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Industry 4.0 and workplace inclusivity

Assessing the effect of institutions on the implementation and use of robots to employ a diverse workforce

TU Delft

Delft University of Technology

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Abstract

The increasing use of robots in the workplace presents a valuable opportunity to diversify the workforce by including underrepresented groups such as ethnic minorities and the elder population. However, high unemployment among these social groups shows that the opportunity to boost inclusivity and diversity is not grasped. Seizing this opportunity presents several challenges, especially since diversity can complicate the innovation process.

Innovation is a complex multifaceted process influenced by numerous factors, among which formal and informal institutions. Formal institutions are written rules such as laws, standards and obligations, while informal institutions are unwritten rules, such as social and cultural norms, that shape people's perceptions and behaviors. Diversity can be related to social groups holding peculiar norms/beliefs that can conflict with other social norms or regulations. The role of formal and informal institutions in diversity and inclusion initiatives has been largely overlooked in the Human-Robot Interaction (HRI) literature, but existing studies suggest that institutions play a crucial role in enabling/hampering inclusion and diversity through technology.

In this research, I make use of qualitative research and the RRI approach to analyze the complex socio-technical system in which robots are implemented and used in the real-world context of the KLM baggage handling facilities at Amsterdam Airport. The aim of this study is to build grounded theory through the analysis of the impact that institutions have on the implementation and utilization of robotic technology in the employment of a workforce that is diverse in terms of age, ethnicity, and race.

The research question guiding the research is: *"How do formal and informal institutions shape the implementation and use of robots at work aimed at including a diverse workforce?"* This research question aims at tackling two different aspects of deploying robots at work: implementation and utilization. The focus on implementation pertains to the analysis of the process by which a diverse workforce is included or not in the deployment of robots in the workplace, and the role that institutions play in shaping this process. The focus on utilization pertains to the analysis of the role that institutions play in shaping the ability and willingness of a diverse workforce to use robots in the workplace.

When it comes to the implementation of robots at work, results show that if there are no formal institutions in place to include a diverse workforce in the implementation process,

then informal institutions, such as a willingness to use technology, play a prominent role in determining the likelihood that diverse workforce will be included in the process or not. In the Dutch context, factors like age or ethnic diversity do not affect the positive perception of robots at work and willingness to use technology, thus these diverse identities do not influence the participation of the diverse workforce in the implementation of robots at work.

When it comes to the utilization of robots, diversity plays both a direct and indirect role. The direct role is related to formal institutions, for instance standard requirements to operate the robot, that may exclude certain ethnic/race groups with different physical characteristics from using the robot. An example of physical characteristics that play a role in the Dutch context are the average height and left-handedness. The indirect effect pertains to the influence of age diversity within the workforce on the formation of informal institutions, such as social norms. Members of the age diverse workforce may hold positions of opinion leadership within the workplace, enabling them to shape the opinions of their colleagues with regard to the use of robots. This, in turn, can influence the utilization of robotic technology by the workforce as a whole.

This study has both strong practical and theoretical implications. From a practical standpoint, this study provides valuable insights for organizations seeking to employ a diverse workforce through the use of robotics. The findings highlight the importance of carefully considering both the practical and social implications of this approach, including the need to take into account the physical requirements of a diverse workforce and the potential influence of diversity on the formation of social norms within the workplace. From a research perspective, this study highlights the suitability of the RRI approach as a conceptual tool for HRI research to assess the socio-technical systems in robotics is used for diversity and inclusivity purposes.

Future research could focus on analyzing the interactions between formal and informal institutions and other diverse identities, such as gender, in the context of implementing robots in the workplace. The main limitations of this study pertain to the limited number of participants and the lack of generalizability to Small, Medium and Micro Enterprises (SMMEs). These firms have different organizational structures and limited financial and intellectual resources, thus, when employing a diverse workforce, they may face considerably different challenges when implementing robotic technology in the workplace.

Acknowledgments

Handing in this thesis marks the end of my two-years journey at TU Delft in the Master programme Management of Technology (MoT). The end of this chapter of my life marks both an accomplishment and a farewell to a time that will forever hold a special place in my heart. As I present this final report, I am filled with a sense of pride for the uncounted hours I have dedicated to this research project. Yet, I am deeply aware that it would not have been possible without the invaluable assistance and support of numerous individuals who have made a significant impact on my work.

First and foremost, I extend my heartfelt gratitude to my supervisors: **Dr. Werker**, for the great support, leadership and guidance, **Dr. Santoni de Sio**, for the insightful comments and suggestions, **Dr. Feenstra** for the day-to-day assistance and the precious help provided during the interviews. I would like to express my deepest gratitude to all of you for your unwavering support, insightful guidance, and constructive feedback. Your contributions have been instrumental in shaping the direction and quality of my research. I am especially grateful for the extra time and dedication you provided, always being available to answer my questions and offering invaluable support throughout the process. Thank you for everything.

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Dear reader, I would like to express my gratitude for the time and attention you will devote to reading this thesis. It is my hope that you will find the arguments presented herein to be compelling and worthy of further discussion. Through my words, I aspire to convey the diligence, dedication, and passion with which I have approached this work. May you derive both enjoyment and insight from the pages that follow.

Vincenzo Castellano
Delft, August 7^{th} 2023

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Introduction

Low levels of employment disproportionately impact individuals belonging to socially marginalized groups, such as ethnic minorities (Houtenville, Shreya, & Rafal, 2022; Lecerf, 2020; OECD, 2022). This leads to the exclusion of social groups from the economic life of the society in which they live. Studies on inclusion and diversity highlight the role of employment as a human right (Ladau, 2021; Mark, Hofmayer, Rauch, & Matt, 2019), therefore failing to provide such an opportunity represents a substantial failure for societies that aim at fostering well-being and social participation for everyone.

The deployment of robots can facilitate the employment of a diverse workforce. The increasing deployment of breakthrough technologies like Artificial Intelligence (AI), Internet of Things (IoT), and advanced robotics gave rise to the notion of "Industry 4.0", used to indicate the potential these technologies have to radically restructure the economic system (Cetrulo & Nuvolari, 2019). Highlighting the impact of robotics, it is opening up new avenues to make the workplace more welcoming to a diverse workforce, defined as individuals who may not possess the typical traits of a traditional employee[1] (Javaid, Haleem, Singh, & Suman, 2021; Kildal & Martín, 2021; Mark, Hofmayer, et al., 2019). For instance, the utilization of a human-operated robotic arm can eliminate the need for physical strength to manually perform a task, thereby rendering the workplace accessible to both elderly individuals and those with physical disabilities.

The inclusion of diverse groups increases the complexity of the innovation process. The complexity increases because people in diverse groups can hold values and beliefs toward technology that are significantly different from the values of other social groups. For

[1] The characteristics associated with employment exclusion vary depending on the occupation. These characteristics are, in general, a person's race, ethnicity, age, gender, and ability.

example people from a race/ethnic minority might expect a robot that is operable with certain physical characteristics, like a certain height, that do not match the characteristics of other ethnic groups (Hewlett, Marshall, & Sherbin, 2013). Holding different beliefs is also related to minoritarian groups behaving in ways that clash with the way other stakeholders assume and expect their behavior to be, leading to potential conflicts in both formal[2] and informal[3] institutions, for example laws that prohibit the diverse workforce to work according to its cultural/social preferences (Djebrouni & Wolbring, 2020).

Formal and informal institutions influence innovation and technological development. The implementation of technologies like robots and its perception within a diverse workforce are shaped by institutions such as laws, social norms, and cultural beliefs. These institutions influence both the deployment and utilization of technology in the workplace. To understand the role that institutions play in shaping technological development, the main conceptual tool used by researchers is the innovation system approach (Bergek et al., 2015; Klein Woolthuis, Lankhuizen, & Gilsing, 2005; Nelson & Nelson, 2002; Werker, 2021), which assesses innovation systems based on four characteristics: its innovative agents, their relations, their actions and the underlying formal and informal institutions influencing the system.

Using robots at work to attain diversity and inclusion goals represents the alignment of economic opportunities with social needs. Thus, the analyse of this innovation can make use of the Responsible Research and Innovation (RRI) approach (Werker, 2021). The RRI approach builds on and extends the innovation system approach by considering all the agents affected by the innovation and the relevant social processes in which agents are included. This approach focuses on unveiling the role that formal and informal institutions, like hierarchy and legitimacy, have on the innovation process, therefore it represents an important tool to analyze and understand the impact that institutions have on the the implementation and use of robots to employ a diverse workforce.

Human-Robot Interaction (HRI) is the interdisciplinary study of interaction dynamics between humans and robots (Meyers, 2009). As such, this discipline is concerned with understanding the interactions between humans and robots, including factors such as the likelihood of robot adoption and the ways in which diverse groups engage with robotic technology. The role that institutions play in the implementation and the use of robots to employ a diverse workforce has been substantially ignored by HRI researchers (Djebrouni & Wolbring, 2020; López et al., 2020; Mandischer et al., 2023), and this deficiency reflects in the lack of literature on the topic. The lack of literature is detrimental for several reasons, among which there is the systematic exclusion and the failure to include marginalized groups in the workplace caused by harmful neglected behavior such as discrimination and prejudice between employers and employees (Drolshagen, Pfingsthorn, Gliesche, & Hein, 2021).

Diverse groups might suffer from biased institutions. Taking into account a rural set-

[2]Formal institutions are written rules in the form of laws, standards and obligations.
[3]Informal institutions are unwritten but socially shared rules such as traditions, customs and routine.

ting, Aregu, Darnhofer, Tegegne, Hoekstra, and Wurzinger (2016) focused on informal institutions and highlighted how these can be biased against marginalized groups and can constitute a symbolic wall that holds values and beliefs of the marginalized group from being enforced in the final decisions taken by the community. Despite the growing importance of robotic technology in the workplace, there is a dearth of research examining the role of institutions in shaping the implementation and use of robots within a diverse workforce.

In this study, I use theory building and case study research to investigate the influence of institutions, such as social norms and standards, on the deployment and utilization of robotic technology to employ a diverse workforce in a real-world context. Specifically, the study examines the implementation and use of robots at the baggage handling facilities of Amsterdam Airport by KLM and Schiphol Group, where the workforce is diverse in terms of age and race/ethnicity.

To guide this study, the research question is:

> *How do formal and informal institutions shape the implementation and use of robots at work aimed at including a diverse workforce?*

As delineated by the research question, this study aims to investigate two key aspects of employing a diverse workforce through the use of robots in the workplace: implementation and utilization. The first aspect focuses on understanding the relationship between institutions and diverse identities, and how this relationship affects the participation of diverse individuals in the implementation of robots at work. The second aspect of the study investigates how formal and informal institutions influence the use and ability of a diverse workforce to effectively utilize robotic technology. Examining these two aspects is fundamental to (a) successfully incorporate the values toward technology of a diverse workforce and (b) to ensure that the diverse workforce uses the robots deployed.

This study aims at building grounded theory to address the existing research gap concerning the role of institutions in shaping the introduction of robotic technology in corporate environments for the purpose of achieving Equality, Diversity and Inclusion (EDI) objectives. To answer the research question, this study employs concepts from innovation systems, RRI approach, and Human-Robot Interaction (HRI). This research makes use of a qualitative approach to analyze two real-world cases where robots are deployed to employ a workforce that is diverse in terms of age and race/ethnicity.

The structure of this report is as follows: Chapter 2 presents the main theoretical concepts that will be used for the research, the research problem and opportunity, then the research question and sub-questions; Chapter 3 explores the research methodology that will be used to answer the research question and sub-questions, together with the analytical tools that will be used and the detailed research process presented in the research flow diagram; Chapter 4 presents the data collected, their analysis, and then discusses the findings in light of existing theory to answer the research question. Finally, Chapter 5 summarizes the main findings, presents the limitations of the study,

potentials for further research and the social and scientific relevance of the research.

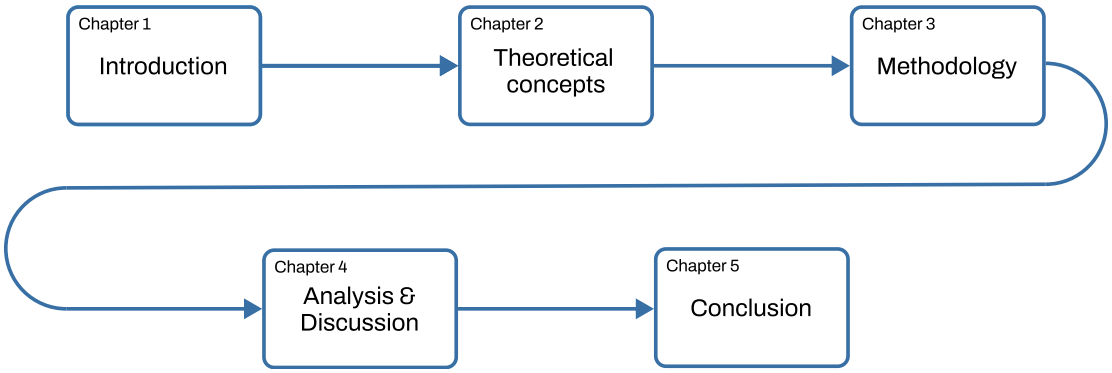

Figure 1.1: Structure of the report

2

Theoretical concepts

In this chapter, I introduce and explicate the key concepts employed throughout the research, thereby establishing a solid theoretical framework for the study. Then, I present the research problem, opportunity, and the research question and its sub-questions.

In Section 2.1 and Section 2.2, I present, respectively, concepts to assess an innovation system, including its components and dynamics, and for evaluating an innovation system that incorporates Responsible Research and Innovation (RRI), such as the implementation of robots to support a diverse workforce.

In Section 2.3, I explore the existing literature on Human-Robot Interaction (HRI), employment, diversity, and inclusion, with a particular focus on four diverse characteristics: age, skills, gender, and ethnicity/race. As such, this research lies at the intersection between the three research domains: innovation system, HRI, and employment, diversity & inclusion; as shown in Figure 2.1.

Then, in Section 2.4 I explore the research opportunities presented by the existing literature, delineating the research problem and outlining the objective of the study.

In Section 2.5, I conclude the chapter by presenting the research question and its sub-questions, which are essential for addressing the research problem. These questions are formulated to guide the study and provide a direction for the research without biasing it, in accordance with building grounded theory (Eisenhardt, 1989), enabling a systematic investigation of the phenomena under study.

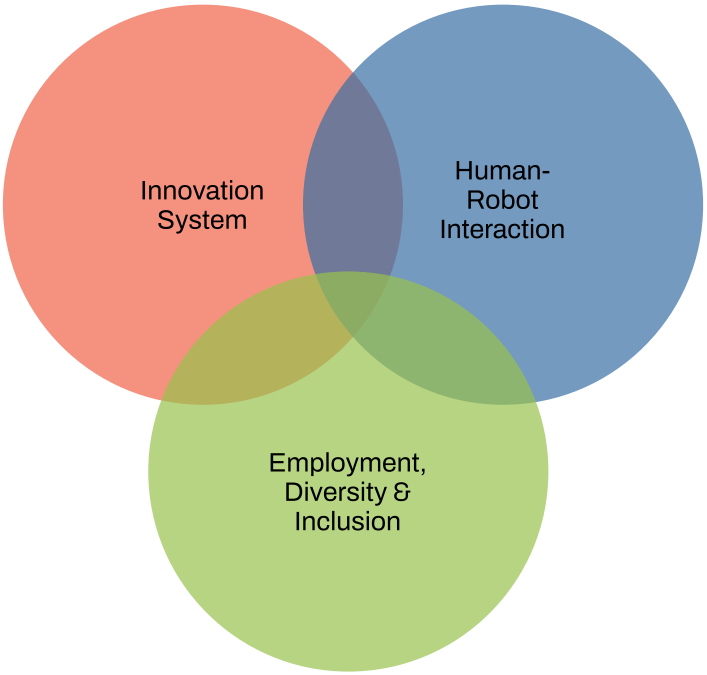

Figure 2.1: Domain of the research

2.1 Assessing an innovation system

In order to assess the effectiveness and identify the shortcomings of an innovation system, like the deployment of robots at work, it is essential to understand its components and dynamics as per the literature on technology management and innovation (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008; Markard, Hekkert, & Jacobsson, 2015). As such, I will employ the innovation system approach to analytically investigate the innovation system and its dynamics.

Researchers converge on conceptualizing innovation according to the system that is enabling it, with the use of four main features (Bergek et al., 2015; Klein Woolthuis et al., 2005; Nelson & Nelson, 2002; Werker, 2021): innovative agents, their relationships, their activities and the underlying formal and informal institutions[1]. *Innovative agents* are those influencing research and innovation processes (e.g., industry organizations, governmental bodies), and their *activities*[2] refer to the way they organize and perform research and innovation. The *relationship* feature explores how innovative agents relate to each other through communication and collaboration, while *formal* institutions define roles of individuals in the form of laws, standards and obligations (Brie & Stölting, 2012; Taebi, Correljé, Cuppen, Dignum, & Pesch, 2014) and *informal* institutions represent "the unwritten but socially shared rules and constraints that generate social behavior expectations" (Dau, Chacar, Lyles, & Li, 2022, p. 986) such as traditions, customs and routines (Taebi et al., 2014).

[1]Sometimes referred to as hard and soft institutions.
[2]Sometimes referred to as functions.

The four features described above can change over time, influencing each other in a co-evolutionary process, therefore highlighting the dynamics of innovation systems. A scheme to assess innovation systems as described above is shown in Figure 2.2.

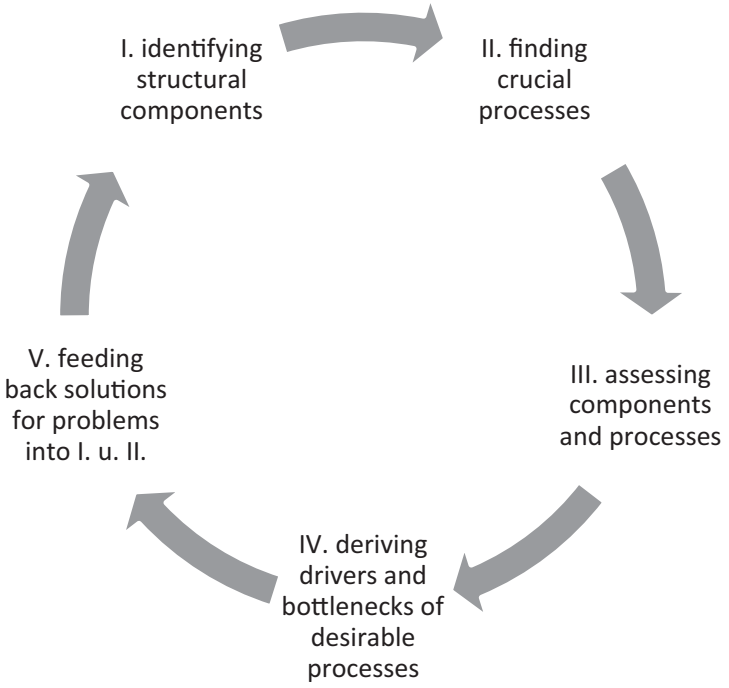

Figure 2.2: Scheme to assess innovation systems (Werker, 2021, p. 278)

2.2 Responsible innovation requires a system approach

Responsible Research and Innovation (RRI) is an approach that promotes the integration of ethical considerations, societal needs, and economic opportunities into research and innovation processes (Taebi et al., 2014). This approach aims to harness the potential of technology in alignment with strategic goals such as socio-economic change (Taebi et al., 2014; Werker, 2021). Using robots in the workplace to attain diversity and inclusion goals represents the alignment of economic opportunities with social needs and changes. Therefore, it is important to analyze this process using a RRI approach to unfold the range of stakeholders and values that are involved or affected by the innovation.

