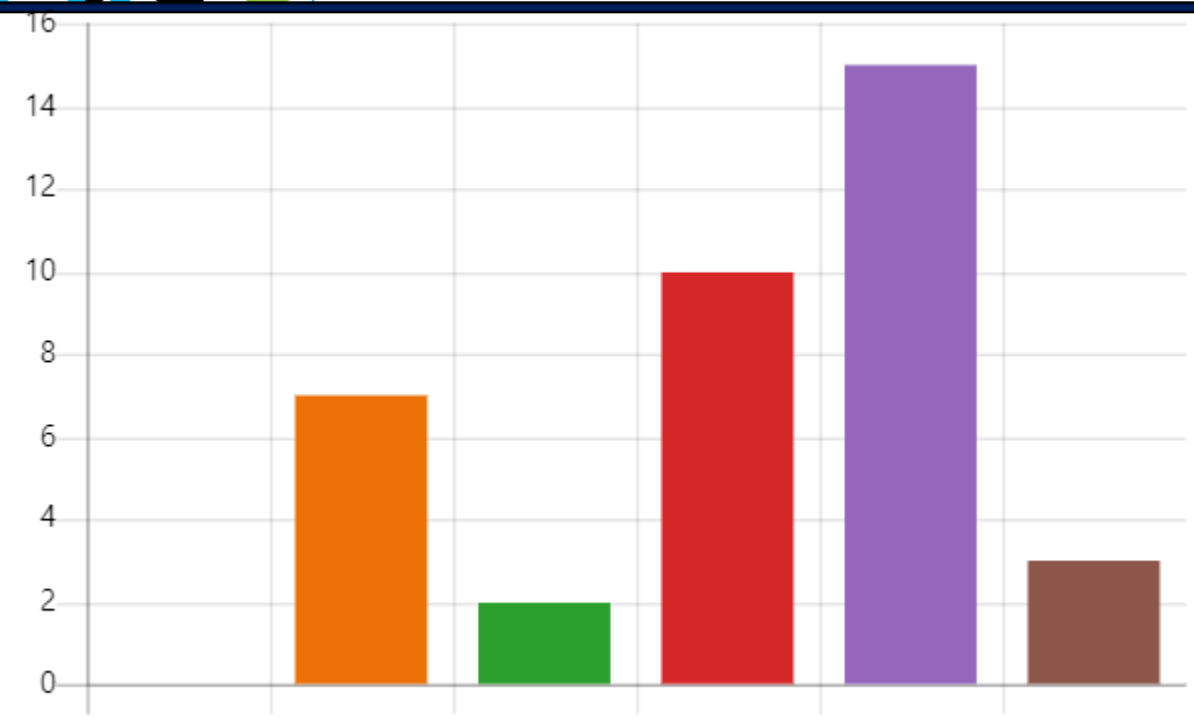


18.
How much do you trust the AI tools?

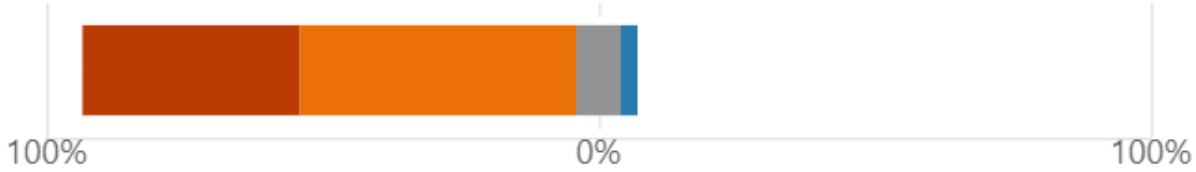
From 0 to 5: 3.27 Average Rating

19.
At what stage are you personally in terms of your experience with AI-based tools?

I have no needs for AI-based tools	0
I am aware of different tools, but haven't tried any yet	7
I am considering to start using AI-based tools right now	2
I tried some AI-based tools, but I am unsure if I should use any of them regularly	10
I am using AI-based tools every day	15
Other	3

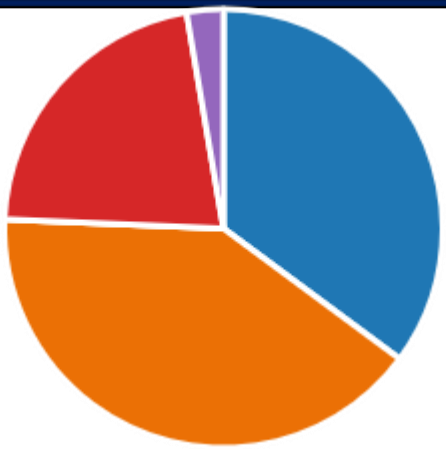


20.
How much would you say AI tools has positively impacted your productivity and efficiency?
Helped a lot!
Somewhat helped
Neutral
Did not help al all
Negatively impacted my productivity and efficiency



21.
Do you believe that it is understandable and clear how AI technologies are working and how they are going to be used?

