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Towards Trustworthy Artificial Intelligence in Railway Operations: A Qualitative Case Study on Adopting Human-Centric and Ethically Responsible AI Integration for Resource Planning

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Abstract

With Artificial Intelligence (AI) shifting heavily into the focus of large corporations and researchers, both the development of systems incorporating techniques and methods using various forms of AI, as well as the research in this field has sped up tremendously the last few years [1]. This development and usage of novel technologies due to an urgency created by external influences often means that human-centrality and ethical alignment is neglected for a reduced time-to-market[2]. Surveys have found that the automation and other technological advancements in AI are a source of anxiety among people [3] [4]. Due to the high impact and transformative force of AI, debates and research focusing on the values and principles of AI are of high importance for a sustainable implementation of AI technologies that allow for trust in the socio-technical environments in which they are embedded [5] [6]. There has been a lot of research on defining ethical guidelines and establishing a general framework for a human-centric, ethically correct approach for the implementation of AI systems [7] [8] [9]. Nevertheless, very little to no research has been done on the nexus between guidance documents and concrete implementations in companies, focusing on the impacts on affected employees and what measures companies can take to ease the transition process from known technologies and processes to novel AI technologies, providing a bottom-up, change management-focused approach that identifies human-focused problems that arise during such an implementation [10] [11]. In this paper, we bridge the gap between guidance documents, focusing on the Ethics Guidelines for Trustworthy AI [6] and a concrete implementation of AI technologies at a large railway company, affecting several hundred employees. Using qualitative research - in concrete purposive sampling, semi-structured interviews and a document analysis - we identify relevant stakeholders and analyse the impact of the introduction of AI technologies across affected subcompanies on fears, expectations, experiences and ethical concerns. Based on these results evaluated through a structured content analysis, we define concrete short-,medium-, and long-term change management and ethically responsible measures with KPIs to enable a human-centric and trustworthy integration of AI. Following communicative validation, triangulation, we validate the results according to the quality criteria by Mayring [12].

Contents

CHAPTER 1

Problem Statement

The introduction of Artificial Intelligence in our economy has led to a transformative impact on companies and industries across all sectors and is seen as "revolution" transforming both science and society [13] [14]. Companies are facing unprecedented challenges and opportunities resulting from arising AI technologies. AI approaches like deep learning, artificial neural networks and machine learning are reshaping data analysis and processing [15], semi autonomous and autonomous systems are being increasingly used in various sectors, including transportation and health care [4]. It is expected, that these technologies will change work all around the world in the next years [16] [17] [18].

With AI shifting heavily into the focus of large corporations and researchers, both the development of systems incorporating techniques and methods using various forms of AI, as well as the research in this field has sped up tremendously the last few years [1]. While the general speed of which companies need to transform and adapt is accelerating, companies in the sector of transportation react slower to disruptive changes than in many others [19]. This means, that especially large companies (>249 employees)[20], need to start adjusting their strategies in due course, because of their size and complexity, in order to stay ahead of competitors [21].

Especially for the transportation sector, which has often been a local monopoly in their respective area or country, states have started pushing towards a more liberal solution, with the focus on creating a fair and equal market. An example is the Fourth Railway Package, adopted in 2016 by the European Union [22], which inter alia opens the domestic passenger markets to competition and makes competitive tendering for public service contracts mandatory. These changes force large, complex organisations in this sector to immediately adapt their strategy to focus on a more competitive approach, creating the urgency for the use and development of disruptive and emerging technologies for their business processes.

This development and usage of novel technologies due to an urgency created by external influences often means that human-centrality and ethical alignment is neglected for a reduced time-to-market[2]. Surveys have found that the automation and other technological advancements in AI are a source of anxiety among people [3] [4]. Due to the high impact and transformative force of AI, debates and research focusing on the values and principles of AI are of high importance for a sustainable implementation of AI technologies that allow for trust in the socio-technical environments in which they are embedded [5] [6]. Concerns about AI jeopardizing the employment status of people [4], being exploited by malicious actors [23] or unintentionally spreading bias and thus challenging fairness [24] have been topics of interest in recent academic articles and news reports. Research and government entities have addressed ethical AI [25] [26] [6] [27], particularly in relation to systemic risks [28] or in meta-assessments [29]. National and international organizations are reacting by forming ad hoc expert committees on AI, which create reports, guidance documents, policies, values and principles on AI as well as human-centric and ethical AI frameworks. The committees include the High-Level Expert Group on AI appointed by the European Commission, the Select Committee on Artificial Intelligence of the UK House of Lords, the expert group on AI in Society of the Organisation for Economic Co-operation and Development (OECD) and the Advisory Council on the Ethical Use of Artificial Intelligence and Data in Singapore. In the private sectors, corporations active in the area of AI are publishing guidelines and principles. Non-profit organisations and professional associations have also issued recommendations and declarations.