The analysis of innovation systems that include Responsible Research and Innovation is presented by Werker (2021) with the introduction of the RRI system approach. The RRI approach builds on and extends the innovation system approach, presented in Section 2.1, by emphasizing that the accomplishment of responsible research and innovation is the work of many hands, and that the establishment of shared values requires the integration of values from all relevant agents, directly and indirectly involved in the innovation process.

Figure 2.3 shows the steps necessary to assess RRI systems. Compared to the innovation

system approach (Figure 2.2) the main additions regard the inclusion of *all* relevant stakeholders affected by the innovation process (and not only the ones included in it) with their values and beliefs toward technology, and the relevant social processes in which they are included.

Focusing on values, Figure 2.3 shows that it is crucial to comprehend the values of different agents and how they come together in light of technological development. In particular, it is important to understand the technical values that the diverse workforce and other agents hold towards technology. The identification of the values toward technology can elucidate how these may differ among different agents, and whether institutions facilitate or impede their realization.

As described by Werker (2021), achieving responsible research and innovation complex process, and the final outcome relates to the power and legitimacy of each stakeholder. The power a stakeholder holds clarifies who can control or influence others to act in a specific way, and is usually tightly related to hierarchies embedded in rules and laws, hence formal institutions. Stakeholders' legitimacy is a more subtle factor, as it relates to what is considered socially acceptable and what is the expected behavior from the different stakeholders. Therefore, legitimacy is embedded in social norms and culture, hence informal institutions. These two institutions represent an important and unseen determinant in the success of the innovation process.

Thus, the RRI approach described above highlights the need to uncover the subtle role of formal and informal institutions to determine how they affect the complex processes that characterize innovation, and to ensure that factors like power structures and hierarchies do not affect negatively the possibility of the diverse workforce to (a) take part in the innovation process and (b) the ability to use and benefit from the innovation being introduced, in this instance the robot. When it comes to inclusion and diversity through technology, to identify and uncover formal and informal institutions we need to understand the different perceptions and opinions that several agents hold to understand their effective and perceived power and legitimacy.

2.3 HRI: Different agents hold diverse views on robotics

Human-Robot Interaction (HRI) is the interdisciplinary study of interaction dynamics between humans and robots (Meyers, 2009). The literature on HRI shows little focus on the systematic analysis of the impact that institutions have on a diverse workforce and their interaction with robots at work, despite some researchers suggesting that institutions might have an impact in the way diverse groups perceive robots and interact with them (López et al., 2020).

In particular, researchers suggest a discrepancy in values held by robotic companies, which will be reflected in their products, the company's stakeholders and society at large (López et al., 2020). When examining the values held by companies in the robotics industry, the most common ones are: innovation, security, profit maximization, excel-

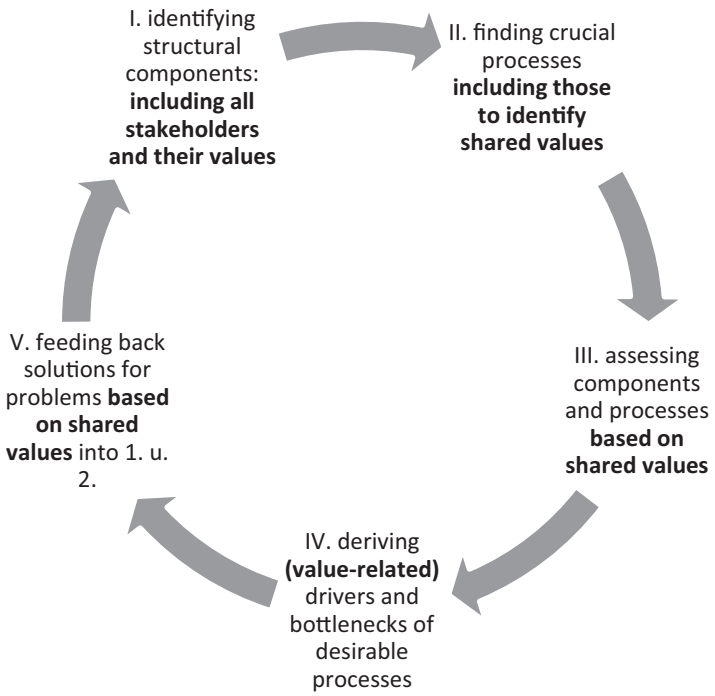

Figure 2.3: Scheme to assess RRI systems (Werker, 2021, p. 281)

lence and respect. On the other end, company's stakeholders value quality, convenience, usefulness, functionality and price, while for the majority of the population the values identified are community, responsibility, trust, integrity, inclusivity, diversity, and sociability[3] (Hesketh & Graco, 2015; López et al., 2020).

The research by López et al. (2020) already shows quite a mismatch among the value of robot designers, buyers, and users, a clash that is especially significant between economic/technical values and social/moral ones. When it comes to robots at work, social groups with a distance from the labor market might have different and peculiar values and beliefs that do not match with those of the general population.

Focusing on values toward technology, to provide a more in-depth understanding of how a diverse workforce might hold peculiar expectations and perspectives regarding robotics, in the following sections I will extrapolate values and perceptions that the HRI literature associates to robot designers and people with: skill, ability and age diversity; gender diversity; ethnicity/race diversity. The real-world cases analyzed in this study only entail age and ethnic/racial diversity. However, this chapter expands the analysis to include gender and disability diversity as well. This provides a more comprehensive understanding of how the values and beliefs towards technologies differ among the diverse identities that are most impacted by unemployment. By including these additional dimensions of diversity, the study offers greater conceptual tools and understanding for both the researcher and the reader.

Robot designers are engineers, computer experts and designers who create robots. It is

[3]Having a robot that does not act as "awkward and socially clumsy" (Hesketh & Graco, 2015, p. 108).

important to analyze their values and perspective as these are embedded in the robots they design. In the past, issues such as Equality, Diversity and Inclusion (EDI) were not considered important in technology-focused work environments (Doyle-Kent & Kopacek, 2023), and these include robotic companies. Discrimination and prejudice have been linked to the underrepresentation of marginalized groups in the workforce (Mandischer et al., 2023). These factors influence the values of robot designers and the design of robots (Barfield, 2021, 2023; Doyle-Kent & Kopacek, 2023), potentially leading to a limited understanding of the benefits and drawbacks robots robots bring to a diverse workforce. In particular, this is true when the designer's values are based on Western norms (Sparrow, 2020) and do not account for the diverse needs of minoritarian groups, including ethnic minorities, who will interact with the robot.

2.3.1 Skills, ability & age

Individuals with skills and ability diversity refer to people who have a wide range of skills and abilities. One of the main social groups included are people with different physical and cognitive abilities. Given the broad definition used by scholars, individuals with age diversity are also usually included among individuals with skills/ability diversity. Among the types of diversity assessed, the literature on individuals with disabilities is the most extensive, and offers a useful example when exploring value discrepancy, as technological solutions for the employment of this varied group are also likely to apply to the elderly population and new employees given the reason why this group is excluded from employment (ability gap) (Mandischer et al., 2023).

Research shows that people with disabilities are willing to use robotics as an aid for their job. Workers with disabilities seem to perceive technology as "friendly and exciting" (Kildal & Martín, 2021, p. 5) and does not cause any fear or discomfort (Drolshagen et al., 2021), the same is true for the elderly population (Vaportzis, Giatsi Clausen, & Gow, 2017), while mainstream media presents people from this social group as threatened by technology. Moreover, people with disabilities feel unheard when it comes to the design of assistive technologies, as these are mostly built to mimic the "functioning" of a temporarily-able[4] worker, and not to bridge the gap between the abilities of the individual and the task to accomplish (Djebrouni & Wolbring, 2020; Wolbring, 2013; Wolbring, Martin, Tynedal, Ball, & Yumakulov, 2015), therefore hinting to a possible mismatch between the values of the final artifact and the values of the group the artifact is supposed to serve.

Policy-makers seem to attribute disabled people the responsibility to build acceptance to assistive technology products and philosophies (Djebrouni & Wolbring, 2020). Thus, policy-makers make an important point about the responsibility people with disabilities have in the diffusion of robotics at work, while this social group shows missing attention toward advocating for assistive technologies, showing a mismatch in informal institutions, in this case between the behavior policy-makers expect and the actual behavior

[4] A term used to refer to the fact that most people will experience disability at some point in their lives (Ladau, 2021).

of people with disabilities.

2.3.2 Gender

Specific studies on the interaction between women and robotics mainly highlight the equalizing value that women associate to robotics (Casals, 2023). This technology is seen as bridging the biological gap between women and men, for instance the difference in strength in sectors and tasks where it historically played a role, like factory jobs (Amesti Mendizábal, 2020).

Researcher Casals (2023) suggests that informal institutions like culture and tradition play a significant role in determining the extent to which gender equity is achieved through robotics. Particularly, the institutions involved could be: cultural issues, mental prejudices, and social interests. In this view, identifying the degree to which a robot sustains gender equity is deemed "invisible", as it lies in the hands, values and prejudices of the person that is designing and programming the robots. Therefore, questioning and uncovering the hidden work and institutions behind robotics is crucial to ensure a final artifact that guarantees the inclusion of women instead of widening the gender gap (Amesti Mendizábal, 2020).

2.3.3 Ethnicity & Race

Individuals with ethnicity and race diversity refer to people who belong to different ethnic and racial groups. Ethnicity refers to a shared cultural heritage (Merriam-Webster, 2023a), while race refers to a person's physical characteristics such as skin color, hair texture, and facial features (Merriam-Webster, 2023b). How people from ethnical and racial minorities relate to robots at work is particularly unexplored by academic literature, despite ethnicity and race being two determining factors when it comes to employability (CBS, 2017; Tesser & Dronkers, 2007).

On the workplace, people with the same ethnic background seem to value communicating with each other in their native language (Hesketh & Graco, 2015). This behavior seems to fit with the value of ethnic identity suggested by other researchers (Barfield, 2021, 2023). In particular, people seem to value working with robots that resemble their cultural identity (Barfield, 2023) and may feel uneasy interacting with a robot that does not resemble their culture and/or does not align with their values (Barfield, 2021).

2.4 A focus on institutions is missing

Based on the literature reviewed, this section delineates the research problem identified, the opportunity to address it, and the objectives of this study.

The research problem is the central issue that this study aims to investigate and resolve. By identifying the opportunity to tackle this problem, the study can propose solutions

and strategies to address it. The objectives of this research outline the specific goals and outcomes that the study aims to achieve in order to address the research problem and contribute to the field.

2.4.1 Research problem

The literature presented above highlights that the diverse workforce holds a range of beliefs and perspectives that vary based on their specific identities. These beliefs may not always align with those of other individuals, leading to potential conflicts in opinions and behaviors. This can affect how different individuals perceive each other and the goals they pursue.

The literature on HRI presents a research gap when assessing the employment of a diverse workforce through robots: by focusing on either the social aspect, for example for ethnic diverse groups, or the technical aspect, for example for elder individuals, it does not focus on the role that institutions framing the wider context play.

Not addressing the role of institutions is a significant error as formal and informal institutions can hinder innovation for different reasons, among which: (a) the robot might not fit the cultural norms of the diverse workforce, thus making the innovation unsuccessful among its users; and (b) if the regulations in place do not allow for the adaptation of a robot to meet the needs of a diverse workforce, then the innovation may not be usable by diverse workers.

2.4.2 Research opportunity

This research gap opens the opportunity to address this problem from a different angle, not focusing on the social perspective, nor on the technical one, but from a socio-technical perspective. A socio-technical perspective starts with the assumption that the study of organizational phenomenon can only be understood if both the social and technical aspects are brought together and treated as interdependent parts of a complex system.

In light of the evidence and considerations above, the RRI system approach can be used as a tool to: (a) analyze the complex socio-technical system in which robots are deployed to employ a diverse workforce, with many agents that hold different values and perspectives toward technology and the complex interactions between them; and (b) to focus on formal and informal institutions to uncover the role that rules, expectations and biases play in the implementation and use of robots at work to employ a diverse workforce.

2.4.3 Research objective

Given the research problem and opportunity identified above, the research objective is to understand the role that institutions play when employing a diverse workforce through the deployment of robots.

To attain this goal, the following objectives must also be achieved:

- identify the agents in the socio-technical system;
- understand the beliefs and values toward technology that the diverse workforce holds;
- understand the organizational perspective on the inclusion of the diverse workforce through robotics; and
- identify the institutions framing the system.

Section 2.5 builds upon the research objective to delineate the research question and associated sub-questions.

2.5 Research question & sub-questions

Building on the idea that a system perspective is necessary when addressing a socio-technical problem, and that understanding the role that institutions play is the main focus of the analysis, the research question reflects the qualitative approach of the study.

In particular, the focus is getting a deeper insight into the role that formal and informal institutions play in the implementation and use of robots to include a diverse workforce. Thus, the research question is:

Research Question

How do formal and informal institutions shape the implementation and use of robots at work aimed at including a diverse workforce?

Answering this question is fundamental to understand how the inclusion of a diverse workforce is affected by factors like regulations, social norms and beliefs that shape how robots are implemented and used.

In order to comprehend the underlying context and address the research question, I formulated six research sub-questions. These sub-questions, along with their respective rationales, are presented below.

Research Sub-question 1

What are the values that the diverse workforce think should be embedded into robots at work?

In accordance with the RRI approach (Werker, 2021), it is fundamental to understand what the values of the diverse group are and how they differ from the values of other stakeholders. Answering this research question is crucial to understand if and how the values of the included group are being shaped by formal and informal institutions (López et al., 2020).

Research Sub-question 2

Do people with diverse backgrounds feel included in the implementation of robots at work?

It is unclear whether the diverse workforce has serious involvement in the development of robotics and what is the role of institutions in this, with studies suggesting that their involvement is not really significant (Aregu et al., 2016). This can both seriously hamper the implementation of robotics and decrease trust between the diverse workforce and the organization/policy-makers.

Research Sub-question 3

What are the values that the organization's management think should be embedded into robots at work?

Understanding the values that the organization's management hold is fundamental to piece together the set of norms and beliefs that compose institutions and frame the context in which robots and the diverse workforce are being employed (Drolshagen et al., 2021; López et al., 2020).

Research Sub-question 4

What is the organization's management perspective of the involvement of a diverse workforce in the implementation of robots?

The diverse workforce may be expected by the organization's management to provide a certain type of assistance, behave in a specific manner, and uphold certain values that are unrealistic when confronted with the actual values and behavior of workers in this group (Drolshagen et al., 2021; López et al., 2020; Werker, 2021).

Research Sub-question 5

Which formal institutions shape the implementation and use of robots with a diverse workforce?

Understanding the formal rules that regulate the implementation process and use of robots sheds light on what the several agents can and cannot do, which constitutes the official frame in which stakeholders can act. Moreover, analyzing rules is important to understand the explicit power hierarchies they sustain (Markard et al., 2015; Werker, 2021).

Research Sub-question 6

Which informal institutions shape the implementation and use of robots with a diverse workforce?

Understanding the informal institutions that frame the implementation process and use of robots sheds light on how different agents are expected to behave and what behavior is deemed acceptable. Informal institutions constitute the basis to justify and legitimize the presence of a specific agent in the innovation system (Dau et al., 2022; Werker, 2021).

3

Methodology

In order to address the research question and its sub-questions, this study employs a qualitative approach, comprising the analysis of two cases. The methodology is informed by the qualitative research approach as presented by Charmaz (2014), Eisenhardt (1989), Eisenhardt and Graebner (2007) and Siggelkow (2007).

Firstly, Section 3.1 provides a justification for the use of case study research to examine the role of institutions in the implementation and utilization of robots to support a diverse workforce.

Secondly, Section 3.2 outlines the steps employed in the construction of grounded theory and describes how these steps have been adapted to suit the specific needs and context of this research.

Then, Section 3.3 delineates the rationale for employing theoretical sampling and provides a detailed description of the cases under analysis, as well as their broader social and political context.

Section 3.4 elucidates the data collection methods utilized in this study, providing a rationale for their selection and detailing the interview guides employed.

Finally, Section 3.5 delineates the approach to data analysis employed in this study, including privacy and ethics considerations. Section 3.6 details the various steps undertaken to progress from an initial review of the literature to the construction of grounded theory.

3.1 Rich, real-world context justifies case study research

Justifying theory building and case study research requires the clarification of (a) why the research question is significant and (b) why there is no existing theory offering a feasible answer (Eisenhardt & Graebner, 2007).

In this study, answering the research question is significant to improve the understanding on the role that laws and social norms have on the implementation of robotics to employ a diverse workforce, in this case age and ethnic/race diversity. Widening the understanding on the interaction between the social processes, diversity and technology is valuable both for organizations and policy-makers, to tackle problems related to the aging workforce and high unemployment rates among the diverse workforce, and for theory, as it offers new insights to understand how diversity and institutions influence the innovation process.

Comprehensive approaches on the study of diversity and robotics lack, as scholars either focus on the social aspect, like social acceptance of a diverse workforce (Hersh & Johnson, 2008), or the technical aspect, like meeting the technical requirements of a diverse workforce (Wolbring, 2013), failing to unveil the problem as a complex combination of both social and technical aspects. Thus, justifying the theory building approach.

As previously explored, the phenomenon arises in a complex system of interactions and interdependencies. The need to understand this rich, real-world context in which the phenomenon occurs, with its many agents, opinions, and lived experiences, justifies case study research as it constitutes a suitable approach to understand the interaction between the context and the phenomenon arising (Charmaz, 2014; Eisenhardt & Graebner, 2007). The case study research approach holds the advantage of permitting the collection and analysis of data from interviewees, that possess substantial experience about the process, therefore centering their experiences and thoughts in the analysis (Charmaz, 2014).

3.2 Steps of building theory from case study research

The process of building theory from case study research is based on the eight steps indicated by Eisenhardt (1989) and presented in Table 3.1. Throughout Chapter 3, I present how I adapted the steps in detail, and provide a concise summary of the adaptations below Table 3.1.

Table 3.1: Building theory from case study research (Eisenhardt, 1989)

#	*Step*	*Activity*
1	Getting started	Definition of the research question
2	Selecting cases	Theoretical, non random, sampling
3	Crafting Instruments and Protocols	Multiple data collection methods technology

#	*Step*	*Activity*
4	Entering the field	Overlap data collection and analysis
5	Analyzing the data	Within-case analysis
6	Shaping Hypotheses	Replication logic across cases
7	Enfolding Literature	Comparison with similar and conflicting literature
8	Reaching Closure	Theoretical saturation when possible

The initial research question, as delineated in Chapter 2, is derived from the research opportunity presented by the academic literature. Chapter 2 also introduces several potentially significant variables that explain that role institutions play when employing a diverse workforce, identified through existing research, that may provide insight into the possible outcomes of the study without introducing bias or limiting its findings.