Yes	13
No	15
I do not know	0
Maybe	8
Other	1



22.
Do you personally think people must be specially educated on how to use AI?

Yes, it must be studied in schools	31
No, it can be understood intuitively, same way as we learned to use mobile phones, Internet, etc.	4
AI boom will go away eventually, it is not going to change our lives, and there is no need to study it	0
I do not know	0
Other	2

23.
Are you worried about your own job security because of AI development?

Yes	4
No	30
I do not know	1
Maybe	1

Other	1

24.
Do you personally think AI will bring along some usage errors (wrong facts, disinformation, poor automated decisions, etc.)?

Yes	35
No	1
I do not know	1
Other	0

25.
Do you believe that AI has the potential to make workplaces less ethical? (i.e. leading to gender bias or racism, ageism etc.)

Yes	15
No	7
I do not know	6

Maybe	9
Other	0

26.
Do you have something to share with us, your own experiences with AI, or your thoughts in relation to the questions asked in this survey?
Responses (5)

- Many organisations want to use AI as there is an initiative from the government. The problem is they all have different approach right now.
- Serious investment in open technologies, open source will be crucial for EU to remain competitive in ADR technologies. Currently lagging very much behind.
- Keep the customer in the loop during most of the AI life cycle steps to increase his/her acceptance
- Most of the time it seem to be the case that organisations in the private and public sector select the wrong tools (illsuited technology) for the wrong problems (low chance of being solved satisfactory by current AI tech). It is easy for a large consultancy firm to make a impressive demo in a POC, but the tech that allows for the impressive demos usually have the same inherent flaws that makes it impossible to reach production (it is not fixable since we don't know how yet). Picking the right technique for suitable problems, and massive gains can be achieved. Too bad this is more of a lucky hit for most. We avoid POC-death and ruin for us and our customers by being broad, knowing the tool kit (not just a single tool), collaborating early with domain experts to jointly figure out the lowest hanging fruit (likely to be possible to solve with current AI tech and which provides real value to organization) and by knowing how to evaluate properly at each stage.
- We shall educate people for AI and more specifically generative AI isn't the answer to all questions. It is a tool we shall use.being aware of how it functions and what it doesn't do.

27.
Would you like your name and the name of your company to be publicly mentioned in publications relevant to this survey?

Yes	24
No	13

9. Bibliography

Al-Mamary, Y. H., Al-nashmi, M., Hassan, Y. A. G., & Shamsuddin, A. (2016). A Critical Review of Models and Theories in Field of Individual Acceptance of Technology. *International Journal of Hybrid Information Technology*, 9(6), 143-158. http://dx.doi.org/10.14257/ijhit.2016.9.6.13

Albahri, A. S., Hamid, R. A., Alwan, J. K., et al. (2020). Role of biological Data Mining and Machine Learning Techniques in Detecting and Diagnosing the Novel Coronavirus (COVID-19): A Systematic Review. *Journal of Medical Systems*, 44, 122. https://doi.org/10.1007/s10916-020-01582-x

Ansari, M. F., Dash, B., Sharma, P., & Yathiraju, N. (2022, September). The impact and limitations of artificial intelligence in cybersecurity: A literature review. *International Journal of Advanced Research in Computer and Communication Engineering*. Available at SSRN: https://ssrn.com/abstract=4323317

Arrieta, A. B., Díaz-Rodríguez, N., Del Ser, J., Bennetot, A., Tabik, S., Barbado, A., Garcia, S., Gil-Lopez, S., Molina, D., Benjamins, R., Chatila, R., & Herrera, F. (2020). Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. *Information Fusion*, 58, 82-115. https://doi.org/10.1016/j.inffus.2019.12.012

Arrow, K. J., Bilir, K., & Sorensen, A. (2017). The impact of information technology on the diffusion of new pharmaceuticals. *American Economic Journal: Applied Economics*, 12, 1–39. https://doi.org/10.1257/app.20160463