Even though the created guidance documents and reports for ethical AI are non-binding, non-legislative soft-laws or policy instruments [30], a growing number of people have started on developing plans for the implementation of sustainable and human-focused AI technologies. There has been a lot of research on defining ethical guidelines and establishing a general framework for a human-centric, ethically correct approach for the implementation of AI systems [7] [8] [9]. Nevertheless, very little to no research has been done on the nexus between guidance documents and concrete implementations in companies, focusing on the impacts on affected employees and what measures companies can take to ease the transition process from known technologies and processes to novel AI technologies, providing a bottom-up, change management-focused approach that identifies human-focused problems that arise during such an implementation [10] [11].

1.1 Goals

One of the most important guidance documents for human-centric and ethic AI within the EU is the Ethics Guidelines for Trustworthy AI by the AI HLEG [6]. This document introduces a framework for achieving Trustworthy AI in which Trustworthy AI has three components: (i) it should be **lawful**, (ii) it should be **ethical**, (iii) it should be **robust** from a technical and social perspective. In order to realize Trustworthy AI, there are seven (non-exhaustive) main requirements set forth by the guidelines: (1) Human agency and oversight, (2) Technical robustness and safety, (3) Privacy and data governance, (4) Transparency, (5) Diversity, non-discrimination and fairness, (6) Societal and mental wellbeing, (7) Accountability. Within these main requirements, this paper will focus on the following four aspects: (I) *Human agency*, where users must be able to make informed autonomous decisions regarding the AI system, (II) *Human oversight*, where measurements must be taken so that an AI system does not undermine human autonomy or causes other adverse effects, (III) *Stakeholder participation*, which means the consultation of stakeholders that are directly or indirectly influenced by the AI system and (IV) *Social impact*, which describes the need of measurement of the impact of the AI system on the physical and mental well-being of affected users.

This paper aims to analyse the impact of AI on affected users and stakeholders, focusing on their fears, expectations, experiences, ethical concerns and barriers of AI on the basis of the four mentioned aspects of the Ethics Guidelines for Trustworthy AI as part of a qualitative single case study with one of the largest railway operators in Europe. The goal is to gain an in-depth understanding of stakeholders and affected users and the change management process in place during the implementation of AI tools replacing existing business structures in order to derive measures that companies within the railway sector can take to adopt a human-centric and ethically responsible approach for the integration of AI into existing business structures.

The expected results of this thesis include:

- an identification of relevant stakeholders and their analysis, including barriers and a deduction of challenges and constraints for the successful adoption of AI
- an analysis following qualitative research methodology guidelines on the impact of AI on affected humans, including fears, expectations, experiences and ethical concerns
- measures companies can take to adopt a human-centric and ethically responsible approach, based on the understanding created in the two results before

This master thesis is considered a success, when an understanding of human aspects during the implementation of novel AI is created, including certain derivatives based on the stakeholder and expert interviews. In addition, it is considered a success, when

measures are defined, which allow companies to guide their change management process during the implementation by focusing on a human-centric and ethically responsible approach. The method of evaluation is shown by the check of the quality criteria for the qualitative content analysis as described in section 3.6.3 and by communicative validation, which entails the direct feedback from the interviewees on the derived results.

1.2 Research Questions

This master thesis will work on the following Research Question (RQ)s:

- **RQ1:** What are internal barriers and challenges to the integration of AI within existing business structures in the railway sector?
- **RQ2:** How do stakeholders perceive the impact of AI integration on work processes and job security in terms of fears, expectations, experiences and ethical concerns and how can these be addressed during the process of integrating AI into existing business structures?
- **RQ3:** What are measures companies within the railway sector can take to adopt a human-centric and ethically responsible approach on the basis of the Ethics Guidelines For Trustworthy AI [6] during the integration of AI into their existing business structures?

Human-centric is defined as stated in the Ethics Guidelines for Trustworthy AI [6] as an approach in which "the human being enjoys a unique and inalienable moral status of primacy in the civil, political, economic and social fields". Ethically responsible means that the AI application follows ethical principles according to the human rights, which are defined as (i) Respect for Human Authority, (ii) Prevention of harm, (iii) Fairness, (iv) Explicability [6].