The selection of cases for this study was intentionally designed to analyze two contrasting scenarios: one in which a robot is highly accepted, and another in which acceptance is low. Data was collected primarily through interviews and grey literature, with a particular emphasis on newspaper articles. This decision was influenced by the fact that insight-driven HRI research commonly employs interviews as the primary method of data collection (Veling & McGinn, 2021), as well as the practical constraints imposed by safety measures that precluded first-hand observation of the baggage handling facilities at Amsterdam Airport Schiphol (Amsterdam Airport).

The overlap between data collection and analysis was maintained through discussions between the interviewers, Dr. Feenstra and myself, immediately following each interview. These discussions focused on the key insights gained from each interview and how they differed from previous ones. Additionally, initial coding was conducted concurrently to identify the primary constructs emerging from each interview.

As both cases are situated within the same organization, the identification of patterns both within and across cases is conducted concurrently, with respondents themselves highlighting similarities and differences in the implementation and use of the two robots. The conclusion of this research was determined by both time constraints, in accordance with the university's regulations governing the duration of thesis projects, and the availability of the organization that facilitated this study, KLM.

3.3 Theoretical sampling

In this research, theoretical sampling is employed as the scope of the study lies in theory building and not to test it (Eisenhardt, 1989; Eisenhardt & Graebner, 2007), as justified by the rationale presented in Section 3.1.

Selecting specific cases helps controlling for environmental variations while theoretical sampling enables the study of specific situations in which the phenomenon of interest is observable (Eisenhardt, 1989). Moreover, selecting a specific population helps identify

the conditions under which the findings of the research are generalizable (Eisenhardt, 1989).

Two different cases will be analysed to provide a stronger base for theory building. To ensure that the cases are relevant to the research, these cases have been chosen to emphasize the difference between two robotic application with different perception from the diverse workforce. In particular, Case 1 presents a robot that excludes physical work altogether, creating distress among the work-floor employees, and Case 2 presents a robot with high acceptance among the diverse workforce.

This sampling approach in which the opposite phenomena arises, in this case opposite perception from the workforce, is useful in qualitative research as it allows the quick identification of new variables, patterns, and alternative explanations that enrich and help explaining the theory identified.

3.3.1 Case description

The two cases explored involve robotic applications at Amsterdam Airport Schiphol (Amsterdam Airport)[1] baggage handling facilities. Amsterdam Airport is the largest airport in the Netherlands and the fourth largest airport in Europe by cargo traffic. It is owned and operated by the Royal Schiphol Group (Schiphol Group), mainly owned by the Dutch Ministry of Finance (in Dutch *Ministerie van Financiën, FIN*).

Around 2,000 people work in baggage handling at Amsterdam Airport. Of these, around 100 are responsible, together with external contractors, for development, management, control and maintenance of the baggage handling system, while the remaining are responsible for the physical handling of luggage (Royal Schiphol Group, 2018). Handling companies carry out the physical handling, the largest of these companies is KLM Royal Dutch Airlines (KLM). KLM operates baggage handling at Amsterdam Airport with the Baggage Services section of KLM Ground Services, with around 1,100 employees involved in this task.

The deployment of robotic technology at Amsterdam Airport was initiated as a business objective. In 2002, a consultancy firm projected that the volume of baggage handled at the airport would double over the subsequent decade, increasing from 35 to 70 million (Vanderlande, 2023). In response, Schiphol Group launched the 70 Million Bags (70MB) project in 2002 with the aim of preserving its strategic position by ensuring that its baggage handling capacity and reliability were sufficient to accommodate future growth while maintaining current staffing levels.

As part of the 70MB project, the first robot to reduce the physical work needed in baggage handling was introduced in 2006, and since then six different robots were introduced to aid in different parts of the baggage handling process. The Schiphol Group considers this implementation as part of its corporate responsibility to reduce physical burden on employees (Royal Schiphol Group, 2018, p. 4).

[1] Often colloquially referred to as “Schiphol” or “Amsterdam Airport” in common usage.

Case 1 presents the Mechanical Unloading Machine (MUM), a robotic application that discards physical labor through a substantial automation of the process, while Case 2 presents the Transfer Belt, a robotic application with a very high acceptance rate among the workforce but a misfit with the organizational goal of discarding physical work altogether. The two cases under consideration are examined in depth in Subsection 3.3.3 and Subsection 3.3.4.

3.3.2 The Dutch context

Conducting a thorough analysis of the Dutch context can signify an important research opportunity for several reasons, presented below.

First, Amsterdam Airport was the first airport in the world to deploy robots of this kind to aid the baggage handling operations, with the first project started in 2003 and the first robot operating in 2006 (Interviewee #1, Royal Schiphol Group (2018)). Therefore, this context represents a truly unique opportunity to analyze how the implementation and use of robots evolved along a 20 years period.

Second, demographics in the Netherlands suits this study because of two main reasons: ethnic heterogeneity of the population, and thus of the workforce, and rapidly aging population. The population in the Netherlands is among the most ethnic diverse in the European Union, with about 25% of the population having an ethnic background different from Dutch (& Frisian) (CBS, 2022a). The main immigration groups come from North Africa and the Middle East (CBS, 2022a). Following the trend of other Western countries, the population in the Netherlands is rapidly aging, with a current average age of 42.4 (CBS, 2023), and the share of over-65s in the population expected to reach one-quarter of the population already by 2040 (CBS, 2021).

The diversity of the Dutch population is reflected in the workforce at Schiphol, where the average age, reported by interviewees, is above 40/45 years old, and there is a considerable ethnic diversity, with a large part of the workforce having a non-Dutch ethnic background.

Further framing the Dutch context, recent concerns of the Netherlands Labour Authority positioned Schiphol Group and KLM at the center of a media and political debate about what was and is happening at the baggage handling facilities of Amsterdam Airport (Bormans, 2023; Holdert & Meindertsma, 2022a, 2022b; Nandram & de Ruiter, 2022; van Bergeijk, 2022). In particular, the Labour Authority observed unhealthy and unsafe working conditions for the work-floor employees, like the inhalation of unhealthy substances (Bormans, 2023) and the severe physical work exceeding permissible limits (Holdert & Meindertsma, 2022a; van Bergeijk, 2022). Because of this misconduct, KLM and five other baggage handling companies at Amsterdam Airport received a fine by the Netherlands Labour Authority in June 2023 (NOS News, 2023). This scandal is another important element framing a context in which implementing robots started as a strategic goal and is now also a need to comply with national labour regulations.

3.3.3 Case 1: Mechanical Unloading Machine

The Mechanical Unloading Machine (MUM) is a robot designed by the Dutch company Moderniek D.V. This robot works by gradually tilting the Unit Load Device (ULD)[2] so that its content, usually luggage, is automatically unloaded onto a lateral, as showed in Figure 3.1 (Moderniek, 2023). Preliminary opinion research from KLM reveals that work-floor employees would like the MUM to speed up the unloading of carts, and that this system is eliminating the need for physical work altogether, as it limits the practical work to (a) pulling baggage with a hook and (b) destacking baggage on the conveyor belt.

Figure 3.1: Mechanical Unloading Machine (MUM) by Moderniek D.V.

3.3.4 Case 2: Transfer Belt

The Transfer belt is a machine designed by the Danish company Power Stow. This robot consists of a small conveyor belt that is used to transfer baggage from a cart/container to a conveyor belt, as shown in Figure 3.2 (Power Stow, 2022). It aids workers by avoiding twisting movements and the need to hold heavy weight, therefore improving their productivity and reducing the probability of back and shoulder injuries without discarding completely the physical work. Preliminary opinion research from KLM shows that the acceptance rate of this machine is very high (90-95%) as it is regarded as "highly friendly" by workers, however the relation between KLM and Schiphol Group make the implementation of this robot difficult, and this machine is considered by both organizations as a temporary bridging solution to the final goal of automatizing the entire process.

[2] A Unit Load Device (ULD) is a removable aircraft part used to load luggage, freight, and mail.

Figure 3.2: Transfer Belt by Power Stow.

3.4 Data collection

Theory-building research can employ a variety of data collection methods, with the most common being interviews, observations and archival sources (Charmaz, 2014; Eisenhardt, 1989). The rationale is to triangulate among multiple data sources to gain valuable insights, substantiate constructs and hypotheses.

As this research has a qualitative nature, the key approach is the use of multiple and highly knowledgeable informants who view the focal phenomena from diverse perspectives (Charmaz, 2014; Eisenhardt, 1989; Eisenhardt & Graebner, 2007), in this case employees with different roles in the baggage handling operations.

The main data source for this research are semi-structured interviews. In semi-structured interviews, the researcher (me) is directed by an interview guide, presented in detail in Appendix B, but the natural flow of the interaction shapes the type and order of the questions asked. Interviewing has become the most common source to obtain qualitative data, and many researchers rely on it (Charmaz, 2014; Eisenhardt, 1989). Moreover, semi-structured interviews represent the most common approach in insight-driven HRI research (Veling & McGinn, 2021). Interviews were conducted by two researchers, myself and Dr. Mariëlle Feenstra, native Dutch speaker, to ensure that language barriers did not impede the collection of data from participants. Having a second researcher attending the interviews and reviewing the interview transcripts increases internal validity, objectivity of the research and enhances confidence in the findings (Eisenhardt, 1989).

Interviewing is a way of generating data for qualitative research, exploring research participants' perspectives on their personal experience with the topic and relying on first-hand experience that fits the research topic, in-depth exploration of participants' experience and situations, reliance on open-ended questions, emphasis on understanding

participants' perspective, meaning and experience, follow-up on unanticipated hints, implicit views and actions (Charmaz, 2014). Also, it suits the efforts to understand the process by which actors construct meaning out of intersubjective experiences.

Findings from the interviews are corroborated by archival sources, especially newspaper articles and company document. Triangulation among these data sources will provide more contextual information, enrich the context and highlight if and how information from different sources differ, and how formal and informal institutions are reflected and enforced.

Due to the stringent security measures in place at Amsterdam Airport, it was not possible to conduct in-person visits to the work-floor. As a result, direct observation of the workplace and the interactions between the diverse workforce and the robots was not feasible. As further explored in Section 5.2, this presented a limitation to the study, as it restricted the ability to gather first-hand data on the dynamics of human-robot interactions in the airport baggage handling facilities.

3.4.1 Interview guides

The interview guide is a tool used in qualitative research to facilitate the structuring of the interview process. It is a document that delineates the topics and inquiries that the interviewer intends to address during the course of the interview (Magnusson & Marecek, 2015). Preparing an interview guide is an important step in qualitative research as it represents a way to learn how to obtain data and ask questions while avoiding loaded questions (Charmaz, 2014). The main idea behind building the interview guide is to have some degree of preconceivement of the content that is going to be explored during the interview by focusing on matters related to the research question, while leaving room to pursue new, unexpected, emerging topics at the same time (Charmaz, 2014).

It is important to note that the interview guide serves as a framework for conducting the interview, and that I will adapt the structure of the interview to suit the flow of each individual conversation. This precaution is necessary to ensure that the conversation flows naturally and to elicit the participant to elaborate their experience (Charmaz, 2014), so it is possible, and likely, that only a subset of the full list of questions in the interview guide is going to be asked during each interview.

The research will comprise in total of six interviews, and interviewees are assigned to three categories:

- diverse workforce: group of employees who exhibit a range of characteristics that diverge from those traditionally associated with the archetypal employee. For the purposes of this research, the specific traits under consideration are ethnicity/race and age;
- organization's management: individuals occupying managerial positions within the organization and tasked with overseeing the implementation of robotic technologies, as well as managing relationships with a diverse workforce; and

- works council: employees who serve as members of the works council, and are thus responsible for representing and advocating for the interests of the workforce.

Each interview lasts between 30 and 45 minutes, starting with introductory questions and then delving into the core questions. Interviews end with the request for a follow-up interview if deem needed. The interview guides in Dutch and English for each category of participant can be found in Appendix B.

Qualitative research calls for the use of an iterative approach to ensure the researcher to move toward emerging theories identified through the study. Therefore, the interview guide is going to be object of revisions throughout the research process, for example when insights from early participants inform that some questions need to be softened or new concepts arise. Changes and adjustments to the interview guide are presented in Subsubsection 3.4.1.

Interview content

The interviews are conducted with the aim of eliciting the individual experiences of each participant, and are tailored to extract insights specific to the roles occupied by the participant.

When conducting interviews with members of the diverse workforce, the emphasis is placed on their perceptions, their day-to-day interactions with machines on the workfloor, the interactions with colleagues and management, and their technical values toward robots. The language employed is adapted to ensure comprehensibility a wider audience.

The interview with organization's management is focused on comprehending the role they played in the implementation of robotic technologies, the business and technological objectives that the organization seeks to achieve through the deployment of new robots, and the interplay between these objectives and the employment of a diverse workforce.

The interview with members of the works council will concentrate on exploring the extent of the council's involvement in the implementation of robotic technologies, the participation of the diverse workforce in this process, the role played by formal institutions in facilitating innovation, particularly referring to safety and health concerns.

Table 3.2: Concepts covered in the interview organized by participant role

Diverse workforce	***Organization's management***	***Works council***
Daily interaction with robots	Role in the implementation of robots	Involvement of the works council in the implementation of robots
Interaction with colleagues	Perception of the diverse workforce	Interaction with the diverse workforce

Diverse workforce	*Organizational personnel*	*Works council*
Interaction with management	Role of technology in the business context	Interaction with the management
Institutions in place to work with robots	Values toward robotics	Values toward robotics
Values toward robotics	Interaction with the diverse workforce	Rules to use robots
Role in the implementation of robots		Role of safety in the implementation and use of robots

Adjustments to the interview guide

The initial interview revealed a deficiency in the number of introductory questions, which hindered a smooth transition toward the core questions. To address this issue, an additional introductory question was introduced to maintain the focus on the interviewee and increase their comfort during the interview. The new question is: "How long have you been working for KLM?".

3.5 Data analysis

In accordance with the interviewees and the privacy cautions in place, interviews are executed online with Microsoft Teams and the same software is used to record the interviews and provide a preliminary transcript.

Since the number of interviews conducted is limited, the data analysis is carried out manually, without the use of any digital tools or software. This approach allows for a more hands-on and personalized analysis of the data, and eliminates the need for additional resources in the use of specialized software.

Data analysis has two main steps: within-case analysis and cross-case research for patterns. The within-case analysis involves examining each case as a stand-alone entity to identify the unique characteristics of each case. Cross-case research for patterns involves comparing different cases to identify similarities and differences to move beyond initial impressions and identify constructs/frameworks that fit with the data collected. Since both Case #1 and Case #2 are situated within the same organizational context, and the majority of participants were involved in the implementation and use of both robots, a simultaneous within-case and cross-case analysis is possible. This analysis makes use of the personal experiences and observations of the participants to gain insights into the differences and similarities among cases, to shed light on the factors influencing implementation and utilization of robots on the workplace.

Coding combines a deductive and inductive coding strategy. Deductive coding strategy makes use of the concepts identified in Chapter 2 and inductive coding enables the

capture of emerging constructs. Coding is executed in two stages: initial coding and focused coding. Initial coding makes use of two techniques: in vivo coding and values coding. In vivo coding is a coding technique that uses as codes the exact terms utilized by participants to capture and preserve the specific terms they use without risking to change their meaning. Values coding is a coding method that allows to tap in the subjective nature of the human experience by labeling values, attitudes and belief systems expressed by participants. An example of in vivo and values coding is shown in Table 3.3.

Table 3.3: Example of in vivo and values coding

In Vivo	***Interview transcript***	***Values***
"Honesty is the best policy"	*I think honesty is the best policy*	Value: Honesty

Focused coding builds on the coding performed during the initial phase and add details, refine and categorize the coding according to the patterns and relationships emerging among the constructs, allowing for the identification of propositions.

Alongside interviews and document analysis, memo writing and initial coding are performed simultaneously to allow for a rapid and insightful understanding of the collected data and to shape the research to fit concepts identified during the interviews (Charmaz, 2014; Eisenhardt, 1989).

Once the main constructs emerged from the analysis, comparison with existing theory, in Chapter 4, allows to understand the role that this research plays in a wider scientific frame. In particular, comparing what is in accordance with the literature and what is not allows to increase the validity of the study and its generalizability, together with the insights that researchers and readers can draw from it (Eisenhardt, 1989).

3.5.1 Privacy & Ethical considerations

This study received approval from both the Human Research Ethics Committee (HREC) and the Privacy Team of Delft University of Technology (TU Delft). The Privacy Team determined that a Data Protection Impact Assessment (DPIA) was not necessary, indicating that the current precautionary measures in place are sufficient to ensure that the processing of personal data did not pose a high risk to the interviewees (the data subjects).

Prior to conducting any interviews, all participants were informed of the privacy measures in place and provided their consent to participate in the interview and be recorded. Additionally, participants were informed that the interviews would be recorded using Microsoft Teams solely for the purpose of transcription.

To ensure the privacy of participants, several measures are implemented. Specifically, the raw data collected, which refers to data that has not undergone any processing, is not shared outside of the researcher and the supervisors for this research, listed on

the title page. Additionally, the data is stored on secure servers located at TU Delft and is only retained until the designated deletion date in August 2024. Excerpts from the interviews are utilized in the analysis chapter (Chapter 4) when the content of the quotation does not reveal personal data of the interviewee. A unique progressive number has been assigned to each respondent to anonymize their responses, and each quotation is tagged with that number. The association between number of respondant and role can be found in Appendix C.

3.6 Research flow diagram

The research flow diagram presented in Figure 3.3, displays the several steps needed to undertake the research, from the start with the primary literature review to its end with theory building.