Awa, H. O., Ojiabo, O. U., & Orokor, L. E. (2017). Integrated technology-organization-environment (T-O-E) taxonomies for technology adoption. *Journal of Enterprise Information Management*, 1741-0398. https://doi.org/10.1108/JEIM-03-2016-0079

Bair, S. P. (2022). Innovation's hidden externalities. *BYU Law Review*, 47(5), Article 5. Retrieved from https://digitalcommons.law.byu.edu/cgi/viewcontent.cgi?article=3378&context=lawreview

Bartlett, M. (2019). Solving the AI Accountability Gap: Hold developers responsible for their creations [Blog post]. *Towards Data Science*. Retrieved from https://towardsdatascience.com/solving-the-ai-accountability-gap-dd35698249f

Belenguer, L. (2022). AI bias: Exploring discriminatory algorithmic decision-making models and the application of possible machine-centric solutions adapted from the pharmaceutical industry. *AI Ethics*, 2, 771–787. https://doi.org/10.1007/s43681-022-00138-8

Bellman, R. (1978). *An introduction to artificial intelligence: Can computers think?* Boyd & Fraser Pub. Co.

Benabdelouahed, R., & Dakouan, C. (2020). The Use of Artificial Intelligence in Social Media: Opportunities and Perspectives. *Expert Journal of Marketing*, 8(1), 82-87. Retrieved from https://marketing.expertjournals.com/ark:/16759/EJM_806benabdelouahed82-87.pdf

Borges, A. F. S., Laurindo, F. J. B., Spínola, M. M., Gonçalves, R. F., & Mattos, C. A. (2021). The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions. *International Journal of Information Management*, 57, 102225. https://doi.org/10.1016/j.ijinfomgt.2021.102225

Bostrom, N., & Yudkowsky, E. (2011). The ethics of artificial intelligence. In W. Ramsey & K. Frankish (Eds.), *Cambridge Handbook of Artificial Intelligence*. Cambridge University Press. Retrieved from https://nickbostrom.com/ethics/artificial-intelligence.pdf

Bowman, N., & Banks, J. (2019). Social and entertainment gratifications of videogame play comparing robot, AI, and human partners. In 2019 28th *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)* (pp. 1-6).

Božić, V. (2023). AI as the reason and the solution of digital divide. *Language Education & Technology*, 3 (2). 96-109. Retrieved from https://www.researchgate.net/publication/370156651_AI_AS_THE_REASON_AND_THE_SOLUTION_OF_DIGITAL_DIVIDE

Buchanan, J., & Stubblebine, W. C. (1962). Externality. *Economica*, 29(116), 371–384. https://doi.org/10.2307/2551386

Chandramouli, K. (2022). Role of AI in promoting European accessibility policy. In C. Stephanidis, M. Antona, S. Ntoa, & G. Salvendy (Eds.), HCI International 2022 – Late Breaking Posters. *Communications in Computer and Information Science*, Vol. 1655, pp. 1–14. Springer. https://doi.org/10.1007/978-3-031-19682-9_77

Chauhan, C., Parida, V., & Dhir, A. (2022). Linking circular economy and digitalisation technologies: A systematic literature review of past achievements and future promises. *Technological Forecasting and Social Change*, 177, 121508. Retrieved from https://www.sciencedirect.com/science/article/pii/S0040162522000403?pes=vor

Chhetri, P. (2023). Analyzing the strengths, weaknesses, opportunities, and threats of AI in libraries. *Library Philosophy and Practice* (e-journal), 7808. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=15026&context=libphilprac

Cihon, P., Kleinaltenkamp, M. J., Schuett, J., & Baum, S. (2021). AI Certification: Advancing Ethical Practice by Reducing Information Asymmetries. *IEEE Transactions on Technology and Society*. https://doi.org/10.1109/TTS.2021.3077595

Council of Europe. (2018). Discrimination, artificial intelligence, and algorithmic decision-making. Directorate General of Democracy. Retrieved from https://rm.coe.int/discrimination-artificial-intelligence-and-algorithmic-decision-making/1680925d73

Cowls, J., Tsamados, A., Taddeo, M., et al. (2023). The AI gambit: Leveraging artificial intelligence to combat climate change—Opportunities, challenges, and recommendations. *AI & Society*, 38, 283–307. https://doi.org/10.1007/s00146-021-01294-x