1.3 Limitations

This study was conducted under certain limitations. These limitations originated from time constraints or constraints in the environment the case study was conducted in and are described in the following section.
Due to time constraints and constraints regarding the amount of work for a master thesis, this research is limited in the attributes and requirements that are analysed with the Ethics Guidelines on Trustworthy AI [6]. These are, in detail, limited to: (I) Human Agency, (II) Human Oversight, (III) Stakeholder Participation and (IV) Social Impact, which were further abstracted to the key requirements (I) Human Agency and Oversight, (II) Transparency, (III) Diversity, non-discrimination and fairness and (IV) Societal and environmental wellbeing. Nevertheless, the main requirements analysed are on the basis of the initial four requirements and are thus imposing a limitation towards the full guideline document.
The focus of this study also lies on the analysis of ethical aspects for the human being. For this reason, all technical aspects that are relevant for ethical and trustworthy AI are not researched in this study. This includes technical robustness and safety.
Because of time constraints, all aspects considered are mainly focusing on internal processes and aspects. This means that this study does not analyse external factors, including suppliers, external customers and external aspects surrounding the research questions.
Due to the case study, this study is also limited in its environment, which is the railway sector. The analysis is limited to this sector.

1.4 Related Literature

With the transformative impact of AI on all sectors, companies are investing highly into the development of technologies incorporating AI in order to create novel solutions, which either substitute existing processes and technologies or disrupt the status quo. With this development, human-centric and ethically responsible approaches are of importance to allow for a sustainable implementation of new technologies. Several studies have been released in the last few years, focusing on these approaches and considerations.

1.4.1 Change Management

Smith et al. [31] present an overview and analysis of challenges and change management strategies for the implementation of AI and similar novel technologies in operating rooms. The approach was a single qualitative case study, where change management processes were defined and tested over the time span of a year. The result is a change management framework which addresses the unique needs and characteristics of operational rooms.
Todnem et al. [32] offers an overview on different change management approaches. They present different theories and approaches to change management and critically review current existing frameworks. The authors state, that existing change management approaches and theories are often contradictory or lack sufficient empirical evidence. The paper shows the need of a robust, empirically validated framework that focus on addressing the complexities of managing change in modern organisations.
Cameron et al. [33] present an in-depth, detailed guide on change management. They give an overview and insights on different techniques, tools and theoretical knowledge relevant for change management. Focus points include project-and program change management, cultural change, and theoretical knowledge like individual and team change, organizational change and how to lead change. The book also explains the impact of uncertainty during change processes.
Martinsuo et al. [34] explore the challenges and evolution of complex, large-scale changes by program management. The authors explain the different stages of the program lifecycle and their non-linear nature during times of uncertainty. They mention the need to align programs with the organizational strategy and the importance of the competencies of program managers.
Post et al. [35] explain barriers and opportunities for the implementation of change management. Main barriers can be categorized into industry barriers, which include technical limitations, competitive pressure or frameworks and organizational barriers, which include employee attitudes, leadership commitment and past practices according to the authors. Opportunities include the leverage of market-driven incentives for ecological benefits and the usage of regulatory frameworks for adopting advanced standards and practices.

1.4.2 AI Implementation

Beckert et al. [36] discuss the implementation of the concept of Trustworthy AI, set up by the European Commission. Findings provide that companies have already started implementing and using AI, but often tend to ignore the non-binding, non-legislative guidelines. The paper highlights the gap between theoretical frameworks and their practical application and provides a suggestion for briding these gaps.
Vakkuri et al. [37] explore the integration of ethical aspects in AI system development within the healthcare sector. The goal is to bridge the gap between theoretical discussions and guidelines and their practical application within software engineering. The approach is a multiple case study approach with focus on how ethical AI is handled when no formal guidelines exist. The findings explain that developers are aware of ethical aspects related to AI but often lack the tools to implement them.
Hassanien et al. [38] conducted a systematic review of 23 research studies in order to analyse and evaluate critical success factors for implementing AI projects within the health sector. The authors argue that external success factors include system quality, self-efficacy, satisfaction, subjective norm, trust, enjoyment and information quality.
Huang et al. [39] explore the implementation of AI applications among academic libraries in Taiwan by conducting quantitative research methods. The authors found, that the further the implementation of AI applications were, the more positive the reception of the technology was. Identified problems include the early investment in resources by management and technological problems during the implementation.

1.4.3 AI Ethics

Ibanez et al. [40] explore how companies operationalise ethical principals. The paper describes the way companies approach AI ethics, including the challenges. The approach is a qualitative case study with interviews. The findings reveal that companies are often more focused on regulatory compliance and reputational risks than ethical considerations.
Kaur et al. [41] provide a comprehensive exploration on the topic of Trustworthy AI, focusing on several requirements for trustworthiness and comparing them through literature. The paper provides an overview of different approaches to mitigate risks of AI and increase the trust in the technology, as well as strategies for verifying such systems.
Etzioni et al. [42] explore ethical considerations for AI. The authors claim that a significant part of the challenges by AI can be addressed by the ethical choices made by its stakeholders, stating that there is little need to teach the machines ethical aspects. They conclude that the focus should lie on practical solutions that involve legal compliance and personal customization. Rare ethical dilemmas should be handled as exceptions.
Bostrom et al. [26] gives an in-depth look into critical ethical considerations for AI. The authors discuss the ethical foundation and near-term issues and long term ethical considerations related to AI and AI safety and advancements. Practical scenarios are explained and ethical norms and AI diversity are explored. The authors note the importance of a robust AI governance framework with focus on the developmental aspects.