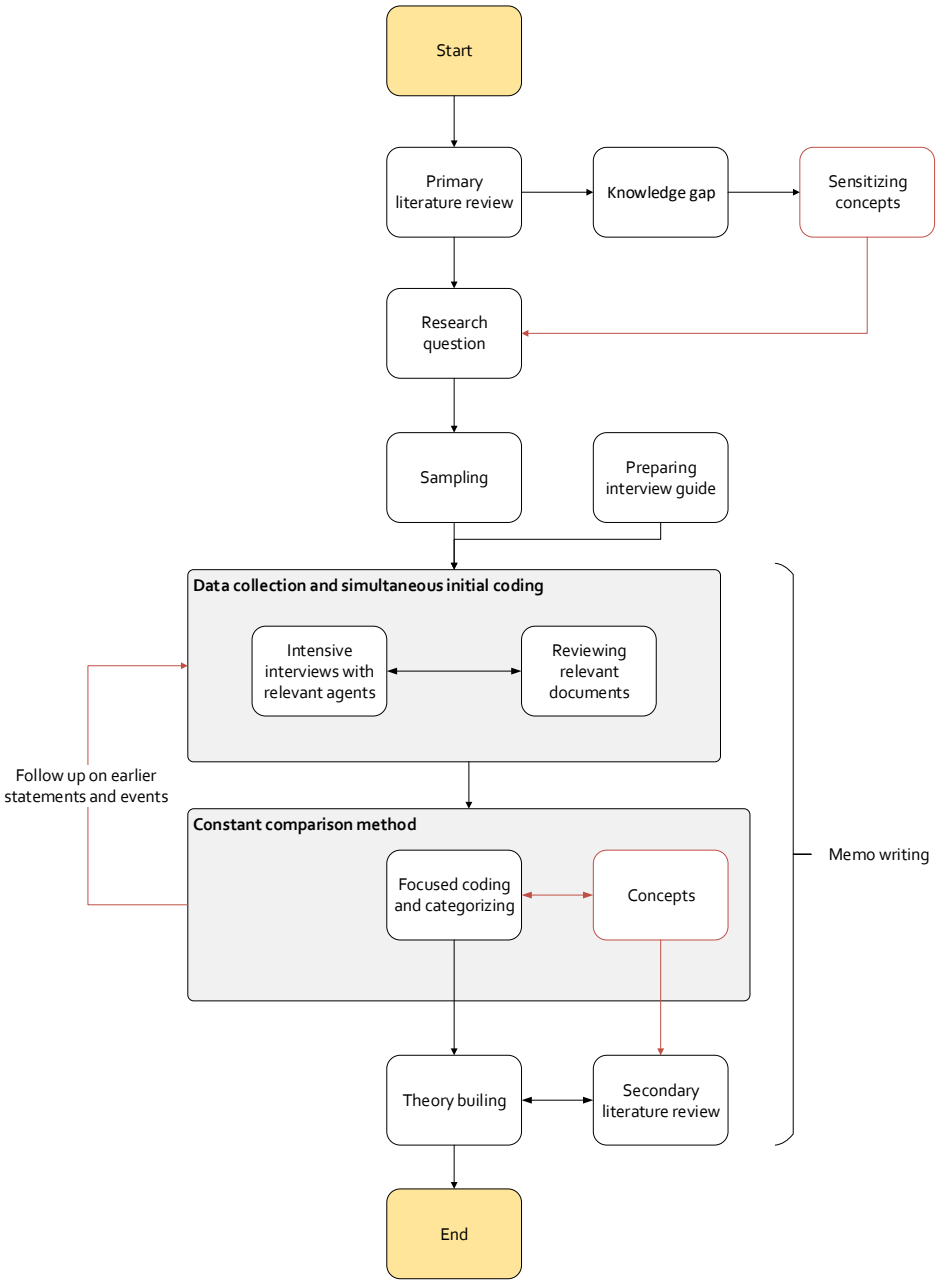

Figure 3.3: Research flow diagram, adapted from Charmaz (2014); Eisenhardt (1989)

4

Analysis & Discussion

In this chapter, I present and analyze the collected data, providing insights through the direct perspectives of the interviewees. The propositions that emerged from the analysis are then discussed in relation to existing theory and the research question.

The chapter begins with Section 4.1, which presents and analyzes the innovation system at Amsterdam Airport, including the deployment of robots to employ a diverse workforce, the agents involved, and the institutions that frame the context.

In Section 4.2, I apply the RRI approach to analyze the values towards robotics held by the diverse workforce, KLM, and Schiphol Group, as well as the effect of institutions such as hierarchy on the inclusion of the diverse workforce and the use of robots.

Section 4.3 presents the propositions identified during the analysis, discusses, fits and expands them in the light of the secondary literature review.

Finally, in Section 4.4, the previously identified propositions are used to answer the research question.

To facilitate the understanding of the analysis and to focus on the direct experiences of agents who are either directly involved in the implementation of robots or who use them, this chapter includes quotes extracted from interviews.

4.1 Understanding the innovation system

Providing a detailed description of the system as according to the innovation system approach is a fundamental starting point to understand who is involved in the innovation system, to what degree, what are the institutions framing the context and what role they play in the implementation of robots.

Given that both cases analyzed pertain to the same organization at Amsterdam Airport, the agents involved and the institutions are shared between the two cases. This commonality provides a basis for comparison and analysis of the implementation and utilization of robots within the organization.

4.1.1 Agents involved

The context of baggage handling at Amsterdam Airport is comprised of a wide range of agents. On a high level there are two organizations involved: Schiphol Group, and KLM.

KLM is divided in several business units, of which KLM Baggage Services is the division responsible for baggage handling at Amsterdam Airport. From hereafter, KLM will be used to refer to the wider corporation, while KLM Baggage Services will be used to refer to the division operating the baggage handling facilities at Amsterdam Airport.

The main agents involved in the implementation of robots at KLM Baggage Services are:

- work-floor employees: also called team members, these employees are responsible for delivering the baggage to the right airplane in the right amount of time, with or without using the robots. The workforce is very diverse, with the main reported characteristics being age and ethnicity/race;
- team coordinators: work-floor employees who are also responsible for coordinating other team members;
- superusers: portion of the work-floor employees that volunteers to try the new robots/machines, provide feedback and train fellow work-floor employees;
- shift leaders: employees responsible to manage the team coordinators/team members, deal with unexpected situations, and act as a contact person between KLM and Schiphol Group;
- process managers: employees that are responsible for and lead projects to improve the baggage handling operations, these projects can have several scopes, among which to increase employee satisfaction and healthy employability, like the implementation of robots to reduce physical work; and

- works council members: employees members of the works council are responsible to promote and protect the interests of employees, together with helping draft the working condition policies with the employing organization.

A summary and description of the main agents involved in the implementation of robots at Amsterdam Airport is presented in Table 4.1.

Table 4.1: Agents involved in the implementation process

Agent	***Description***
Work-floor employees	Team members, responsible for delivering the baggage to the right airplane at the right time
Team coordinators	Work-floor employees responsible for coordinating other team members
Superusers	Portion of the work-floor employees that volunteers to try new robots and train other employees
Shift leaders	Employees responsible to manage the team members and deal with unexpected situations
Process managers	Employees responsible for projects to improve the baggage handling operations, like implementing robots
Works council members	Employees members of the works council responsible for promoting and protecting the interest of the workforce

4.1.2 Formal institutions

The main formal institution that influences the implementation and use of robots is the Dutch Working Conditions Act (in Dutch *Arbeidsomstandighedenwet*) (Arbeidsomstandighedenwet, 1999), with the Netherlands Labour Authority (in Dutch *Nederlandse Arbeidsinspectie*) responsible for regularly checking if the working conditions are met. The Dutch Working Conditions Act is a framework act with three goals: (a) contains general provision on health and safety policy in organizations, (b) promotes good working conditions, (c) prevents illness and incapacity for work.

Some of the provisions inside this act that apply to Amsterdam Airport regard:

- the noise decibel limit that workers can be subject to (Arbeidsomstandighedenwet, 1999, art. 6.8);
- the need for Personal Protective Equipment (PPE) like safety boots, helmet, gloves, etc. (Arbeidsomstandighedenwet, 1999, art. 3);
- the minimum requirement for tools of having the CE-mark (Arbeidsomstandighedenwet, 1999, art. 7.2).

In the Netherlands, employers are required by law to provide sufficient training to their employees when they are required to operate machinery at work, as stipulated in Annex

I of the Working Conditions Act (Arbeidsomstandighedenwet, 1999, Annex I). This is particularly important in industries such as baggage handling and manufacturing, where the use of machines and robots is commonplace.

At Amsterdam Airport employees undergo a specific training program for each robot they are required to operate. The duration of the training varies depending on the complexity of the machine; for instance, training for the MUM takes four to five days, while training for the Transfer Belt takes only half a day of online training (Interviewees #3, #4).

On top of these regulations, the Netherlands Labour Authority issued guidelines regarding manual lifting, according to which employees are not allowed to lift more than 23 kilograms (Health Council of the Netherlands, 2012; Holdert & Meindertsma, 2022a). If workers also have to perform squatting/twisting movements, which is often the case at Schiphol Airport (Holdert & Meindertsma, 2022a), the weight should not exceed five kilograms, and exceeding this limit is part of the cause of the labor conditions scandal at the airport.

The regulations governing working conditions are particularly stringent during this period, following a political scandal (Bormans, 2023; Holdert & Meindertsma, 2022a) in which the Netherlands Labour Authority imposed fines on KLM and other baggage handling firms for non-compliance with health and safety requirements for work-floor employees in June 2023 (NOS News, 2023).

The regulations that Schiphol Group has to comply with translate into several imposition on baggage handling companies, for example to compulsorily make use of lifting aids and other materials that make the work less physically intense, but only if these tools are available, and as reported by interviewees this is not often the case.

> *"At the moment our people do the work in a way they should not be working according to our laws"* (Interviewee n°2)

Throughout the implementation of robots/machines, KLM and Schiphol Group has issues with safety regulations and safety managers, and these problems have a strong impact on how things evolve at the airport. The need to involve the management of the airport, KLM and safety consultants to fulfill the safety regulations in the implementation of robots results in long bureaucratic procedures and in the past it even resulted in robots that got shut-down months after their implementation because no longer classified as safe by safety responsibles (Interviewees #2, #3).

When considering the diverse workforce and robots, safety regulations mainly translate in the obligation to use the robots and the required amount of people needed to operate a robot (Interviewee #3). For example, workers report that when there is a shortage of personnel or trained workers, which is not uncommon, workers are relocated to other roles, for example as drivers, and the robot gets shut down because it no longer has the minimum required amount of operators required to work, therefore baggage handling immediately goes back to manual loading/unloading. But having too many people

working on one robot/machine is as much of a safety problem as shortage, because if machines have mobile parts then these might hit workers involuntarily if the workspace is too crowded (Interviewee #3).

Aside safety regulations, important is the regulation about the purchase of lifting aid equipment. Baggage handling firms, like KLM Baggage Services, assign the responsibility for equipment procurement to Schiphol Group. On the other end, Schiphol Group blames baggage handling companies because they are responsible to enforce the use of robots that are being procured among the workforce (Holdert & Meindertsma, 2022b).

Despite the several laws in place on the inclusion of a diverse workforce (Participatiewet, 2003; Wet Tegemoetkomingen Loondomein, 2015), to employ, for example, older employees and people who have a disability, there is no formal requirement to include the (prospect) workforce when implementing new technologies on the workplace for feedback and opinions. Moreover, organizations deploying robots and machines do not have regulations to ensure that procured robots fit the physical characteristics of a wide range of users.

A summary of the formal institutions as identified by the research is presented in Table 4.2.

Table 4.2: Formal institutions at Amsterdam Airport

Formal Institution	***Description***
Working Conditions Act	Both organizations must ensure that working conditions are healthy and safe
Procurement of robots	Schiphol Group is responsible for procuring robots
Enforce the use of robots	KLM is responsible for ensuring that workers make use of robots
Employees training	KLM is responsible to train each employee for the robots they has to use
Missing formal rule to include a diverse workforce	There is no formal requirement to include a diverse workforce in the implementation of robots
Missing formal requirement about robots' compatibility with users	There is no formal requirement to procure a robot that fits a wide range of physical characteristics

4.1.3 Informal institutions

To accurately depict the difference between the informal institutions of corporate organizations and the diverse workforce, these will be analyzed in two different sections.

KLM & Schiphol Group

Arising from the interviews, employees of KLM Baggage Services find themselves at the intersection between the institutions of KLM and of the Schiphol Group, being, therefore, subject to both (Interviewees #1, #2).

This intersection can be quite hard to manage, as reported by different interviewees.

> *"We are dependent on the Schiphol* [Group] *organization [...] and that sometimes it's very hard to handle"*
> (Interviewee n°1)

> *"[...] we have a lot of dependencies on the airport, their budgets, their priorities, their visions on how things should be implemented"*
> (Interviewee n°2)

When it comes to technology, both Schiphol Group and KLM hold a deep technocratic belief (Interviewee #1, #2, #4) and look at robots and machines as the solution to the long-lasting problems that afflict the baggage handling facilities at the airport (Royal Schiphol Group, 2018), like lack of capacity to handle more baggage units and safety concerns.

> *"Because it's modern time, everything as to be done with technology"*
> (Interviewee n°4)

Focusing on robots, the upper and lower management at KLM have a strong desire to automate the entire process. The aspiration for automation exists for several reasons: (a) the strategic business goal of Schiphol Group to make the growth of Amsterdam Airport possible by increasing the number of luggage that the airport can process without increasing the number of employees (Interviewee #1, Vanderlande (2023)); on the other end (b) KLM has to maintain good standards for its employees to fulfill its corporate responsibility strategy, especially when it comes to well-being and safety, while maintaining the appropriate service level (Interviewee #2).

> *"Our main focus is 100% use of the machines"*
> (Interviewee n°5)

> *"We want to do the doubling of bags handling with the same kind of staff"*
> (Interviewee n°1)

> *"KLM as an employer wants to have high standards for employees"*
> (Interviewee n°2)

KLM shows willingness to include work-floor employees in decisions about the improvements of robots and machines, however, as previously discussed, the inclusion of a diverse workforce is not mandatory and is not supported by formal institutions, therefore

mostly relying on the willingness of the lower management at KLM to take on board a, limited, number of employees for testing and feedback of new robots (Interviewees #1, #2). Moreover, this inclusion is considered insufficient by work-floor employees that see it as one of the main reasons behind the safety and robot acceptance issues currently faced in the baggage handling facilities.

> *"Too little use is made of the know-how of the people on the work-floor, and that is a shame, and you see what is happening now"* (Interviewee n°3)

Also, the management at KLM expects superusers to be not only accountable for the training of the workforce, but also to enforce the use of robots among workers that are not using them (Interviewee #3), highlighting an allocation of responsibility to the workforce and the lack of appropriate leadership to provide clear instructions from the top.

> *"Our manager expected from me, for example, that if someone* [a work-floor employee] *wasn't using it* [the robot]*, I would address them"* (Interviewee n°3)

A summary of the informal institutions at KLM/Schiphol Group as identified by the research is presented in Table 4.3.

Table 4.3: Informal institutions at KLM/Schiphol Group

Informal Institution	***Description***
Deep technocratic belief	Both organizations look at robots/machines as the solution for the long-lasting problems at the airport
Desire to entirely automate the process	Both organizations consider complete automation as their final goal
Limited inclusion of the workforce	KLM lower management often includes a limited amount of workers to get feedback on machines/robots before being implemented
Accountability of superusers for robot usage	The lower management associates superusers the responsibility to ensure that robots/machines are used

Workfloor employees

The work environment at the baggage handling facility is fast-paced, demanding and very physically intensive, there is always something to do and the workload can be challenging at times (Interviewees #1, #6)

> *"We have a lot of supply of luggage, there is a whole load waiting, always"* (Interviewee n°1)

with workers required to lift two to four times the limit weight set by health experts (Holdert & Meindertsma, 2022a; Nandram & de Ruiter, 2022), thus creating a culture of hard work. Interestingly, this hectic work environment boosts a strong sense of community among a considerably diverse workforce.

> *"The people are people. If you work, the color or age or gender or where you come from, it's not important if you do your job"* (Interviewee n°6)

> *"We don't look at your background. We don't look at your color. We're not looking at you. KLM has goals, instructions, and a process. That is the most important point"* (Interviewee n°4)

Delving in the social norms among the diverse workforce, the need and value for leadership and hierarchy emerges as an important factor

> *"We are depending on the leaders, they have to take their job seriously"* (Interviewee n°5)

> *"When someone from the management comes to the work-floor. Everyone gets a little timid there,* [...] *some because they are culture-oriented, others because of hierarchy"* (Interviewee n°3)

together with the respect for seniority, an important factor for social influence especially about the use or not of robots.

> *"It's mostly older people* [who speak up] *because the older people are the ones with more influence than the people who are just new or just starting at KLM"* (Interviewee n°5)

Some senior employees have very influential voices, being able to skew what other employees think about robots, their adoption and their use.

> *"Some voices are just heavier than others* [...] *it can be dangerous if the voices get really heavy"* (Interviewee n°5)

A summary of the informal institutions on the work-floor as identified by the research is presented in Table 4.4.

Table 4.4: Informal institutions of the diverse workforce

Informal Institution	*Description*
Hard work culture	The work culture focuses deeply on one goal: working hard to deliver baggage at the right place on the right time, everything else hardly matters
Respect for top-down leadership	Workers value clear instructions from above regarding the tasks to accomplish and how to accomplish them
Respect for seniority	Senior employees are respected and hold opinion leadership among the diverse workforce

4.2 Using the RRI approach

Following the RRI approach, the following section explores the main processes in place to include the diverse workforce in the implementation of robots and the main values regarding technology, highlighting the power and legitimacy of different agent (Werker, 2021).

4.2.1 Attitudes towards robotics among the diverse workforce

As explored in Subsubsection 4.1.3, in their hectic workplace the diverse workforce is deeply focused on their unique objective: delivering luggage to the right airplane and in the time limit.

Thus, from the interviews arises that the workforce values robots that are easy to operate, reliable[1], fast[2], that empower them to work in favourable conditions according to their physical mobility and the way they traditionally work(ed) (Interviewees #1, #2, #3, #5, #6).

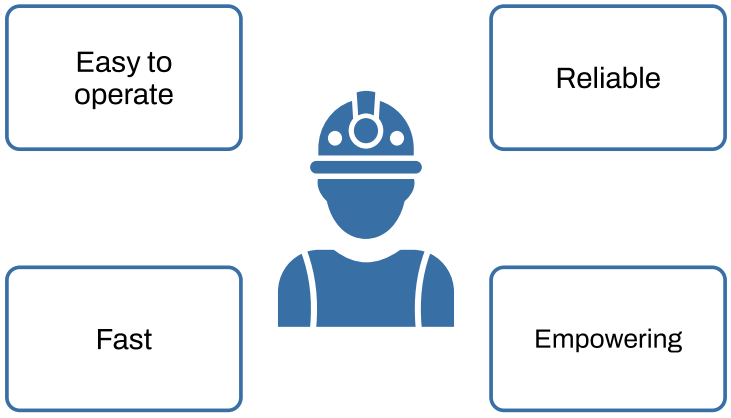

Figure 4.1: Values toward robotics for work-floor employees

[1]Not prone to frequent disruptions.
[2]Able to accomplish the workers' unique objective in the given time.

Considering the two lift aid equipment of focus in this research, the MUM does not fit the requirement of the diverse workforce because it is prone to disruptions, needs at least six workers to operate and it is slower than manual unloading (Interviewees #1, #3). Therefore not meeting the values of reliability and speed.

On the other end, the Transfer Belt is very easy to operate, it is not prone to disruptions, speeds up the work compared to manual work while allowing the worker to adjust it according to their needs, for example it is operable by right- and left-handed employees and its height is adjustable (Interviewees #2, #4). Therefore this machine meets workers' values and its use is widespread among the workforce.

Using another machine as an example, proof of the value for empowerment are to be found in the refusal to operate the CLS because it requires the workforce to operate in ways that are physically uncomfortable, like the need to continuously bend over or use only one side of the body, while normally the worker would accomplish his job in a way that avoids continuous bending over and would switch right/left arm to counter fatigue (Interviewees #5, #6).

4.2.2 Values toward robotics for Schiphol Group and KLM

Two main organizations play a role in the implementation of robots at Amsterdam Airport: Schiphol Group and KLM.