Cubric, M. (2020). Drivers, barriers and social considerations for AI adoption in business and management: A tertiary study. *Technology in Society*, 62, 101257. https://doi.org/10.1016/j.techsoc.2020.101257

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. Massachusetts Institute of Technology, Sloan School of Management.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.

de Acypreste, R., & Paraná, E. (2022). Artificial intelligence and employment: A systematic review. *Brazilian Journal of Political Economy*, 42, 1014-1032. https://doi.org/10.1590/0101-31572022-3320

Deshpande, A., & Sharp, H. (2022). Responsible AI Systems: Who are the Stakeholders? In AIES '22: Proceedings of the *2022 AAAI/ACM Conference on AI, Ethics, and Society* (pp. 227–236). doi:10.1145/3514094.3534187. Retrieved from https://dl.acm.org/doi/10.1145/3514094.3534187

Di Vaio, A., Hassan, R., & Alavoine, C. (2022). Data intelligence and analytics: A bibliometric analysis of human–Artificial intelligence in public sector decision-making effectiveness. *Technological Forecasting and Social Change*, 174, 121201. https://doi.org/10.1016/j.techfore.2021.121201

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Luo, Z., Wamba, S. F., & Roubaud, D. (2019). Can big data and predictive analytics improve social and environmental sustainability? *Technological Forecasting and Social Change*, 144, 534-545. https://doi.org/10.1016/j.techfore.2019.02.024

Dwivedi, Y. K., Sharma, A., Rana, N. P., Giannakis, M., Goel, P., & Dutot, V. (2023). Evolution of artificial intelligence research in Technological Forecasting and Social Change: Research topics, trends, and future directions. *Technological Forecasting and Social Change*, 192, 122579. https://doi.org/10.1016/j.techfore.2023.122579

Easy BA. (n.d.). Understanding the SWOT analysis of artificial intelligence [Blog post]. Retrieved from https://easyba.co/blog/business-analysis/swot-analysis/understanding-the-swot-analysis-of-artificial-intelligence/

Ernst & Young Global Limited. (2023). How organizations can stop skyrocketing AI use from fueling anxiety. Retrieved from https://www.ey.com/en_us/consulting/businesses-can-stop-rising-ai-use-from-fueling-anxiety

European Union Agency for Fundamental Rights (FRA). (2022). Bias in algorithms: Artificial intelligence and discrimination. Retrieved from https://fra.europa.eu/sites/default/files/fra_uploads/fra-2022-bias-in-algorithms_en.pdf

Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman.

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254–280.

Furlonger, D., & Austin, T. (2018). What CIOs should ask when someone pitches a project that uses AI. *Gartner.com*. Retrieved from https://www.gartner.com/doc/3792879/cios-ask-pitches-project-uses-

Gerlich, M. (2023). Perceptions and acceptance of artificial intelligence: A multi-dimensional study. *Social Sciences*, 12(9), 502. https://doi.org/10.3390/socsci12090502

Haugeland, J. (1985). *Artificial Intelligence: The Very Idea*. MIT Press.

Horani, O. M., Al-Adwan, A. S., Yaseen, H., Hmoud, H., Al-Rahmi, W. M., & Alkhalifah, A. (2023). The critical determinants impacting artificial intelligence adoption at the organizational level. *Information Development*. Online publication. https://doi.org/10.1177/02666669231166889

Horowitz, M. C., et al. (2018). Strategic competition in an era of artificial intelligence. *Center for a New American Society*. Retrieved from https://www.cnas.org/publications/reports/strategiccompetition-in-an-era-of-artificial-intelligence

Hu, Y., Kuang, W., Qin, Z., Li, K., Zhang, J., Gao, Y., Li, W., & Li, K. (2021). Artificial intelligence security: Threats and countermeasures. *ACM Computing Surveys*, 55(1), Article 20, 1–36. https://doi.org/10.1145/3487890

Hua, D., Petrina, N., Young, N., Cho, J.-G., & Poon, S. K. (2024). Understanding the factors influencing acceptability of AI in medical imaging domains among healthcare professionals: A scoping review. *Artificial Intelligence in Medicine*, 147, 102698. https://doi.org/10.1016/j.artmed.2023.102698

Inuwa-Dutse, I. (2023). FATE in AI: Towards algorithmic inclusivity and accessibility. In EAAMO '23: Proceedings of the *3rd ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization* (pp. 1–14). https://doi.org/10.1145/3617694.3623233