1.5 Case Study

The qualitative case study is conducted at the biggest railway operator in Austria. The railway operator is partly owned and governed by the Austrian state. The company has around 45.000 employees and is operating internationally, most of them working in Austria. It is separated into 3 main subsidiaries: (i) *Infrastructure (INFRA)*, which is responsible for the complete infrastructure service and maintenance, as well as all business related to usage of said infrastructure, not only by the other subsidiaries of the company, but also by competitors using the Austrian railway infrastructure, (ii) *Rail Cargo (RCG)*, which operates in the sector of transporting goods by train. This subsidiary owns multiple subcompanies internationally and most non-Austrian employees work at Rail Cargo. (iii) *Passenger Transportation (PV)*, which is responsible for all topics related to the movement of people by train. These three main subsidiaries are governed by the Holding. All 4 entities own multiple subcompanies, some of which are partly owned by multiple entities at once.

Due to the rising competitive environment and the introduction of the Fourth Railway Package by the European Parliament [22], the company has started several digitalisation programs in order to modernize, optimize and digitize existing business structures. In addition, a lot of the current operative work force are reaching retirement age. This means, that the company is currently in a transition phase, where a significant part of the work force is leaving or about to leave the company. A big challenge is to enable the generational shift and to allow for further operability while multiple thousand employees are leaving in the same short time span, which are not all replaceable due to a shortage in skilled labour forces. One of these programs to tackle the above mentioned aspects is the **Automated Resource Planing Program (ARP program)**. The ARP program has the strategic goal to enable the train planning, including all the production resources of the company full operability and improved efficiency with an increasing demand by using modern technologies and a standardized planning system. This should be achieved by the implementation of a standardised software, used for the planning of production resources (e.g.: traction units, train drivers, board personnel). The standardised software is backed by a self-developed platform, which uses AI and simulations to optimize resource planning and offer decision-making support for the planners. The operative goal is the integrated continuous production planning (integrierte rollierende Produktionsplanung), which means that all resources that are production-relevant are continuously and adaptively planned based on the current needs. The program started in 2020. In 2022 Phase 1, which included the concept phase of the program and concluded in the completion of the tender process of the SWARP standard software (See: 1.5.4). Phase 2, which is the current phase of the program, includes the development and implementation of SHARP and SWARP. The planned completion year of the ARP program is 2027. Figure 1.1 shows the setup and structure of the program.