Delving from the interviews, when it comes to Schiphol Group, the organization values robots that are fast and reliable, to pursue the business/strategic goal of increasing the number of passengers the airport can handle and therefore the number of baggage it can process without increasing the workforce and causing disruptions to the operations of the airport (Interviewee #1, Royal Schiphol Group (2018))

For KLM different values can be observed across lower and upper management. Upper management (KLM corporate) is aligned to the corporate social responsibility goals of the organization to keep good standards in the working conditions of its employees and therefore strive for complete automation of the baggage handling facilities through machines that minimize the need for physical work (Interviewees #1, #2). The value for automation is reflected in the numerous, more or less successful, attempts to implement different robots on the workplace.

On the other end, the lower management (KLM Baggage Services) being closed to the workforce is more pragmatic and, while striving for complete automation, understands that robots at the current state of development will not be able to replace the manual work that the workforce supplies and that there is room for improvement in the robots used to better match the desires of the diverse workforce. Therefore, KLM Baggage Services while valuing robots that can lower weight requirements from robots, also values robots that more closely aligns with the requirements of the diverse workforce (Interviewees #1, #2, #3).

4.2.3 Robots and the diverse workforce

At KLM Baggage Services the workforce is quite diverse, with the two prominent diversities being age and ethnicity/race (Interviewees #1, #5).

> *"Here at* [Amsterdam Airport] *Schiphol everyday is different, everyone is different"* (Interviewee n°2)

> *"Employees inside baggage handling work with all different nationality, let me say, almost all. Yes, some countries only have one or two or three* [employees represented]*, but you work with different cultures like that."* (Interviewee n°4)

Other than the values mentioned in Subsection 4.2.1, different workers have different requirements and preferences when it comes to the robots they work with. Generalizing, work-floor employees value flexibility in their work and this especially translates in their ability to choose how to perform certain tasks:

> "[If I do not use the robot] *I can use my body like I want instead of to bend over"* (Interviewee n°6)

Robots and machines at Amsterdam Airport are arranged to work with the "average person". How the average person looks like can vary greatly based on the country in which the robot is being designed and deployed. Among the work-floor employees, the main ethnic minority is comprised of people coming from or descendant of emigrants from North Africa and the Middle East, which correspond to the largest ethnic minorities in the Netherlands (CBS, 2022a). These ethnic groups have an average height which is considerably lower than the average height in the Netherlands (De Wilde, Van Dommelen, Van Buuren, & Middelkoop, 2015; Schönbeck, Van Dommelen, HiraSing, & Van Buuren, 2015), which has the highest average height in the world (CBS, 2022b), and is also lower than the average height of neighbouring countries (WorldData, 2020), which are the main countries where the companies designing the robots are settled (Interviewees #1, #4). This results in certain members of the diverse workforce finding it hard or even impossible to use the machines available on the workplace (Interviewees #4, #5).

> *"One of the complaints I also heard a lot it's about length because there is no average length,* [...] *in the Netherlands it's about six feet*[3] *and the short guys, they complain that's not optimal for them."* (Interviewee n°5)

To a different degree, the "average person problem" can also be observed in problems operating the robot for left-handed people.

[3] Six feet equals to 183 cm.

> *"It's* [the robot] *just only one-side operable. If you're left-handed, then you can't use the machine like you want to."* (Interviewee n°5)

This problem is especially observable in the Dutch context, where the population has one of the world's highest rates of left-handedness (13.23%) (McManus, 2009; Statista, 2020).

One employee associates this problem to the geographical distance between Amsterdam Airport and the company designing/manufacturing the robot.

> *"They* [KLM] *go too quickly to Germany and abroad"* (Interviewee n°4)

According to this work-floor employee, the geographical distance is hampering the direct communication between KLM and the designers of the robot, thus making it harder to test the machine and incorporate workers' feedback and requirements.

> *"I'm talking about the direct communication. Just as an example, if you buy a car in your area, and there is something wrong with your car, you can approach that garage directly. It's something different if you buy a car in Germany, then you have to go all the way."* (Interviewee n°4)

4.2.4 Organizational hierarchy and robot implementation process

When it comes to the implementation of robots, a clear formal vertical hierarchy is outlined by the interviews (Figure 4.2). This structure enforces a power structure that sees the workforce at the bottom of a hierarchy that has KLM and Schiphol Group on top. Having these two firms at the top of the hierarchy results in a complex interaction among formal institutions, especially when sharing responsibilities and duties. This complex interaction translates in KLM Baggage Services having to undergo approval of both organizations even for trivial matters, significantly hindering the autonomy of KLM Baggage Services to improve the workplace on its own.

The process to involve the diverse workforce in the implementation of robots is presented in Figure 4.3. As discussed in Table 4.2, there is no formal requirement from KLM and Schiphol Group to include the workforce when implementing robots, let alone the diverse workforce. What actually happens is that, discretionarily, process managers responsible for the implementation of a specific robot/machine, some of which are former work-floor employees, involves a portion of the workforce to provide feedback. The workforce involved is inherently diverse given the high diversity among the employees.

> *"When I do a project, I always ask the employees because I started* [...] *as an employee, so I know how to work."* (Interviewee n°1)

Work-floor employees are requested to participate on a voluntary base, and this translates in a selection bias where the people that end up taking part in the implementation

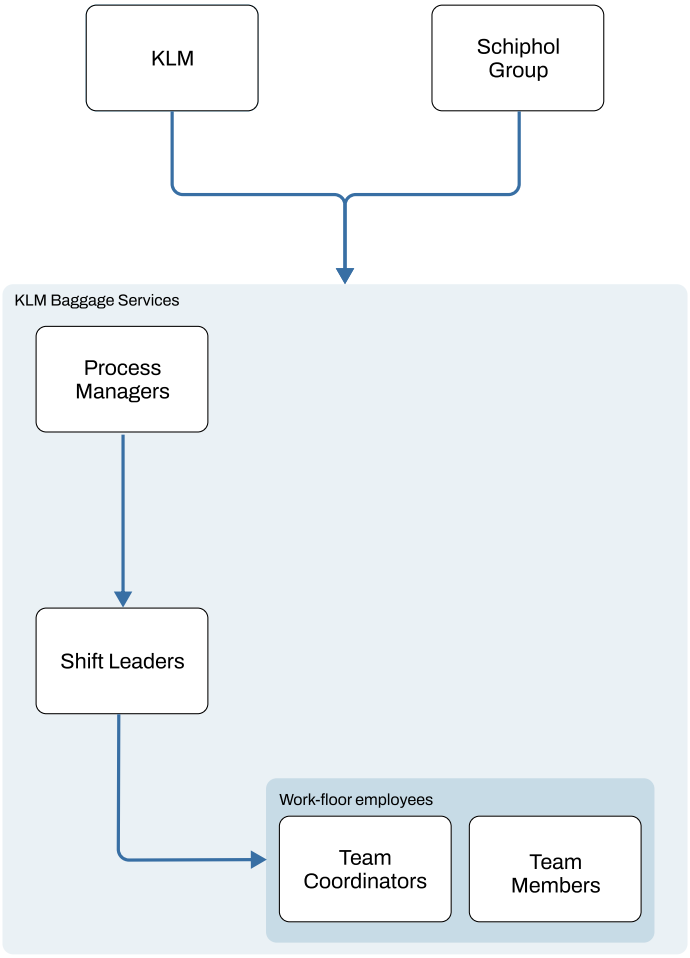

Figure 4.2: Hierarchy in robot implementation at KLM Baggage Services

process are those who are already the most appreciative of KLM and technology and willing to use new tools and, thus, are likely to be the least critical about it. This factor emerged when interviewing superusers, who, as previously mentioned, voluntarily decide to try new technologies and train fellow colleagues.

> *"I make it clear to the boys* [colleagues]*, I say: this* [the robot] *or do you prefer nothing at all?"* (Interviewee nº4 - Superuser)

> *"I say to those guys* [colleagues] *You should be happy this time, you are really lucky at this time, you are very lucky.* (Interviewee nº4 - Superuser)

> *"But they* [colleagues] *forget that KLM has a big problem* [employee shortage] *and many people are sitting at home. The support is only necessary.* (Interviewee nº4 - Superuser)

> *"People have to realize that it's just a way of working. You work with the new machines or you don't work at all, and that's the thing."* (Interviewee nº3 - Superuser)

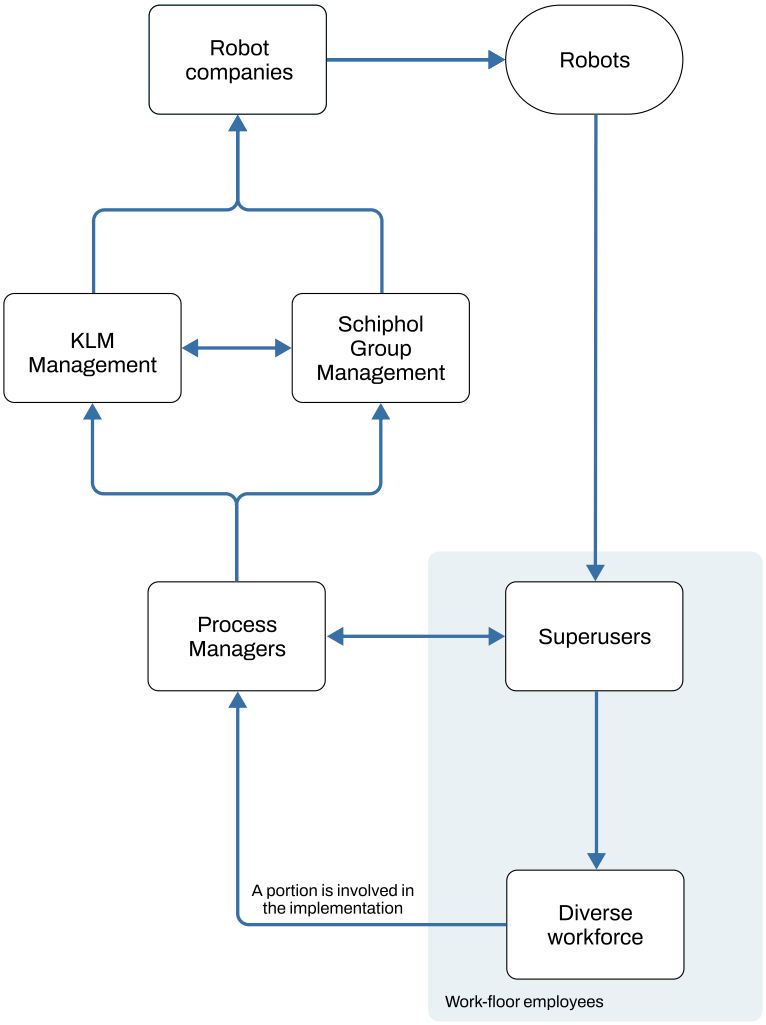

Figure 4.3: Involvement of the diverse workforce in robot implementation

However, as explored in Subsection 4.1.3, the workforce sense that too little use is being made of their knowledge regarding how the workplace should be improved and what robots are needed for. The lack of involvement is perceived by the workers as the reason why some robots have little acceptance and the airport has many safety concerns (Interviewees #3, #5).

Pairing the partial involvement of an already technologically enthusiast workforce and the institutional distance between the diverse workforce and the companies designing the robots, highlighted by the graph, is that there is a clear separation between the diverse workforce and the companies designing the robots.

4.3 Fitting the construct identified within existing literature

Moving from initial to focused coding, the analysis of the innovation system allows to identify several propositions, presented in Table 4.5 together with example quotes that illustrate the proposition.

The propositions identified allow for a deeper understanding of the impact that institutions have on the implementation and use of robots to employ a diverse workforce, thus providing valuable insights to answer the research question.

I present the propositions below, and further explore the role they play in the wider academic literature.

Referring to the literature explored in Chapter 2, the propositions identified in the previous section explore and expand on previously identified concepts and improve our understanding on the role of institutions to employ a diverse workforce.

Table 4.5: Propositions emerging from the analysis

Propositions	***Example evidence***
Proposition 1: hard work mitigates the negative effect of diversity on the sense of community among the workforce	*"The people are people. If you work, the color or age or gender or where you come from, it's not important if you do your job"* (Interviewee n°5); *"We don't look at your background. We don't look at your color. We're not looking at you. KLM has goals, instructions, and a process. That is the most important point"* (Interviewee n°4)
Proposition 2: ethnic/race diversity directly influences the use of robots through physical characteristics	*"One of the complaints I also heard a lot it's about length because there is no average length"* (Interviewee n°5); *"You can use it* [the robot] *from two sides. So whether you're left-handed or right-handed, or you want to change in between.* (Interviewee n°6)
Proposition 3: age diversity indirectly influences the use of robots	*"The older people are the ones with more influence"* (Interviewee n°5); *"if that person* [the group leader] *is against a machine or against innovations, then the other ones* [colleagues] *follow the leader. It can be dangerous if the voice gets really heavy."* (Interviewee n°5)
Proposition 4: weak management leadership does not influence the sense of community among the workforce	*"We are depending on the leaders, they have to take their job seriously"* (Interviewee n°5); *"I think it's good at least hear the voices. And if you if we can answer them as a shift leader or someone who's in control, then we absolutely have to do."* (Interviewee n°5)
Proposition 5: Age and ethnicity do not influence the positive perception of robots	*"I see young people are for the robot and I see old people are for the robot, it is, you know, in the people itself, I think."* (Interviewee n°6)

4.3.1 Proposition #1: hard work mitigates the negative effect of diversity on sense of community

When a diverse workforce is subject to an hard work culture, then this informal institution boosts a sense of community among workers.

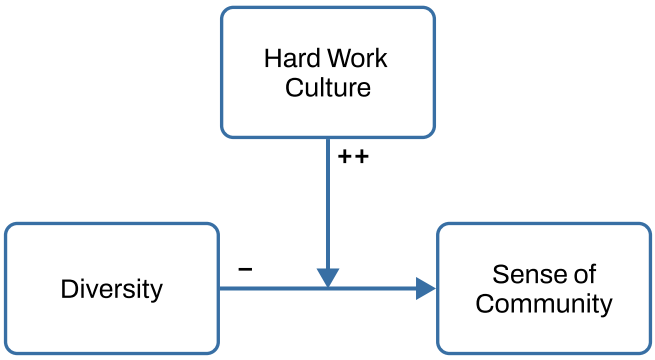

Figure 4.4: Proposition #1

On the other end, heavily implementing robotics will relieve the requirement for labor-intensiveness, therefore potentially worsening the relationship among workers and their sense of community.

The analysis of the workforce at KLM Baggage Services reveals that the employees are united in their primary task of delivering baggage to the correct location in a timely manner. This shared goal fosters a strong sense of community[4] among the diverse workforce, despite potential challenges arising from differences in cultural and social norms.

This finding builds upon existing literature by providing a valuable contribution to research on diversity and sense of community. Previous studies have proposed a dialectical relationship between these two factors, suggesting that high levels of diversity cannot lead to a strong sense of community, and vice versa (Neal & Neal, 2014). However, in a demanding work environment, a culture that values hard work can foster a sense of community among a diverse workforce.

The implementation of robotics in labor-intensive industries has the potential to relieve the workload of employees and reduce the hectic nature of the workplace. However, little research has been conducted to understand the impact of relieving workload on the relationships between sense of community and diverse workforce. The case study presented here suggests that a demanding work environment can serve as a unifying factor among a diverse workforce.

On the other hand, the widespread implementation of robotics may reduce the need for labor-intensive work, potentially worsening the relationships and sense of community among workers.

[4]Defined as membership, influence, integration and fulfillment of needs.

4.3.2 Proposition #2: ethnic/race diversity directly influences the use of robots through physical characteristics

The ethnic group a worker belongs to directly influences their use of robots because different ethnic/racial groups have different physical characteristics.

Figure 4.5: Proposition #2

The analysis reveals that some workers are unable to operate certain robots or machines due to their design, which is based on the average height of individuals in the Netherlands and neighboring countries. This height is significantly different from the average height of individuals from the main migratory groups, as reported by CBS (2022a); De Wilde et al. (2015); Schönbeck et al. (2015). A similar issue arises for left-handed workers, as some robots are only operable with the right hand, causing problems and distress for these individuals. The proportion of left-handed individuals also varies by country, as noted by McManus (2009), indicating that this issue may be related to ethnicity.

Research on robotics and ethnicity/race has found that individuals with an ethnic background value robots that align with their traditions and customs (Barfield, 2021, 2023). While participants in this study did not report explicit mismatches between their customs or traditions and the robots they encountered, they did highlight another issue related to ethnicity: not all machines or robots are optimally operable by individuals with different physical characteristics. This finding supports the literature on HRI, which suggests that robots often reflect the values of their designers, based on Western norms (Sparrow, 2020), and may not account for the needs of minority groups.

For example, in the case under consideration, workers belonging to ethnic groups with a lower average height are unable to operate robots or machines designed for a taller average height. Failing to establish formal institutions that require robot designers to comply with different height requirements can result in a mismatch between the average height considered by robot companies when designing their products and the actual average height of individuals from different ethnic groups. This problem is particularly evident in the Netherlands, where the native population has the highest average height in the world (CBS, 2022b), while ethnic minorities from Africa, the Middle East, and Asia are considerably shorter (De Wilde et al., 2015; Schönbeck et al., 2015).

4.3.3 Proposition #3: age diversity indirectly influences the use of robots

Employing the elder population indirectly influences the use or robots by holding opinion leadership and influencing the view of other workers on the use of robots.

Figure 4.6: Proposition #3

At Amsterdam Airport, older employees hold a significant degree of opinion leadership, meaning that their views and opinions carry considerable weight among their colleagues on the work floor. This strong position enables them to shape the opinions of other employees on a variety of topics, including the use of robots. As such, an age-diverse workforce can indirectly influence the adoption and use of robots in the workplace.

Existing literature on employing a senior workforce through the use of robots primarily focuses on addressing the skill gap that arises in the workplace, and the role of robots in filling this gap (Wolbring, 2016). However, this study reveals that, in addition to the practical aspects of employing a diverse workforce, there is also a strong social dimension to employing an older population. This is due to the opinion leadership role that senior workers often hold in manufacturing jobs, where they have the potential to shape the opinions and use of robots among their colleagues.

This research highlights the importance of analyzing the impact that employing a diverse workforce will have on informal institutions. In addition to the practical implications of having an age-diverse workforce, like physical requirements of robots, employing an older population also has a strong social dimension that is often overlooked in academic literature on the topic. Given the influence that these workers can have on the adoption, integration and successful use of new technologies in the workplace, the social aspect of employing an older population is at least as important as the practical aspect.

4.3.4 Proposition #4: weak management leadership does not influence the sense of community among the workforce

A conflict between cultural norms (informal institutions) and safety regulations (formal institutions) at the management level leads to weak leadership. Weak leadership does not influence the workforce's sense of community due to the presence of substitutes for leadership.