Ito, J. (2018). Why Westerners fear robots and the Japanese do not. *Wired*. Retrieved from https://www.wired.com/story/ideas-joi-ito-robot-overlords/

Johnson, P. C., Laurell, C., Ots, M., & Sandström, C. (2022). Digital innovation and the effects of artificial intelligence on firms' research and development – Automation or augmentation, exploration or exploitation? *Technological Forecasting and Social Change*, 179. https://doi.org/10.1016/j.techfore.2021.120007

Kaya, F., Aydin, F., Schepman, A., Rodway, P., Yetişensoy, O., & Kaya, M. D. (2022). The roles of personality traits, AI anxiety, and demographic factors in attitudes toward artificial intelligence. *International Journal of Human–Computer Interaction*. https://doi.org/10.1080/10447318.2022.2058315

Kelly, S., Kaye, S. A., & Oviedo-Trespalacios, O. (2023). What factors contribute to the acceptance of artificial intelligence? A systematic review. *Telematics and Informatics*, 77, 101925. Retrieved from https://www.sciencedirect.com/science/article/pii/S0736585322001587

Koos, S., Syukron, A., & Agustin, N. (2017). SWOT analysis on the implementation of artificial intelligence in the human dignity perspective. *Universität der Bundeswehr München*, Universitas Nahdlatul Ulama Al Ghazali. Retrieved from https://repository.unugha.ac.id/574/1/SWOT%20ANALYSIS%20ON%20THE%20IMPLEMENTATION%20OF%20ARTIFICIAL%20INTELLIGENCE%20IN%20THE%20HUMAN%20DIGNITY%20PERSPECTIVE%20%28Artikel%29.pdf

Kopka, A., & Grashof, N. (2022). Artificial intelligence: Catalyst or barrier on the path to sustainability? *Technological Forecasting and Social Change*, 175, 121318. https://doi.org/10.1016/j.techfore.2021.121318

Labajová, L. (2023). The state of AI: Exploring the perceptions, credibility, and trustworthiness of the users towards AI-Generated Content (Master's Thesis). *Malmö University*. Retrieved from https://www.diva-portal.org/smash/get/diva2:1772553/FULLTEXT02.pdf

Lai, P. C. (2017). The literature review of technology adoption models and theories for novelty technology. *Journal of Information Systems and Technology Management*, 14(1). https://doi.org/10.4301/S1807-17752017000100002

Lebcir, R., Hill, T., Atun, R., et al. (2021). Stakeholders' views on the organisational factors affecting application of artificial intelligence in healthcare: A scoping review protocol. *BMJ Open*, 11, e044074. doi:10.1136/bmjopen-2020-044074. Retrieved from https://uhra.herts.ac.uk/bitstream/handle/2299/24306/e044074.full.pdf?sequence=1&isAllowed=y

Lima, G., & Cha, M. (2020). Responsible AI and its stakeholders. *Fair & Responsible AI Workshop at ACM CHI 2020*. arXiv preprint arXiv:2004.11434. https://arxiv.org/abs/2004.11434

Madan, R., & Ashok, M. (2023). AI adoption and diffusion in public administration: A systematic literature review and future research agenda. *Government Information Quarterly*, 40(1), 101774. https://doi.org/10.1016/j.giq.2022.101774

Marangunić, N., & Granić, A. (2015). Technology acceptance model: A literature review from 1986 to 2013. *Universal Access in the Information Society*, 14(1), 81–95. https://doi.org/10.1007/s10209-014-0348-1

Maxwell, J. A. (2013). *Qualitative research design: An interactive approach*. SAGE Publications.

McKinsey. (2017). Jobs lost, jobs gained: Workforce transitions in a time of automation. Retrieved from https://www.mckinsey.com/~/media/BAB489A30B724BECB5DEDC41E9BB9FAC.ashx

Méndez-Suárez, M., Monfort, A., & Hervas-Oliver, J. L. (2023). Are you adopting artificial intelligence products? Social-demographic factors to explain customer acceptance. *European Research on Management and Business Economics*, 29(3), 100223. Retrieved from https://www.sciencedirect.com/science/article/pii/S2444883423000104

Miller, G. J. (2022). Stakeholder roles in artificial intelligence projects. *Project Leadership and Society*, 3, 100068. Retrieved from https://www.sciencedirect.com/science/article/pii/S266672152200028X