The program is set up to follow the framework "SAFe" [43]. This agile approach

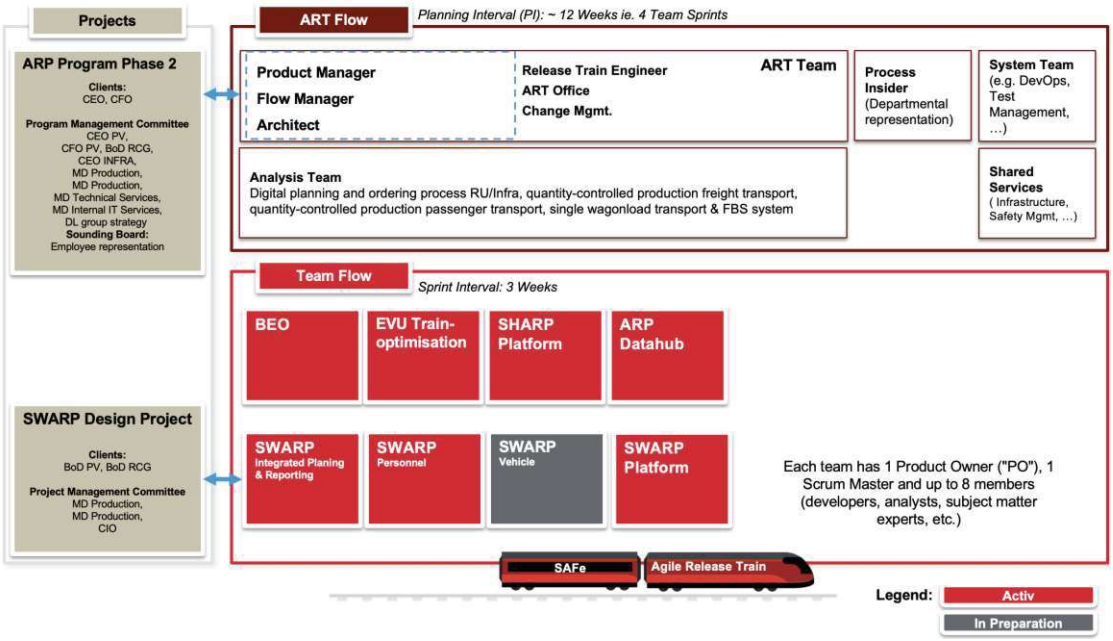

Figure 1.1: ARP Program Plan

means that the ARP program does not follow conventional waterfall program methodologies. It is separated into two different main components, the **Agile Release Train (ART) Flow** and the **Team Flow**. Each of them consist of individuals or teams. The total number of employees working in the ARP program is around 80 people, including developers and external support.

1.5.1 Agile Release Train Flow

The ART Flow operates in Planning Intervals (PI). These planning intervals are for 12 weeks each. The goal of the planning intervals is to define the next components needed to be implemented to further the total progress of the program. The ART Flow consists of five different components.

ART Team

Within the ARP program, there is no individual program manager responsible for the organisation and tracking of progress. Instead, the coordination of the program is done by the Agile Release Train (ART) Team. This team consists of 6 different roles. The following descriptions of the roles are not necessarily in complete alignment with the framework but adapted to fit the needs, processes and structures of the railway company:

- **Product Manager** The product manager is responsible for technical- and content-related topics and guides the program in terms of strategic decisions to fulfill the

vision of the program.

- **Flow Manager** The flow manager is responsible for the financial characteristics of the program. They have the overview over all financial aspects of the program. This includes contract management, forecasts, payments on accounts, service costs, deductions for deprecation and billing-related topics.

- **Architect** The architect is responsible for all architectural decisions of the program. This includes design decisions for software structures, planning the needed interfaces for the integration process and implementation of a platform that transforms data sources from different interfaces into formats that are usable by the new software solution.

- **Release Train Engineer** The release train engineer is the expert of agile methodologies and the SAFe-framework. They act as enabler and coach. Their role is to identify problems arising within the program and support contributors to act according to their respective roles.

- **Agile Release Train Office** The ART office consists of employees responsible for general administrative tasks (e.g.: creation of newsletter, representation of the ARP-program on the intranet, creation and planning of program-related events). They also support the product manager, architect and flow manager when needed and are the point of contact for internal topics and questions.

- **Change Management** The change management team is responsible for supporting affected stakeholders through the change originating from the program. This includes the organization of events to gather insights, experiences, needs, requirements and fears, prepare and react accordingly and ease the transition phase.

In general, the product manager, flow manager and architect are acting as trio to thrive the ARP program. They act as sparring partners for each other, make decisions together and act as representatives to the stakeholders of the program. Each of them have different professional backgrounds, fit to their specific role.

Process Insider

The process insider are not direct workers within the ARP program, but have a role relevant to fulfill the core requirements of the software that is to be implemented. This means, that the process insiders are the employees at the company, which will get support by the AI-software in the future. This makes them a highly relevant group for various aspects of the program. Their responsibility is testing the system, setting requirements, supporting the process planning and acting as enabler. They are involved in various aspects of the program and the main target group for change management. The process insiders are distributed across different locations in Austria and are coming from different departments.

System Team

The system team is responsible for setting up necessary environments for development and testing. They define testing strategies, test management and set up scenarios following a testing plan. This also includes DevOps and Cloud management. Typical tasks are the development and maintenance of the continuous delivery pipeline and end-to-end user testing. Their goal is to allow teams in the Team Flow (See: 1.5.2) to operate continuously and with full capacity by setting up their environments.

Analysis Team

The analysis team focuses on the creation and analysis of concepts of target processes, which are not yet assigned to a product team. This includes requirements engineering and clear definitions for target processes. Their work is coordinated by the product manager.

Shared Services

The team in shared services includes people of different departments who have expert knowledge on topics that are relevant to the successful completion of the ARP program. These services include (non-exhaustive): specialists in Change Management, Cloud, controlling, safety management and infrastructure services. These resources are not working in the ARP program full-time.

1.5.2 Team Flow

Each element in the Team Flow section in figure 1.1 refers to one specific product and consists of a scrum [44] team. This includes a product owner, a scrum master/team coach, a business analyst, developers, key users and content testers. Their respective tasks are according to the scrum methodology. Each team works in sprints, the sprint intervals are 3 weeks. The ARP program has two main components that have to be implemented in parallel for the program to be concluded successfully (i) SHARP and (ii) SWARP.