KLM and Schiphol Group's management have to balance the organizational culture of loose surveillance of their workforce with strict safety requirements coming from the

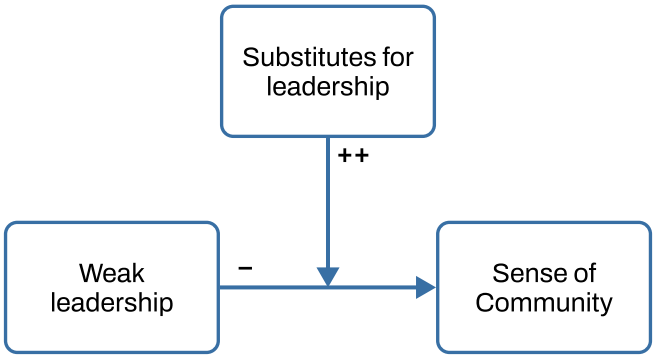

Figure 4.7: Proposition #4

Netherlands Labour Authority. This balance act is difficult and results in weak leadership, with either missing orders/control from the management or very strict obligations. Despite the weak leaderships, the workforce accomplishes its tasks and duties with little guidance.

In particular, at KLM the management guarantees a certain degree of independence to work-floor employees and this translates in employees working according to their preferences with, historically, little to no surveillance from the top. However, if work-floor employees do not use robots for their work, Schiphol Group/KLM incur in violation of the safety regulation, and therefore the management performs intimidating acts to force the use of robots. The conflict of these two institutions considerably worsen the perception that workers have of the management, but it does not influence sense of community of the workforce and its ability to perform its tasks and duties.

The literature links positively sense of community and leadership, classifying a strong leadership as a critical factor to have sense of community and community collaboration (Lamm, Carter, Lamm, & Lindsay, 2017; Nowell, Izod, Ngaruiya, & Boyd, 2016; Redondo, 2016). According to the literature, it would be expected that there would be little sense of community at KLM Baggage Services due to the presence of weak leadership. However, this it not the case when considering what actually happens at KLM Baggage Services.

To understand what actually happens, the literature on substitutes for leadership explains that management leadership is not always the crucial factor influencing workforce performance and sense of community when substitutes for leadership are present. Substitutes for leadership refers to certain characteristics of the job and workforce that come into play when management leadership is missing or weak and fulfill its duty (Howell, Bowen, Dorfman, Kerr, & Podsakoff, 1990). In particular, from the literature on substitutes for leadership (Howell et al., 1990), two substitutes for leadership can be identified that come at play at KLM Baggage Services: the strong relationships among the workforce; and the intrinsic satisfaction that work-floor employees get from accomplishing their tasks. These two substitutes replace the weak management leadership and allow for a strong sense of community despite the weak leadership.

This finding has significant practical implications. If the intrinsic satisfaction that

employees derive from their work decreases as a result of increasing automation in the workplace, then this factor as substitute for leadership may be lacking. Thus, if management leadership keeps being weak, the result is diminished sense of community among the workforce, resulting in decreased performance and reduced well-being among workers.

4.3.5 Proposition #5: age and ethnicity/race do not influence the positive perception of robots

Age or ethnicity/race diversity do not influence the positive perception that a worker has of robots to improve their work and reduce the workload.

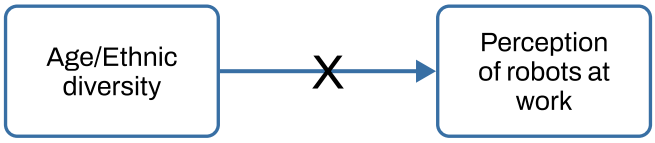

Figure 4.8: Proposition #5

At Amsterdam Airport, neither age diversity nor ethnic/racial diversity appear to influence workers' perceptions of robots as a means of improving their work and the workplace in general. This includes relieving physical tasks and making the job more enjoyable. This does not imply that older employees or employees with diverse ethnic backgrounds will systematically like and use robots, which would conflict with proposition #2. Rather, it suggests that age or ethnicity/race do not necessarily correlate with negative opinions on the use of robotics to improve the workplace.

In terms of age, the literature on age and technology acceptance generally supports the finding that age does not influence perceptions of technology (Vaportzis et al., 2017). This suggests that social norms and beliefs associated with older populations do not generally influence the acceptance of new technologies.

For ethnicity, studies on the topic are limited. Research on ethnicity and consumer acceptance of novel technologies has shown that ethnicity is an important factor shaping the acceptance of technology, with high ethnicity[5] being negatively correlated with the acceptance of new technologies (Mansori, Sambasivan, & Md-Sidin, 2015). Despite the diverse workforce, this study did not identify ethnicity as a critical factor in the acceptance of novel technologies at work. However, given the different setting and scope of this study, this does not necessarily indicate a conflict with existing literature on ethnicity and technology acceptance. For example, acceptance of technology in the workplace may be substantially unrelated to consumer acceptance of novel technologies. Thus, the result about about ethnicity/race and positive perception of robots can only be generalized to the Dutch context, where, as previously discussed, the main ethnic/race

[5]Individuals have "high ethnicity" when they have strong attachment to their ethnic group, therefore strong attachment to its social norms and beliefs.

minorities are coming from or are descendant of people from North Africa and the Middle East.

4.3.6 Other relevant findings

In the ensuing sections, findings that are not directly pertinent to the research question, but are nonetheless relevant for practical and theoretical considerations, are presented and discussed.

The influence of geographical proximity

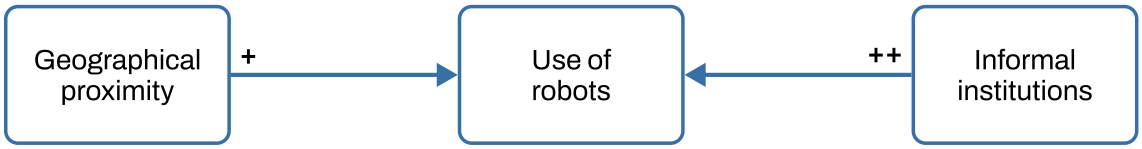

Figure 4.9: Influence of geographical proximity on the use of robots

As outlined in Subsection 4.2.3, an employee involved in the implementation of the MUM stated that the geographical proximity to the robotics company responsible for designing the robot facilitated the exchange of ideas and feedback. As a result, it was suggested that KLM and Schiphol Group should prioritize collaboration with domestic companies rather than seeking partnerships abroad. The employee argued that geographical proximity would enable more rapid and effective communication between the organization designing the robot and the purchaser, as it would allow for frequent reciprocal visits between the two companies.

The literature on geographical proximity within the Dutch context generally agrees that it plays a role in facilitating effective and efficient collaborations among organizations (Broekel & Boschma, 2012; Cunningham & Werker, 2012; Werker, Ooms, & Caniëls, 2016). Geographical proximity can enhance knowledge spillover and information exchange, foster trust and cooperation, and facilitate the coordination of joint activities.

This observation constitutes a significant finding that aligns with the literature on the positive impact of geographical proximity on effective and efficient collaboration. However, it contrasts with the lower acceptance of this particular robot compared to other machines developed by foreign companies, such as the Transfer Belt. A comparison of the employee's report with the actual implementation of robots at Amsterdam Airport suggests that geographical proximity between companies involved in the deployment and design of robots may influence their use and acceptance by a diverse workforce. However, this factor appears to be less influential than others, such as alignment with workers' technical values, as discussed in Subsection 4.2.1, and other informal institutions, as presented in Subsubsection 4.1.3.

The influence of training

Figure 4.10: Influence of training on the use of robots

As explored in Subsection 4.1.2, training to use robots is an important part of being a work-floor employee at Amsterdam Airport. In this research, training has been mentioned several times as a factor that might affect the willingness of workers to use robots. However, no relation between training and diversity can be drawn from the interviews and from participants' answer it is unclear what are the characteristics of training that might influence the use of robots.

At Amsterdam Airport, in particular, interviewee #4 reports that the Transfer Belt that, quoting from the interview, "was suddenly there" without "good introduction" and no mandatory requirement to work with it has receiving great approval by the workforce, while other machines with a more organized introduction and multiple-days-long training, like the MUM, have lower approval among employees. This finding suggests that training duration and training complexity might be negatively correlated to the use of robots.

Reviewing the literature on training effectiveness, Noe (1986) suggests that it is worth exploring workers' attributes and attitudes to understand the various motivational and situational factors that may explain why employees on the work floor avoid training, such as motivation to learn or expectations of promotion or recognition. However, due to a lack of information on workers' attributes and attitudes, no conclusions can be drawn from this.

4.4 Results

The research started with the following research question:

> *How do formal and informal institutions shape the implementation and use of robots at work aimed at including a diverse workforce?*

The research question delves in two different aspects of robots at work: implementation and use. The two aspects will be answered separately in the two sections below making use of the propositions previously identified.

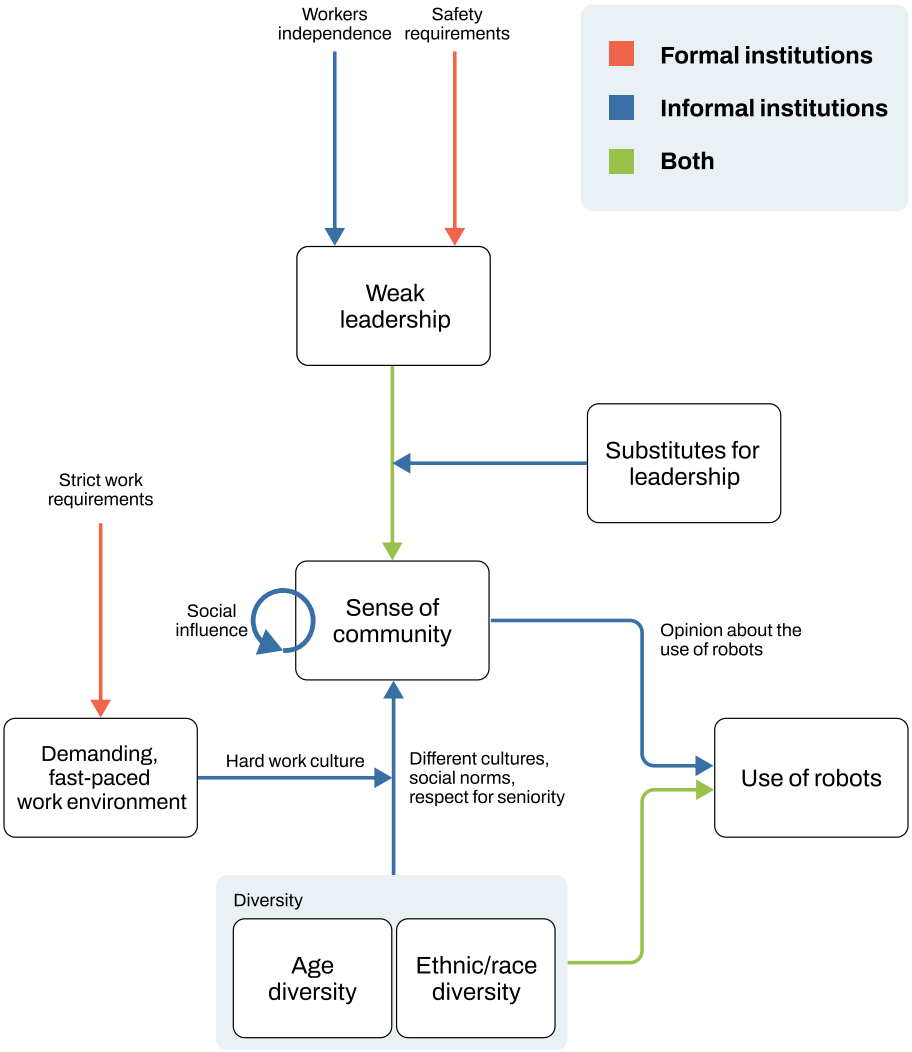

Figure 4.11: Influence of institutions on diversity and robot use

4.4.1 Use of robots

This research shows that, under a technocratic approach, institutions, diversity and use of robots interact in complex ways (Figure 4.11).

Focusing on diversity, the research shows that institutions can impact how diverse people use robots in two ways: a direct and an indirect way.

Indirect interaction

In an indirect manner, strong informal institutions, such as a culture of hard work, can overshadow other informal institutions, such as strongly different cultures and social norms. As explored in proposition #1, this overshadowing boosts a sense of community among the workforce.

In a workforce that values age diversity and respect for seniority (informal institutions),

the senior workforce plays a key role in supporting this sense of community and holds a position of opinion leadership among their colleagues. This generates social influence and shapes the opinions of others, for example about the use of robots.

As explored in proposition #3, the indirect relationship between diversity and the use of robots can be found in the leadership role that senior employees play among the diverse workforce. These individuals have the ability to influence the opinions of their colleagues on robots and their use.

Direct interaction

The direct interaction between diversity and the use of robots can be found in both formal and informal institutions.

First, formal institutions, such as regulations and laws, play a role in determining the characteristics that a robot must possess in order to be operable by humans. In the cases studied, the absence of regulations regarding the height of the user or the ability to use robots with either hand had a significant impact on the ability of workers to operate robots or machines. As explored in proposition #2, this directly influenced the ability of a diverse workforce to make use of supporting equipment.

Second, this research found that diversity could have an direct impact on the use of robots if a specific diverse identity is tied to specific informal institutions, for instance, conservative values against the use of technology. Focusing on the Dutch context, neither age nor ethnic diversity had an impact on workers' perceptions of the positive role that robotics can play in improving their working conditions, thus informal institutions do not impact the use of robots.

4.4.2 Implementation of robots

This research examines the role of institutions in the implementation of robots in a diverse workforce. The findings suggest that, in the absence of formal institutions regulating diversity inclusion and when input from the workforce is provided on a voluntary basis, informal institutions play a prominent role in shaping the input and feedback provided by the diverse workforce on the robot being implemented.

The prominent role of informal institutions is also illustrated in Figure 4.12, where blue lines indicate that the only connection between the diverse workforce and KLM is through informal institutions, such as willingness to help and enthusiasm for technology.

This result suggests that if age and ethnic diversity are not associated with informal institutions, such as enthusiasm for technology, as is the case in the Dutch context explored in proposition #5, then diversity does not affect the ability of the diverse workforce to participate in and provide input for robot implementation. This applies both directly, by being part of the initial group that provides input on the robot, and indirectly, by becoming a superuser who can influence the opinions and use of robots

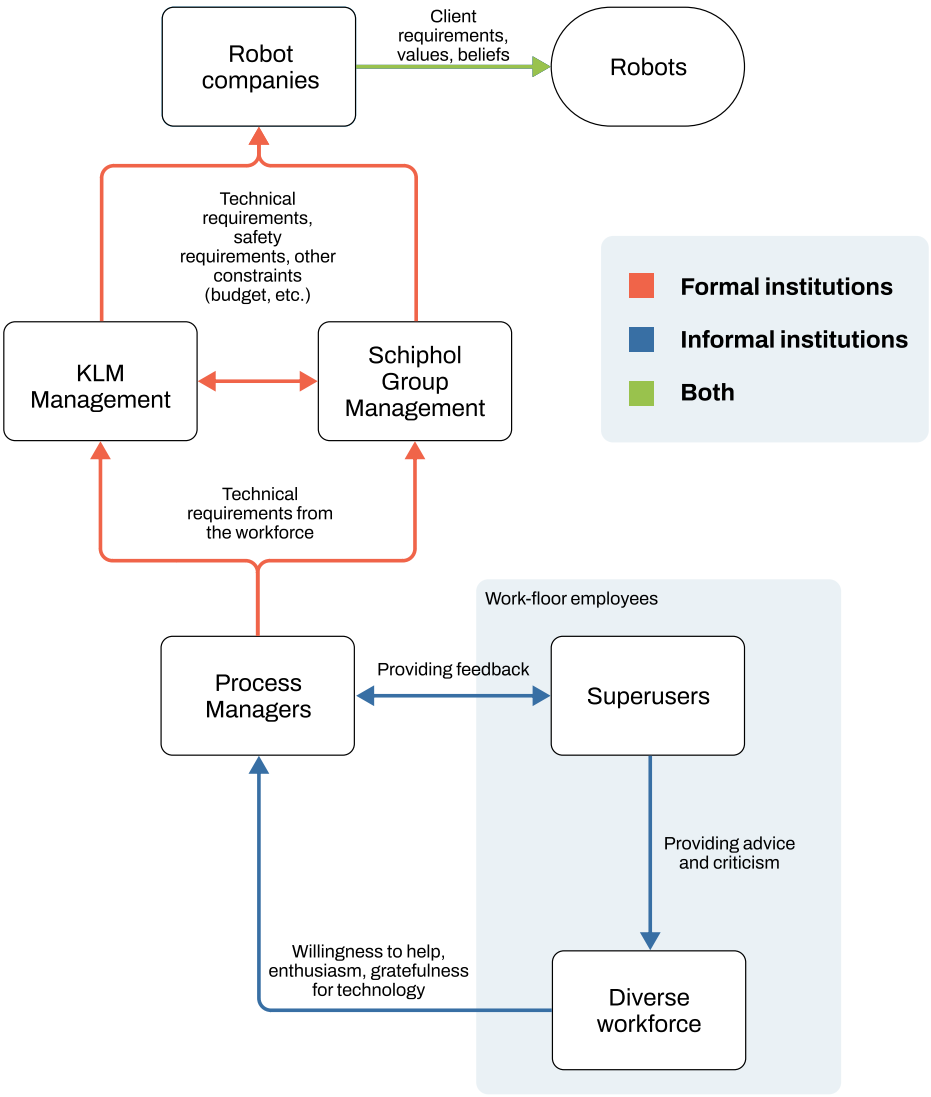

Figure 4.12: Influence of institutions on diversity and the implementation of robots

among their colleagues.

On the other hand, failing to recognize the importance of formal inclusion of workers' input can limit the opinions that workers are able and willing to provide. While the diversity analyzed in this study did not prove to be related to participation in the robot implementation process, this does not necessarily hold true on a general scale. Providing an institutional channel for feedback is particularly important for other types of diversity, such as gender diversity and skills/ability. These can be linked to fear of speaking up in organizations (Auger-Dominques, 2019) and inability to do so, such as for individuals with speech disabilities.

4.5 General implications

Demographic trends indicate that the population of Western countries is rapidly aging (CBS, 2021, 2023; Eurostat, 2023). This trend, coupled with immigration, will inevitably result in an increasingly diverse workforce, where robots will be deployed to compensate for the scarcity of physical labour in the workforce. This demographic shift is also reflected in the policies and subsidies being introduced to support the aging workforce and promote workplace inclusivity. For instance, in the Netherlands, policies have already been implemented to promote the inclusion of a diverse workforce (Participatiewet, 2003; Wet Tegemoetkomingen Loondomein, 2015). As such, research into the implementation of robots is crucial for understanding how to deploy them in a manner that supports employees, ensures operational efficiency, and guarantees employment for the future workforce.

This study demonstrates, through a real case study, that robots and machines possess considerable potential to enhance the workplace, and that a diverse workforce recognizes the value of technology in facilitating their tasks by making their work easier, faster, and less physically demanding. However, as evidenced by the example of KLM/Schiphol Group, the implementation of robotics is far from a trivial process and presents numerous challenges.

Firstly, if an organization wants to boost its EDI then it is crucial to establish formal institutions that facilitate the inclusion of a diverse workforce in the implementation of robotics. In the absence of such institutions, certain workers may self-exclude from the implementation process due to factors such as divergent informal institutions, including a lack of enthusiasm for technology or reluctance to voice their opinions. Different informal institutions may result in the values towards technology held by a diverse workforce not being incorporated into the implementation of new technology. This, in turn, could lead to the diverse workforce being unable or unwilling to use the robot.