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *The Academy of Management Review*, 22(4), 853–886. https://doi.org/10.2307/259247

Mumuni, A. N., Hasford, F., Udeme, N. I., Dada, M. O., & Awojoyogbe, B. O. (2023). A SWOT analysis of artificial intelligence in diagnostic imaging in the developing world: Making a case for a paradigm shift. In *Basic Sciences for Sustainable Development*. De Gruyter. https://doi.org/10.1515/9783110913361-003

Na, S., Heo, S., Han, S., Shin, Y., & Roh, Y. (2022). Acceptance model of artificial intelligence (AI)-based technologies in construction firms: Applying the technology acceptance model (TAM) in combination with the technology–organisation–environment (TOE) framework. *Buildings*, 12(2), 90. Retrieved from https://doi.org/10.3390/buildings12020090

Nadarzynski, T., Miles, O., Cowie, A., & Ridge, D. (2019). Acceptability of artificial intelligence (AI)-led chatbot services in healthcare: A mixed-methods study. *Digital Health*, 5. https://doi.org/10.1177/2055207619871808

Nishimura, A. (2023). Human subjects protection in the era of deepfakes. *LawFareMedia.* Retrieved from https://www.lawfaremedia.org/article/human-subjects-protection-in-the-era-of-deepfakes

Open Access Government portal. (2023). AI's impact on mental health: Could loneliness and insomnia be affected? Retrieved from https://www.openaccessgovernment.org/ai-impact-on-mental-health-loneliness-insomnia/160860/

Oxford Commission on AI & Good Governance. (2020). Global attitudes towards AI, machine learning & automated decision making: Implications for involving artificial intelligence in public service and good governance. *Report* by Lisa-Maria Neudert, Aleksi Knuutila, Philip N. Howard. Retrieved from https://oxcaigg.oii.ox.ac.uk/wp-content/uploads/sites/11/2020/10/GlobalAttitudesTowardsAIMachineLearning2020.pdf

Palomares, I., Martínez-Cámara, E., Montes, R., García-Moral, P., Chiachio, M., Chiachio, J., Alonso, S., Melero, F. J., Molina, D., Fernández, B., Moral, C., Marchena, R., Perez de Vargas, J., & Herrera, F. (2021). A panoramic view and SWOT analysis of artificial intelligence for achieving the sustainable development goals by 2030: Progress and prospects. *Applied Intelligence*. https://doi.org/10.1007/s10489-021-02264-y

Park, J., & Woo, S. E. (2022). Who likes artificial intelligence? Personality predictors of attitudes toward artificial intelligence. *The Journal of Psychology*, 156, 68–94. https://doi.org/10.1080/00223980.2021.2012109

Parthiban, E. S., & Adilb, M. (2023). Examining the Adoption of AI-based Banking Chatbots: A Task Technology Fit and Network Externalities Perspective. *Asia Pacific Journal of Information Systems*, *33*(3), 652-676. https://doi.org/10.14329/apjis.2023.33.3.652

Passi, S., & Vorvoreanu, M. (2022). Overreliance on AI: Literature review. *Microsoft report*. Retrieved from https://www.microsoft.com/en-us/research/uploads/prod/2022/06/Aether-Overreliance-on-AI-Review-Final-6.21.22.pdf

Pratt, M. K. (2021). AI accountability: Who's responsible when AI goes wrong? *TechTarget*. Retrieved from https://www.techtarget.com/searchenterpriseai/feature/AI-accountability-Whos-responsible-when-AI-goes-wrong

Preece, A., Harborne, D., Braines, D., Tomsett, R., & Chakraborty, S. (2018). Stakeholders in Explainable AI. Presented at *AAAI FSS-18: Artificial Intelligence in Government and Public Sector*, Arlington, Virginia, USA. Retrieved from https://arxiv.org/abs/1810.00184

Purvis, B., Mao, Y., & Robinson, D. (2019). Three pillars of sustainability: In search of conceptual origins. *Sustainability Science*, 14, 681–695. https://doi.org/10.1007/s11625-018-0627-5

Radhakrishnan, J., & Chattopadhyay, M. (2020). Determinants and Barriers of Artificial Intelligence Adoption – A Literature Review. In *IFIP Advances in Information and Communication Technology* (Vol. 617). Retrieved from https://link.springer.com/chapter/10.1007/978-3-030-64849-7_9

Robinson, O. C. (2013). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, 11(1), 25-41. https://doi.org/10.1080/14780887.2013.801543