1.5.3 SHARP

SHARP is a service that will be provided to the subcompanies after the completion of the ARP program. It stands for "Service Hub Automated Resource Planning". The service offers the creation of AI-based mathematical optimisations and simulations. The results of these optimisations and simulations are used as decision supporting systems for the strategic, tactic and operative resource planning processes. The service also serves as company-wide data hub for the deployment of train paths, roads, trains, train personnel in a standardized data format, offering generic interfaces for these data as well as data transformation and reporting. Within SHARP, there are six different agile teams, working on respective topics:

- **BEO:** BEO stands for board service optimisation and focuses on the optimisation of shift plans for the board personnel.

- **EVU Trainoptimisation:** EVU Trainoptimisation is the largest product of SHARP. The goal is develop AI-supporting algorithms that automatically plan resources. EVU Trainoptimisation is split into LEO and TEO. LEO stands for Lok-Einsatz-Optimierung (=Locomotive deployment optimisation). The goal of LEO is to automate, optimize and ease the traction deployment planning process. TEO stands for Triebfahrzeugführer:innen-Einsatz-Optimierung (= Train driver deployment optimisation). The goal of TEO is to optimise and automate the shift planning process.

- **SHARP Platform:** The SHARP Platform team is responsible for the architectural design and deployment of the required technical environment necessary for the other product teams to manage, test and develop their respective goals.

- **ARP Datahub:** The ARP Datahub focuses on the provision of underlying data sources needed for both SHARP and SWARP. The product team identifies relevant sources, coordinates with respective data owners and develops transformation algorithms to bring the data into a standardized, usable format. This process also includes the cleanup of low quality data.

1.5.4 SWARP

SWARP is a service that will be provided after the completion of the ARP program. It stands for "ARP Standardsoftware für Fahrzeug-, Schicht- und Einsatzplanung" (ARP standard software for vehicle-, shift- and deployment planning). SWARP allows for an integrated and rolling planning of transport services in the passenger and freight transport by rail, including its production resources across different time horizons. In addition, planning of individual resources separately should be possible. SWARP includes the standardized software, which is a software developed by an external company. While the name hints, that the software is uniform across multiple companies and processes, the main focus of the SWARP product teams is to tailor the software to the needs of the end users. SWARP is the core of the ARP program and includes the software that end-users will work with after the completion and deployment of the program.

1.5.5 Project Timeline

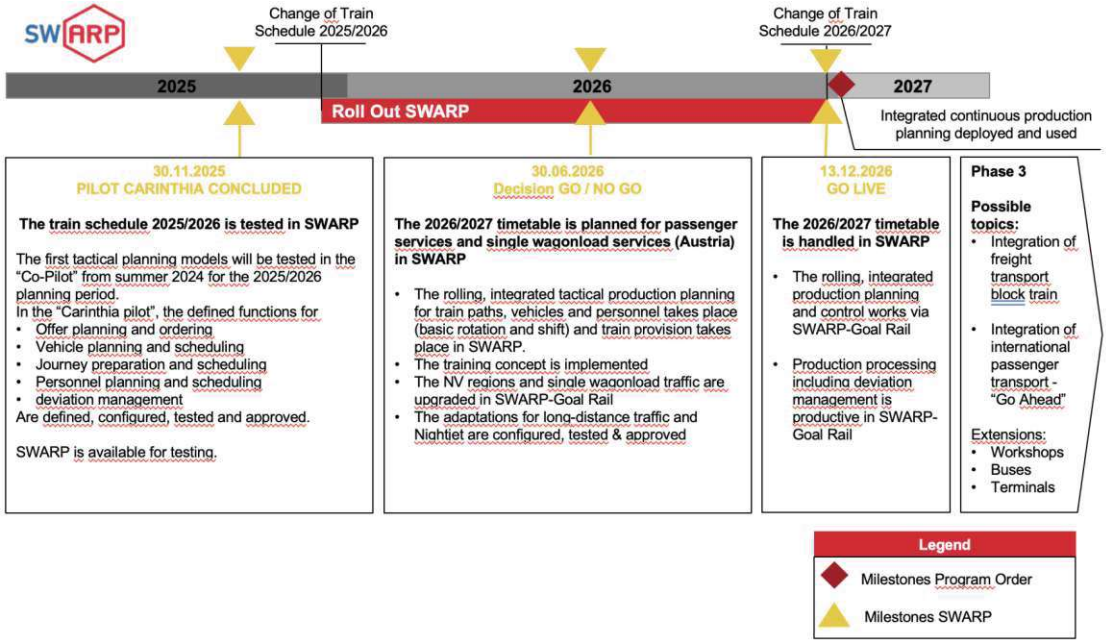

Figure 1.2: ARP Timetable

CHAPTER 2

Background

2.1 The Digital Strategy

2.1.1 Introduction to the digital strategy

Over the last two decades, technological advancements have become imperceptibly more important. They actively impact the economy and shape our society as a whole [45]. In addition, consumerism has shifted drastically to a very high level of individualization of goods, services and products, where customers seek unique and new experiences continuously [46]. These technological advancements allow for competitive advantages through the shift of the product and service line to the digital space [47]. This means, that companies have to adapt their entire value chain and subsequently their business model to incorporate new technological advancements in order to stay competitive and allow for the fulfillment of the fast changing requirements of their customers [46][48].