Organizations must recognize that employing a diverse workforce necessitates a holistic approach, beginning with an examination of the institutions that support and impede workers in their job. With regard to the procurement of robots, it is crucial for organizations to ensure that appropriate formal institutions are in place to source robots that are compatible with the physical characteristics of a diverse workforce, for instance height requirements and usability for both left- and right-handed individuals.

Organizations must recognize that employing a diverse workforce entails not only practical considerations, but also significant social dimensions. A diverse workforce can substantially alter the informal institutions present within an organization. For instance, the employment of an older population can generate social influence and create different power dynamics among the workforce, thereby shaping social norms. These social norms can, in turn, affect the willingness or reluctance of the workforce to participate in operations. This research provides a practical example of how innovation-resistant older employees can influence other employees on the work-floor. The presence of such individuals can shape the attitudes and behaviors of their colleagues, potentially affecting

the adoption and utilization of technology within the organization.

Furthermore, when transitioning to an automated workplace, it is crucial for organizations to evaluate the impact of reducing the workload on work-floor employees. This research demonstrates that a demanding work environment can foster a sense of community, despite the negative effects of diversity highlighted by Neal and Neal (2014). However, if the work-floor becomes less hectic, problems and conflicts may arise among the diverse workforce, creating new challenges for the organization. On the other hand, if the intrinsic satisfaction that workers derive from accomplishing their job serves as a substitute for leadership, then increased automation may reduce this satisfaction. This could lead to a decrease in worker well-being and reduced performance.

5

Conclusion

In this chapter, I present the conclusion of the research by summarizing the main findings, reflecting on the concepts and methods used, the limitations of the study and the relevance of the research from different perspectives.

The chapter begins with Section 5.1, which summarizes the research scope, the main findings, reflects on the concepts used for this research and the methodology employed to answer the research question.

Then, Section 5.2 delineates the main limitations of the study, arising from the research design, methodology, and data analysis. By acknowledging and addressing these limitations, the study aims to enhance the rigor and validity of its findings.

In Section 5.3 I identify opportunities for further research that have emerged from this study. These opportunities include the application of alternative methodologies and the extension of the study to new contexts or diverse identities. By pursuing these avenues of inquiry, future research can build upon the insights generated by this study and contribute to a deeper understanding of the role that institutions play when employing a diverse workforce.

Finally, with Section 5.4 I conclude the research by presenting the relevance of the study from a societal, scientific and Management of Technology (MoT) perspective.

5.1 General conclusions

The aim of this research is to investigate the role of institutions in the implementation and utilization of robots to employ a diverse workforce. Utilizing the RRI approach to unveil the complex socio-technical system in which robots are implemented, findings reveal that, despite the tendency of HRI literature to overlook the role of institutions in shaping interactions between humans and robots, institutions play a crucial role in both the implementation and utilization of robots in the workplace when employing a diverse workforce.

Starting from the implementation of robots, as depicted in Figure 5.1, results show that if there are no formal institutions in place to include a diverse workforce in the implementation process then informal institutions play a direct determinant role in the involvement of a diverse workforce in the innovation process. For instance, informal institutions, such as a willingness to use technology, become the determinant that leads to the diverse workforce being included or not in the innovation process. Consequently, the degree to which informal institutions, such as positive perceptions of technology, are associated with diversity directly influences the involvement of a diverse workforce in the implementation of new technologies. In the Dutch context, factors like age or ethnic diversity do not affect the positive perception of robots at work and willingness to use technology, thus these diverse identities do not influence the participation of the diverse workforce in the implementation of robots at work.

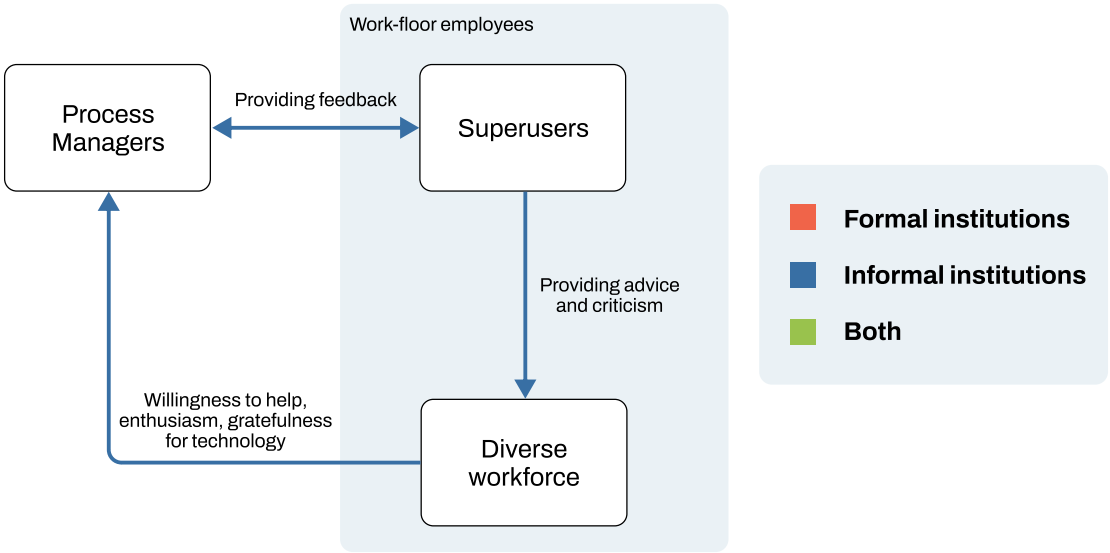

Figure 5.1: Influence of institutions on robot implementation of the diverse workforce

Diversity influences the use of robots in both direct and indirect ways, as illustrated in Figure 5.2. The direct role is related to formal institutions, for instance standard requirements to operate the robot, that may exclude certain ethnic/race groups with different physical characteristics from using the robot. An example of physical characteristics that play a role in the Dutch context are average height and left-handedness. The indirect effect pertains to the influence of age diversity within the workforce on the

formation of informal institutions, such as social norms. Members of the age diverse workforce may hold positions of opinion leadership within the workplace, enabling them to shape the opinions of their colleagues with regard to the use of robots. This, in turn, can influence the utilization of robotic technology by the workforce as a whole.

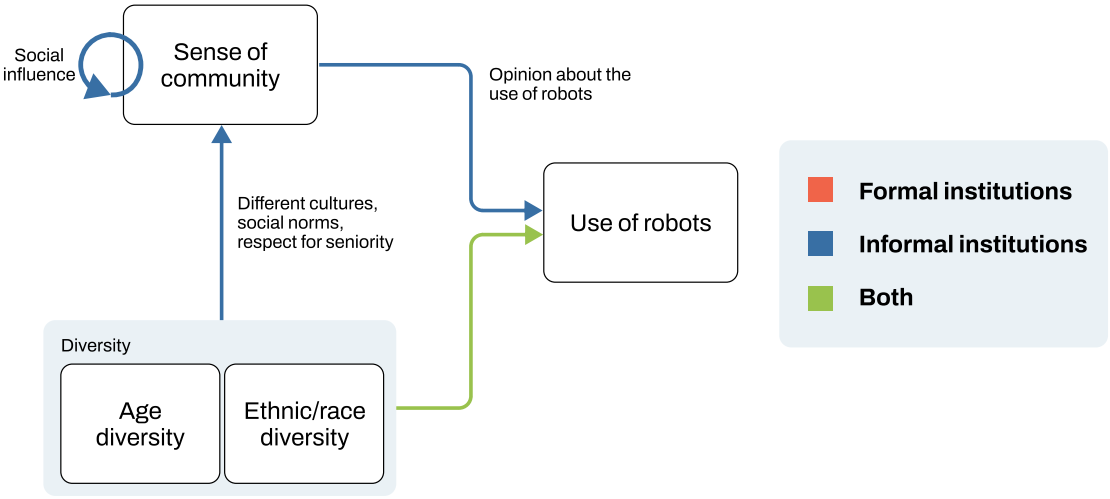

Figure 5.2: Influence of institutions on the use of robots by a diverse workforce

This study proves that HRI research can make use of the conceptual tools provided by the RRI approach to effectively elucidate and highlight the role of institutions in complex socio-technical system where robots are implemented and utilized for Equality, Diversity and Inclusion (EDI). Methodologically, this research confirms that a qualitative approach, utilizing interviews with highly informed participants, is a suitable tool for conducting insight-driven HRI research (Veling & McGinn, 2021) to rapidly gain knowledge and perspectives on the phenomena under investigation to build grounded theory. In this research, the approach for building grounded theory proposed by Eisenhardt (1989) proved to be a valuable tool in guiding the research process. In particular, conducting a broader exploration of the research topic before analyzing the cases and employing theoretical sampling were essential in systematically building theory from the data while remaining open to new insights and perspectives.

This research has significant practical and theoretical implications. From a practical standpoint, it underscores the necessity for organizations to systematically include a diverse workforce in the implementation of robots, and to comprehend the social role that diversity will play in shaping the social norms of the organization. From a research perspective, this study provides several insights into the ways in which different forms of diversity can influence the use and implementation of robots in unexpected ways. First, it proves that different diverse identities are impacted differently by formal and informal institutions and should thus be analyzed independently. Second, it highlights the need for further exploration of how other forms of diversity, such as gender, or the intersection of different identities shape and are shaped by formal and informal institutions.

5.2 Limitations

Regarding the context of this research, one limitation is to be looked for in the organizations that are willing (and will) deploy robotics to employ a more diverse workforce. These organizations are usually large corporations with sufficient intellectual and financial capitals that enables them to enact the required changes. Therefore, further research is needed to study the applicability of this study and its implications to Small, Medium and Micro Enterprises (SMMEs) which have limited resources and might face considerably different obstacles.

Reflecting on the methodology chosen for this study, being based mainly on people's experiences, case study research presents the limitation that results depend on people's subjectivity, meaning that people might present inauthentic experiences or might decide purposefully not to share them, resulting therefore in drawing incomplete/faulty conclusions (Charmaz, 2014). This pitfall is partially controlled by having multiple interviewees from diverse backgrounds and roles, therefore providing a stronger base for theory building. However, due to practical limitations in time and limits set by KLM, the number of cases studied and people interviewed is limited.

Concerning the data collection method, the impossibility to obtain a permit for safety concerns to visit the luggage handling facilities did not allow for the collection of additional information through direct observation of the work-floor. Qualitative research makes use of an holistic approach when considering the case at hand (Charmaz, 2014), thus direct observation of the workplace would have helped obtaining other additional helpful information about how employees relate to each other and interact with robots, together with more information on the formal and informal institutions that regulate the work-floor.

5.2.1 Considering the intersection of different identities

When analyzing the experience of marginalized social groups, it is important to understand the role that intersectionality plays. Intersectionality acknowledges that people have various identities that overlap and influence one another, resulting in distinct experiences and obstacles (Crenshaw, 1991). For instance, a person who has both a disability and is a member of an ethnic minority group might experience substantially different obstacles than an individual with a disability that belongs to a different ethnic group.

A limitation of this study is that, while recognizing that individual experiences are influenced by the intersection of multiple identities and cannot be generalized, the focus of the research is on analyzing institutions and their roles and as such examining the role intersectionality plays among the diverse workforce falls outside the scope of this research.

5.3 Further research

When trying to gather information from marginalized individuals, focus groups can be an effective method. This is particularly true for those who feel more comfortable sharing their thoughts in a group setting with their peers (Veling & McGinn, 2021), therefore further research could make use of focus groups to understand the needs of different marginalized groups, like specific ethnic groups.

Building upon the discussion of geographical proximity and its impact on effective and efficient collaborations presented in Subsubsection 4.3.6, future research could explore the circumstances under which formal and informal institutions exert a greater influence than geographical proximity in facilitating efficient collaborations. Additionally, given a certain level of geographical proximity, further research could investigate the additional factors, other than institutions, that influence the refinement of robots in accordance with workers' feedback, for example cognitive and organizational proximity.

In this study, the impact of training on the use and acceptance of robots was partially analyzed. The results of the interviews do not suggest a link between the likelihood of receiving training and being part of a diverse workforce. However, training characteristics and workers' attitudes and attributes appear to influence the likelihood of workers being trained to use robots. At Amsterdam Airport, in particular, the duration and complexity of training may be decisive factors in whether or not the workforce chooses to participate in training. Further research could build on these considerations to explore how different characteristics of training, such as duration, and workers, such as motivation to learn, affect the likelihood of joining training for robots.

Subsection 2.3.2 examines the technical values held by a gender-diverse workforce with regard to robotics. These values may differ from those held by a workforce that is diverse in terms of ethnicity or age, resulting in potentially divergent requirements for these groups, and this calls for further research on the topic. Additionally, the employment of a gender-diverse workforce, similar to the employment of an age-diverse workforce, may influence social norms and other informal institutions within the workplace. The study of how gender diversity influences informal institutions is particularly relevant in sectors historically dominated by men, such as baggage handling at Amsterdam Airport, as reported by interviewees, or more broadly in sectors where physical strength has traditionally played a role (Amesti Mendizábal, 2020). As changes in informal institutions can impact the implementation and utilization of robots in the workplace, further research is essential to understand the influence of a gender-diverse workforce on these institutions. Such research could provide valuable insights into how to effectively implement and utilize robots in a manner that is inclusive and responsive to the needs of a gender-diverse workforce.

5.4 Relevance

This section offers a reflection on the research and elucidates its relevance from both societal and scientific perspectives. Then, the significance of the work is examined from the standpoint of the Management of Technology (MoT) program.

5.4.1 Societal relevance

This research has significant societal relevance. As the global population becomes increasingly diverse, it is essential for organizations to understand how to create inclusive and equitable workplaces that reflect this diversity. Understanding the role that institutions play when employing a diverse workforce streamlines the use of robotic technology at work, thus providing new job opportunities to a diverse workforce.

Using the Sustainable Development Goals (SDG) as a reference (UN, 2015), by studying the implementation of robots to make the workplace more inclusive this research directly aims toward the goals of equal opportunities (goal 10), decent work and economic growth (goal 8) and fostering inclusive innovation (goal 9), while indirectly supporting the reach of other goals like no poverty (goal 1) and gender equality (goal 5).

Figure 5.3: Sustainable Development Goals supported by this research

5.4.2 Scientific relevance

This study contributes to the scientific understanding of how researchers can analyze the way by which formal and informal institutions interact with and shape the adoption and use of robotic technology in the workplace. This knowledge improves the understanding of what happens when the workplace is make more accessible to people with diverse identities thanks to the use of robots, and how specific identities relate in specific ways with institutions. Additionally, such a study provides valuable insights into the dynamics of HRI in the context of a diverse workforce, and how these interactions are influenced by institutional factors.

5.4.3 Relevance to Management of Technology (MoT)

The introduction of robots at work to employ a diverse workforce requires the analysis and understanding of both social and technical aspects to obtain a comprehensive view of the system and its characteristics. This socio-technical problem relates to MoT as it

involves the study of how innovation can be effectively integrated and managed within real-world complex organizations to achieve both their business goals and objectives for society. In this study, I explore the use of robotics as a means of balancing the dual roles of being an important corporate resource, shaping the organization and operation of the firm, and being an integral component of the firm's corporate responsibility towards its employees. Thus, this study examines how robotics can be leveraged to achieve not only business objectives, but also broader societal goals such as social inclusion and reduced inequalities.

In particular, the courses Technology Dynamics, Research Methods, Social and Scientific Values, Integration Moment have been fundamental to shape the quality and content of my research. The aforementioned courses equipped myself with the necessary tools to assess an innovation system, including its agents and interactions, provided guidance on how to develop and execute research steps, understand the role of values in science and technology, and navigate and report on the complexities of real organizations.

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A

Literature review methodology

This chapter presents the literature review methodology used to (a) initially explore the topic and identify the research gap and (b) to compare unexpected concepts arising from the interviews/analysis with existing literature.

A.1 Initial literature review

To retrieve relevant academic literature on HRI and diversity, a systematic literature review was conducted.

The research was executed on the digital databases Web of Science (using the default option "All fields") and Scopus (using the default option "Article title, Abstract, Keywords"). The research initially started with a focus on disability, thus the keywords used were *"disability"*, *"robot"* and *"employment"*, and was later refined with the inclusion of synonyms and related terms identified in the literature, as shown in Table A.1.

Table A.1: Keywords and synonyms used in initial literature research

Disability	***Robot***	***Employment***
Disabled people	HRI	Occupation
People with disabilities	Machine	Job
Disabled person	Assistive technology	Work
Person with a disability	Human enhancement	
	Robotic	

The initial research resulted in 21 results on Scopus and 25 results on Web of Science, an already limited number of papers, of which the relevant are presented in Table A.2.

Since there is little academic research on the intersection between disability and robotics, the number of citations and other popularity indices provide limited information about the relevance of the papers. Therefore, the main selection criteria chosen is the publish date of the article, favoring novel papers as they consider state-of-the-art robotic technologies. The pertinence of the articles identified has been evaluated by analyzing the abstract.

Table A.2: Papers analyzed on skill diversity, employment and robotics

Author(s)	***Description***
Mandischer et al. (2023)	Assesses how to model capabilities to employ people with disabilities
Kildal and Martín (2021)	Explores the use and perception of robots to employ people with cognitive disabilities
Drolshagen et al. (2021)	Analyzes the acceptance of robotic arms among workers with physical and/or mental disabilities
Djebrouni and Wolbring (2020)	Assesses the role that robotics have on the employment of people with disabilities and the perception of policy-makers and other agents
Mark, Gualtieri, et al. (2019)	Explore the role that different Industry 4.0 technologies have to employ workers with cognitive and physical disabilities
Mark, Hofmayer, et al. (2019)	Examines the formal institutions and the technologies available to employ people with disabilities

To accommodate the Dutch context, where workplace diversity primarily pertains to ethnicity and age, and to address the specific case examined in the analysis, the scope of the literature review was expanded. Instead of focusing solely on disability, a more comprehensive perspective on diversity was adopted by incorporating additional literature on gender, age, and ethnicity/race. This allowed for a more thorough and nuanced understanding of the issues at hand. Thus, new keywords are identified and shown in Table A.3.

Table A.3: Keywords and synonyms used in the broader literature research

Diversity	***Robot***	***Employment***
Inclusion	Robotic	Workplace
Inclusi*	Robot*	Workforce
Gender	Machine	Work
Divers*	HRI	Employment
Age		

Diversity	*Robot*	*Employment*
Ethnicity		
Ethnic*		
Race		

A search of the digital databases Web of Science and Scopus yielded 141 results, of which the ones deem relevant to the research are presented in Table A.4. This systematic approach to data collection and analysis allowed for a rigorous and comprehensive examination of the available literature on the topic at hand.