Robinson, S. C. (2020). Trust, transparency, and openness: How inclusion of cultural values shapes Nordic national public policy strategies for artificial intelligence (AI). *Technology in Society*, 63, 101421. https://doi.org/10.1016/j.techsoc.2020.101421

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Rowley, T. J. (1997). Moving beyond Dyadic Ties: A Network Theory of Stakeholder Influences. *The Academy of Management Review*, 22(4), 887–910. https://doi.org/10.2307/259248

Scott, I. A., Carter, S. M., & Coiera, E. (2021). Exploring stakeholder attitudes towards AI in clinical practice. *BMJ Health Care Informatics*, 28(1), e100450. https://doi.org/10.1136/bmjhci-2021-100450

Sheehan, M. (2023). China's AI regulations and how they get made. Carnegie Endowment for International Peace. Retrieved from https://carnegieendowment.org/2023/07/10/china-s-ai-regulations-and-how-they-get-made-pub-90117

Silva, C. N. (2005). SWOT analysis. In R. W. Caves (Ed.), *Encyclopedia of the city* (pp. 444–445). Routledge.

Sparrow, R., & Howard, M. (2021). Robots in agriculture: Prospects, impacts, ethics, and policy. *Precision Agriculture*, 22, 818–833. https://doi.org/10.1007/s11119-020-09757-9

Stantcheva, S. (2017). Lecture 7: Externalities. *Harvard OpenScholar*. Retrieved from https://scholar.harvard.edu/files/stantcheva/files/lecture7.pdf

Strich, F., Mayer, A.-S., & Fiedler, M. (2021). What do I do in a world of artificial intelligence? Investigating the impact of substitutive decision-making AI systems on employees' professional role identity. *Journal of the Association for Information Systems*, 22(2). https://doi.org/10.17705/1jais.00663

Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington Books.

Tubadji, A., & Nijkamp, P. (2016). Six degrees of cultural diversity and R&D output efficiency: Cultural percolation of new ideas. *Letters in Spatial and Resource Sciences*, 9, 247–264.

Turja, T., & Oksanen, A. (2019). Robot acceptance at work: A multilevel analysis based on 27 EU countries. *International Journal of Social Robotics*, 11, 679–689. https://doi.org/10.1007/s12369-019-00526-x

Tzachor, A., Devare, M., King, B. (2022). Responsible artificial intelligence in agriculture requires systemic understanding of risks and externalities. *Nat Mach Intell* 4, 104–109. https://doi.org/10.1038/s42256-022-00440-4

Verdier, T., & Zenou, Y. (2017). The role of social networks in cultural assimilation. *Journal of Urban Economics*, 97, 15–39.

Vinuesa, R., Martinez, I. L., & Darrel, I. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications*, 11(1), 1-11.

Wei, W., & Lin, Y. (2022). The Impact of Artificial Intelligence on the Mental Health of Manufacturing Workers: The Mediating Role of Overtime Work and the Work Environment. *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2022.862407

Weise, K., & Metz, C. (2023). The race to dominate A.I. *The New York Times*. Retrieved from https://www.nytimes.com/2023/12/08/briefing/ai-dominance.html

Wilson, C. (2018). Playing to the strengths of humanity. In *Designing the Purposeful World* (1st ed., pp. 10). Routledge. Retrieved from https://www.taylorfrancis.com/chapters/mono/10.4324/9781351210683-12/playing-strengths-humanity-clive-wilson

Witteloostuijn, A. van. (2023). *International business and Sustainable Development Goals*. Routledge.

World Economic Forum. (2023). Davos23: *AI divide global North–global South*. Retrieved from https://www.weforum.org/agenda/2023/01/davos23-ai-divide-global-north-global-south/

Yam, K., Tan, T., Jackson, J., Shariff, A., & Gray, K. (2023). Cultural differences in people's reactions and applications of robots, algorithms, and artificial intelligence. *Management and Organization Review*, 1-17. doi:10.1017/mor.2023.21

Yigitcanlar, T., Corchado, J. M., Mehmood, R., Li, R. Y. M., Mossberger, K., & Desouza, K. (2021). Responsible Urban Innovation with Local Government Artificial Intelligence (AI): A Conceptual Framework and Research Agenda. *Journal of Open Innovation: Technology, Market,* and *Complexity*, *7*(1), 71. https://doi.org/10.3390/joitmc7010071