To adapt and create new business models efficiently in the future, companies need to define a clear strategic orientation, by which the business models are implemented accordingly. This includes a shift of the culture of the company and its organization while also integrating arising disruptive technologies as part of the companies identity during its digital transformation. The changes that come from such strategic alignment have to be taken on an enterprise level, spanning across the whole company, with the goal to take advantage of the perks that come with the advancement of the technological landscape. The digital transformation should on the highest level result in cost savings (by automating or optimizing the work flow or existing processes) or an increase of revenue (by changing, adapting or creating a new product or service line) [48].

In the past, the digital strategy, if there was one, was a separate strategy which was subordinated to the business strategy [49]. In recent times, however, the digital strategy has become more than just a subsequent strategy, due to digital technologies being deeply

rooted to the business strategy, fundamentally transforming it into cross-functional global strategies that allow for an establishment of business processes that are beyond past constraints like distance, function or time [50]. With the circle of which new technologies disrupt and change markets, some companies have started to separate the digital strategy into one that is of equal level to the corporate and business strategy, placing it as main focus for the future development of the company. The goal is to increase the agility of the company to allow for faster internal changes based on arising external factors, showing that a clear strategy, which focuses on the efficient use of digital technologies is essential for the success of companies [48]. Thus, the digital business strategy can be defined as *"organizational strategy formulated and executed by leveraging digital resources to create differential value"* [51]

Due to all companies across all industries being affected by digitalization [52], they need to re-orient or adapt their strategy to their individual needs. Large companies (>249 employees) tend to generate their revenue through the sale of traditional products and services [53]. This means, that they are often still in the beginning of their digital transformation process. This is fortified in the sector of transportation, where the exposure and impact of digital disruptions is delayed significantly compared to many other sectors [54]. The delayed impact coupled with the complexity of which large companies in the sector of transportation operate makes them prone to arising competitors, who use modern technologies from the beginning, compared to traditional, often analogue business models [53]. Thus, a sense of urgency to digitalize, combined with a corresponding strategy is a focus of large companies.

In the transportation sector, companies are often in the position of being a local monopoly within their respective area or country. This is due to multiple different reasons. Infrastructure for transportation exhibits characteristics of natural monopolies, where the cost of entry is so high that it functions as barrier for possible competitors to enter the market. In addition, maintenance costs are of significant proportion due to firms operating in the sector of transportation often count as critical infrastructure, which results in a higher expected level of security and quality. In many countries, the infrastructure operator and the user of infrastructure are the same company, or individual sub-companies of a group. This leads to the discouragement of new competitors and results in monopolistic or oligopolistic market structures [55] [56]. Due to the transportation sector being of high strategic importance, it is also often regulated heavily by the respective government. These regulations may include pricing controls, market access restrictions or service standards. Especially in Europe, countries granted exclusive rights to offer certain services or operate on specific routes in order to meet public service obligations or ensure a certain level of coverage [57]. This is coupled with higher subvention rates, stemming from public funding and companies acting as monopolies being partly or completely owned by the state they operate in, because they promote economic development and enable equal access to markets, justifying public investments [58].

In recent years however, states have started pushing towards a more liberal solution, with the focus on creating a fair and equal market. An example is the Fourth Railway Package, adopted in 2016 by the European Union [59], which inter alia opens the domestic passenger markets to competition and makes competitive tendering for public service contracts mandatory. These changes forced large, complex organisations in this sector to immediately adapt their strategy to focus on a more competitive approach, creating the urgency for a digital strategy to react to (and incorporate) technological developments into their business processes.

2.1.2 Development of the digital strategy

The development of the digital strategy can be categorized into a roadmap with six different phases [60][61].

External strategic analysis
In this phase, external influences are analyzed on a micro-and macro-level. The micro-level focuses on factors related to competitors and customers. The macro-level focuses on technological developments and trends. The goal of this phase is to develop an understanding of external influence factors and gain an understanding of current and existing trends in order to develop scenarios within the digital space.

Scenario development
In this phase, the findings of the micro-and macro-level are selected in order of their future relevance within the digital context. The typical observational horizon is 10 years. Following that, a forecast with focus on the technological development for each influence factor within the set observational horizon is done. The individual forecasts are then prioritized, depending on the level of impact. Then scenarios are developed, containing the influence factors and their forecasts.