Table A.4: Papers analyzed on age, gender, ethnic/race diversity and robotics

Author(s)	*Theme*	*Description*
López et al. (2020)	Inclusivity, Values	Maps the values held by robotic industry, users and society
Hesketh and Graco (2015)	Age, Ethnicity/Race	Explores how changes in the technical system affects the cultural, societal and management structure of organizations
Doyle-Kent and Kopacek (2023)	Diversity & Inclusion	Couples managing for diversity and Industry 4.0
Casals (2023)	Gender	Explores the roles that robots have to change the role of women in healthcare
Amesti Mendizábal (2020)	Gender	Analyses how robotics advances or hinders women's position in the workplace

From the references of the papers above, the following papers have been identified as relevant: Barfield (2021), Barfield (2023).

Table A.5: Keywords and synonyms used in the literature research

Author(s)	*Theme*	*Description*
Barfield (2021)	Ethnicity/Race	Explores how different people perceive differently robots based on their color
Barfield (2023)	Ethnicity/Race, Gender	Investigates how people relate to robots based on perceived gender, ethnicity and race

A.2 Secondary literature review

To grasp the meaning of the constructs that arose during the analysis, a secondary literature review was executed to identify how the propositions identified fit in the wider academic literature.

The concepts identified during the analysis are:

- the relation between sense of community and diversity;
- the relation between leadership and sense of community;
- the effect of substitutes for leadership;
- the impact of training on the use of robots;
- the effect of geographical proximity on effective collaboration among firms;
- the effect of age on innovation perception; and
- the effect of ethnicity/race on innovation perception.

Table A.6 presents the papers analysed during the secondary literature together with the theme of the paper and a brief description.

Table A.6: Papers analyzed during the secondary literature review

Author(s)	***Theme***	***Description***
Neal and Neal (2014)	Sense of community & Diversity	The research assesses the possibility to have simultaneously sense of community and diversity
Lamm et al. (2017)	Relation between leadership and sense of community	Discusses the role of leadership in community contexts
Nowell et al. (2016)	Relation between leadership and sense of community	Describes leadership as a crucial aspect to have sense of community
Howell et al. (1990)	Substitutes for leadership	Presents characteristics of jobs/workforce that substitute weak leadership
Vaportzis et al. (2017)	Effect of age on innovation perception	Discusses the perception that older individuals have of novel technologies
Mansori et al. (2015)	Effect of ethnicity/race on innovation perception	Discusses the role that high/low ethnicity plays in the acceptance of novel technologies
Broekel and Boschma (2012)	Effect of geographical proximity on firm collaboration	Analyzes the effect of proximity on the Dutch aviation industry
Cunningham and Werker (2012)	Effect of geographical proximity on firm collaboration	Analyzes the effect of proximity and collaboration in European nanotechnology
Werker et al. (2016)	Effect of geographical proximity on firm collaboration	Analyzes the effect of proximity on collaboration among Dutch nanotechnology researchers

Author(s)	*Theme*	*Description*
Noe (1986)	Impact of training on the use of robots	Assesses how workers' attributes/attitude impact training effectiveness

B

Interview Guides

This chapter presents the interview guides that have been used to assess interviewees belonging to the four categories below:

- diverse workforce: employees who do not possess the typical traits of a traditional employee;
- organization's management: individuals responsible for the implementation of robots and the relationships with the diverse workforce; and
- works council: employees who are members of the works council.

B.1 Diverse workforce

This interview guide is meant for the people from marginalized groups that would normally not be employed for this specific vacancy and are now being included in the workplace through the deployment of robots. It is important to take into account that the implementation of robotics in private companies is often supported by wage compensations, subsidies from the government and company-wide social responsibility policies. Examples of interviewees are people with physical or cognitive disabilities and ethnic minorities.

Four employees from the work floor with a diverse background will participate in online interviews that last between 30 and 45 minutes each. Depending on the interviewee, the language of the interview will be either Dutch or English.

Interview - English

Introduction to the study and the safeguards put in place to protect interviewee privacy.

I am Vincenzo and I am a student at Delft University of Technology. I am interested to know more about your work and how the machines you use help you perform your tasks. I'd like to have a conversation with you about your experiences. Our talk will be confidential and you are free to end it at any time.

During this interview, we will discuss about the Mechanical Unloading Machine, by Moderniek, and the Transfer Belt, by Power Stow, so we will refer to them throughout our questions.

Ask for approval to record the interview.

Introductory questions:

1. Let's start by getting to know you: Can you tell me about your job? How long have you been working at KLM? What machine(s) do you use?

   Based on the reply to this question, ask about the Mechanical Unloading Machine (Case 1) or the Transfer Belt (Case 2).

Core questions:

1. Are there rules you have to follow when working with others?

   Relates to research sub-questions 5 and 6.
2. What do you think is important about machines and how you use them at work?

   Relates to research sub-question 1.
3. Did your boss or colleagues ask your advice or opinion on the machines that were needed at work? Did they listen to you?

   Relates to research sub-questions 2 and 3.
4. Did your boss or colleague help you understand how to use the new machine? How did they help and was it useful?

   Relates to research sub-questions 2, 3, 5 and 6.
5. Do you like the machine? Does it make your job easier?

   Relates to research sub-question 1.
6. Does the machine help you with what's important in your job?

   Relates to research sub-question 3.

Final questions and request to follow-up:

1. Who do you think we should talk to based on what you said and what we asked?
2. Can I ask you more questions later if I need to? Did I miss anything important?

Interview - Dutch

Inleiding tot het onderzoek en de waarborgen die zijn getroffen om de privacy van geïnterviewden te beschermen.

Ik ben Vincenzo en ik studeer aan de Technische Universiteit Delft. Ik ben geïnteresseerd om meer te weten te komen over uw werk en hoe de machines die u gebruikt u helpen bij het uitvoeren van uw taken. Ik wil graag met je in gesprek over je ervaringen. Ons gesprek is vertrouwelijk en u bent vrij om het op elk moment te beëindigen.

Tijdens dit interview zullen we het hebben over de Mechanical Unloading Machine, van Moderniek, en de Transfer Belt, van Power Stow, dus we zullen er tijdens onze vragen naar verwijzen.

Vraag toestemming om het interview op te nemen.

Introductory questions:

1. Laten we beginnen met u te leren kennen: kunt u me iets vertellen over uw baan? Hoe lang werk je al bij KLM? Welke machine(s) gebruikt u?

   Based on the reply to this question, ask about the Mechanical Unloading Machine (Case 1) or the Transfer Belt (Case 2).

Core questions:

1. Zijn er regels waaraan u zich moet houden als u met anderen samenwerkt?

   Relates to research sub-questions 5 and 6.
2. Wat vind je belangrijk aan machines en hoe je ze op het werk gebruikt?

   Relates to research sub-question 1.
3. Heeft uw baas of collega's uw advies of mening gevraagd over de machines die op het werk nodig waren? Hebben ze naar je geluisterd?

   Relates to research sub-questions 2 and 3.
4. Heeft uw baas of collega u uitgelegd hoe u de nieuwe machine moet gebruiken? Hoe hielpen ze en was het nuttig?

   Relates to research sub-questions 2, 3, 5 and 6.
5. Bevalt de machine je? Maakt het uw werk gemakkelijker?

   Relates to research sub-question 1.

6. Helpt de machine u met wat belangrijk is in uw werk?

   Relates to research sub-question 3.

Final questions and request to follow-up:

1. Met wie denk je dat we moeten praten op basis van wat je zei en wat we vroegen?
2. Mag ik je later meer vragen stellen als dat nodig is? Heb ik iets belangrijks gemist?

B.2 Organization's management

This interview guide is meant for the people working or representing the organization and are responsible for the implementation of robots at work together with the relationships with the diverse workforce. Examples of interviewees are project leader, project manager and process managers.

Two workers from this group will participate in online interviews that last between 30 and 45 minutes each. Depending on the interviewee, the language of the interview will be either Dutch or English.

Interview - English

Introduction to the study and the safeguards put in place to protect interviewee privacy.

The use of machines and robots at Amsterdam Airport has been selected as a case study for a master thesis at Delft University of Technology. The aim of this qualitative study is to deepen the insights on the role institutions (laws, social norms, beliefs, etc.) play when including a diverse workforce through robotics. As part of KLM Baggage Services, we would like to hear how this impacts your work and what is your perspective on the matter. We guarantee that all statements given will be treated with strict confidentiality. We remind you of the consent and the right of the interviewee to stop the interview at any moment.

During this interview, we will discuss about the Mechanical Unloading Machine, by Moderniek, and the Transfer Belt, by Power Stow, so we will refer to them throughout our questions.

Ask for approval to record the interview.

Introductory question:

1. Could you talk about your work?

2. How long have you been working for KLM?
3. What do you know about robots at work?

Core questions:

1. In the context of your work at KLM, what values do you deem important in robots?

   Relates to research sub-question 3.

2. In technological and business terms, what is the primary objective of implementing the Mechanical Unloading Machine? And what about the Transfer Belt?

   Relates to research sub-questions 3 and 4.

3. Were you involved in the implementation of these machines (robots) and did you feel included?

   Relates to research sub-questions 3, 4, 5 and 6.

4. Are there any specific regulations or standards that you are required to follow at work, particularly with regards to your interactions with other stakeholders?

   Relates to research sub-questions 4, 5 and 6.

5. Throughout the implementation of the Mechanical Unloading Machine, have people from the diverse workforce provided help? In what ways did they offer support, and how has this support proven beneficial? And what about the Transfer Belt?

   Relates to research sub-question 4, 5 and 6.

6. When you evaluate the Mechanical Unloading Machine, what is your perspective on it? Has it met your expectations? (or Is it meeting your expectations?) And what about the Transfer Belt?

   Relates to research sub-question 3.

7. Do you perceive the Mechanical Unloading Machine as aligned with your values? How about the values of the people from the diverse workforce? And what about the Transfer Belt?

   Relates to research sub-questions 3 and 4.

Closing questions and request to follow-up:

1. Based on your responses and our questions, which employee(s) would you recommend for us to interview?
2. May I follow up with you later if I have additional questions or require further information? Is there anything pertinent that I may have overlooked?

Interview - Dutch

Inleiding tot het onderzoek en de waarborgen die zijn getroffen om de privacy van geïnterviewden te beschermen.

Het gebruik van machines en robots op Amsterdam Airport is geselecteerd als casestudy voor een masterscriptie aan de Technische Universiteit Delft. Het doel van deze kwalitatieve studie is om de inzichten te verdiepen in de rol die instellingen (wetten, sociale normen, overtuigingen, enz.) spelen bij het opnemen van een divers personeelsbestand door middel van robotica. Als onderdeel van KLM Baggage Services horen we graag welke impact dit heeft op uw werk en wat uw kijk hierop is. Wij garanderen dat alle gegeven verklaringen strikt vertrouwelijk worden behandeld. We herinneren u aan de toestemming en het recht van de geïnterviewde om het interview op elk moment te stoppen.

Tijdens dit interview zullen we het hebben over de Mechanical Unloading Machine, van Moderniek, en de Transfer Belt, van Power Stow, dus we zullen er tijdens onze vragen naar verwijzen.

Vraag toestemming om het interview op te nemen.

Introductory questions:

1. Kun je iets vertellen over je werk?
2. Hoe lang werk je al voor KLM?
3. Wat weet jij over robots aan het werk?

Core questions:

1. Welke waarden vind je belangrijk in robots, in het kader van je werk bij KLM?

   Relates to research sub-question 3.

2. Wat is in technologisch en zakelijk opzicht het primaire doel van de implementatie van de Mechanical Unloading Machine? En hoe zit het met de Transfer Belt?

   Relates to research sub-questions 3 and 4.

3. Was je betrokken bij de implementatie van deze machines (robots) en voelde je je erbij betrokken?

   Relates to research sub-questions 3, 4, 5 and 6.

4. Zijn er specifieke voorschriften of normen die u op het werk moet volgen, met name met betrekking tot uw interacties met andere belanghebbenden?

   Relates to research sub-questions 4, 5 and 6.

5. Hebben mensen van het diverse personeelsbestand tijdens de implementatie van de Mechanical Unloading Machine hulp geboden? Op welke manieren hebben ze ondersteuning geboden en hoe is deze ondersteuning nuttig gebleken? En hoe zit het met de Transfer Belt?

   Relates to research sub-question 4, 5 and 6.

6. Als u de Mechanical Unloading Machine evalueert, wat is dan uw kijk erop? Voldoet het aan je verwachtingen? (of Voldoet het aan uw verwachtingen?) En hoe zit het met de Transfer Belt?

   Relates to research sub-question 3.

7. Beschouwt u de Mechanical Unloading Machine als in lijn met uw waarden? Hoe zit het met de waarden van de mensen uit het diverse personeelsbestand? En hoe zit het met de Transfer Belt?

   Relates to research sub-questions 3 and 4.

Closing questions and request to follow-up:

1. Op basis van uw antwoorden en onze vragen, welke medewerker(s) zou u ons aanraden om te interviewen?

2. Mag ik later contact met u opnemen als ik nog vragen heb of meer informatie nodig heb? Is er iets relevants dat ik over het hoofd heb gezien?

B.3 Works Council

This interview guide is meant for members of the works council that promote and protect the interests of employees.

One person from this group will participate in an online interview that will last between 30 and 45 minutes. Depending on the interviewee, the language of the interview will be either Dutch or English.

Interview - English

Introduction to the study and the safeguards put in place to protect interviewee privacy.

The use of machines and robots at Amsterdam Airport has been selected as a case study for a master thesis at Delft University of Technology. The aim of this qualitative study is to deepen the insights on the role institutions (laws, social norms, beliefs, etc.) when inclusivity plays a role through robotics. As a works council member, we would like to hear about your perspective on the matter. We guarantee that all statements given will

be treated with strict confidentiality. We remind you of the consent and the right of the interviewee to stop the interview at any moment.

During this interview, we will discuss about the Mechanical Unloading Machine, by Moderniek, and the Transfer Belt, by Power Stow, so we will refer to them throughout our questions.

Ask for approval to record the interview.

Introductory question:

1. Could you talk about your work?
2. How long have you been working for KLM?
3. What do you know about robots at work?

Core questions:

1. In the context of your work at KLM, what values do you deem important in robots?

   Relates to research sub-questions 1 and 3.

2. Were/Are you involved in the implementation of the machines at work and did/do you feel included?

   Relates to research sub-questions 2, 4, 5 and 6.

3. Throughout the implementation of the Mechanical Unloading Machine, have people from the diverse workforce provided help? In what ways did they offer support, and how has this support proven beneficial? And what about the Transfer Belt?

   Relates to research sub-questions 4, 5 and 6.

4. When you evaluate the Mechanical Unloading Machine, what is your perspective on it? Has it met your expectations? (or Is it meeting your expectations?) And what about the Transfer Belt?

   Relates to research sub-question 1.

5. Do you perceive the machine as aligned with your values? How about the values of people from the diverse workforce?

   Relates to research sub-questions 3 and 4.

6. Are there any specific regulations or standards that you are required to follow at work, particularly with regards to your interactions with other stakeholders?

   Relates to research sub-questions 5 and 6.

7. Talking about your role at the works council, how does the works council look at machines (robots) in terms of helping employees or replacing them?

   Relates to research sub-questions 3, 5 and 6.

8. How does the works council want KLM to consider workplace safety and security when using machines (robots) on the workplace?

   Relates to research sub-questions 3, 5, and 6.

9. Generally speaking, is the works council in favor or against the use of machines (robots) on the workplace? Why?

   Relates to research sub-question 6.

Closing questions and request to follow-up:

1. Based on your responses and our questions, is there someone you would recommend for us to interview?
2. May I follow up with you later if I have additional questions or require further information? Is there anything pertinent that I may have overlooked?

Interview - Dutch

Inleiding tot het onderzoek en de waarborgen die zijn getroffen om de privacy van geïnterviewden te beschermen.

Het gebruik van machines en robots op Amsterdam Airport is geselecteerd als casestudy voor een masterscriptie aan de Technische Universiteit Delft. Het doel van deze kwalitatieve studie is om de inzichten te verdiepen over de rol van instituties (wetten, sociale normen, overtuigingen, enz.) wanneer inclusiviteit een rol speelt door middel van robotica. Als OR-lid horen wij graag uw visie op de zaak. Wij garanderen dat alle gegeven verklaringen strikt vertrouwelijk worden behandeld. We herinneren u aan de toestemming en het recht van de geïnterviewde om het interview op elk moment te stoppen.

Tijdens dit interview zullen we het hebben over de Mechanical Unloading Machine, van Moderniek, en de Transfer Belt, van Power Stow, dus we zullen er tijdens onze vragen naar verwijzen.

Vraag toestemming om het interview op te nemen.

Introductory question:

1. Kun je iets vertellen over je werk?
2. Hoe lang werk je al voor KLM?

3. Wat weet jij over robots aan het werk?

Core questions:

1. Welke waarden vind je belangrijk in robots, in het kader van je werk bij KLM?

   Relates to research sub-questions 1 and 3.

2. Was/Bent u betrokken bij de implementatie van de machines op het werk en voelde/voelt u zich hierbij betrokken?

   Relates to research sub-questions 2, 4, 5 and 6.

3. Hebben mensen van het diverse personeelsbestand tijdens de implementatie van de mechanische losmachine hulp geboden? Op welke manieren hebben ze ondersteuning geboden en hoe is deze ondersteuning nuttig gebleken? En hoe zit het met de overdrachtsband?

   Relates to research sub-questions 4, 5 and 6.

4. Als u de mechanische losmachine evalueert, wat is dan uw kijk erop? Voldoet het aan je verwachtingen? (of Voldoet het aan uw verwachtingen?) En hoe zit het met de Transfer Belt?

   Relates to research sub-question 1.

5. Ziet u de machine als in lijn met uw waarden? Hoe zit het met de waarden van mensen uit het diverse personeelsbestand?

   Relates to research sub-questions 3 and 4.

6. Zijn er specifieke voorschriften of normen die u op het werk moet volgen, met name met betrekking tot uw interacties met andere belanghebbenden?

   Relates to research sub-questions 5 and 6.

7. Over jouw rol in de ondernemingsraad gesproken, hoe kijkt de ondernemingsraad naar machines (robots) om medewerkers te helpen of te vervangen?

   Relates to research sub-questions 3, 5 and 6.

8. Hoe wil de OR dat KLM rekening houdt met veiligheid op de werkvloer bij het gebruik van machines (robots) op de werkvloer?

   Relates to research sub-questions 3, 5, and 6.

9. Is de ondernemingsraad in het algemeen voor of tegen het gebruik van machines (robots) op de werkvloer? Waarom?

   Relates to research sub-question 6.

Closing questions and request to follow-up:

1. Is er op basis van uw antwoorden en onze vragen iemand die u ons zou aanraden om te interviewen?

2. Mag ik later contact met u opnemen als ik nog vragen heb of meer informatie nodig heb? Is er iets relevants dat ik over het hoofd heb gezien?

C

Interviewees

The subsequent table categorizes interviewees according to their respective roles in the organization and diversity. Age diversity pertains to employees who are 50 years of age or older, while ethnic diversity encompasses employees who are not of Western ethnicity.

Table C.1: Anonymized interviewees with the associated number and their role at KLM Baggage Services

Interviewee	*Role*	*Diversity*
1	Process Manager	Age
2	Process Manager	Gender
3	Works Council/Team Coordinator	–
4	Team Coordinator	Ethnicity/Age
5	Shift Leader	Ethnicity
6	Team Member	–