Internal strategic analysis
In this phase, the company analyzes internal aspects relevant for their strategic progress. The analysis consists of the company's internal divisions in the context of digitalization. The result is an internal digital maturity level, which enables the company to find new potentials for their digital strategy.

Digital statement
In this phase, possible fields of actions that focus on digital initiatives derived from phase 3 are defined. These form the basis for the digital strategy. In addition, a digital strategy statement is formulated for the company during this phase.

Strategic options
In this phase, strategic options are defined and evaluated. The goal is to choose a fitting strategic option, taking into influence the data gathered through earlier phases. Generic digital strategy are utilised.

Digital strategy formulation
In this phase, a digital strategy is formulated, based on the strategic option chosen. During this process, the digital strategy is compared to the corporate strategy and the mission statements, measurements and projects to implement the digital strategy are defined. The mission statement, measurements and projects form the digital strategy.

2.2 Organisational Change Management

Moran and Brightman define change management as "the process of continually renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of external and internal customers" [62]. Organisational change and organisational strategies are closely intertwined and can thus be not separated from each other [63]. For this reason, change management skills have seen a surge in importance within management [32]. Especially in the current era of work, where globalisation and highly distributed teams are occurring more often in organisational structures and the speed with which companies have to adapt to environmental factors and technological advancements has been continuously increasing [54], there has been a surge in organisational change within individual companies. The origins of the change are often unpredictable and the resulting change management is reactive, triggered by organisational crisis [63]. There are, however, also planned change management initiatives, often in combination with transformation projects and programs
Numerous frameworks, methods, and policies [64] [65] [66] have been developed to show forms of organisational change management and the respective roles of relevant stakeholders during the organisational change management process [67] [68]. All of them highlight strengths and weaknesses for their respective approaches - making an identification of any consensus difficult. There are, however, two important issues identified by multiple different sources according to Todnem et al. [32]: (I) The pace of change has been continuously increasing and has never been higher in organisations. (II) Change comes in all forms and shapes, no matter whether it is triggered by external or internal influences and thus affects all industries and organisations.

2.2.1 Lewin's Three-Step Change Model

Arguably one of the most important and significant contributors to organisational change management was Kurt Lewin. Lewin contributed to the developed and research of organisational change management with multiple critical publications in 1946 and 1947. He researched and identified change in the context of action research [69] and introduced and expanded on group dynamics [70], field theory and developed the three-step change model [71].

The three-step model is a change model to visualise the social change in social groups. Lewin argues, that there are restraining forces that influence the behaviour of individuals

and organisations, leading the change. These restraining forces also highlight possible resistances to change. The three-step model of change includes:

- **Unfreezing:** In this step, preparations for the change are developed. These plans for change are communicated within the group and discussions with participants are done. Effective communication and the creation of a sense of urgency for affected stakeholders are measures that can be take in this step.
- **Moving:** In this step, new group standards are introduced. This is done by concrete measures of the responsible parties. The change is implemented.
- **Freezing:** In this step, the affected parties need to build up security in the new environment. The core of this step is to create psychological security by tactically using measures to reduce feelings of threat and increase motivation towards the change. Stabilisation and acceptance are the goal.

This model has prevailed due to its simplicity and relevance. It also formed the basis of modern theories on change management, e.g. planned organisation change management. Some papers [64] argue, that research in the last 50 years has not fundamentally developed novel methods or frameworks - and have rather provided a better understanding of what was developed by Lewin.

The following analysis of organisational change management methods focuses only on planned organisation change models. and separates them into three different categories: (I) Change as a Project, (II) Change as a response for resistance, (III) Change as an interpretive process as first shown in [64].

2.2.2 Change as a project

7-S Model (1982)

The 7-S Model is a model that was developed by Peters and Waterman [72]. The model is based on the theory, that seven internal aspects of an organisation need to be aligned in order for the organisation to perform efficiently. These aspects are separated into two categories: The hard aspects - also referred as "Hard S": Strategy, Structure, System and the soft aspects, "Soft S": Skills, Style, Staff, Shared Values.

- **Strategy** means the behaviour of companies and their respective measures that are set as reaction, anticipating changes originating from their environment.
- **Structure** is the organisational construction of the company, ranging from business units to specialisations for the coordination of processes.
- **System** refers to all processes (formal and informal) that form the efficiency of the organisation.

- **Style** refers the behaviour pattern of key groups (e.g.: management).
- **Staff** includes the analysis of resources and the processes connected to them, e.g.: career paths, educational attributes.
- **Skills** refer to the knowledge and abilities of the company, and the ability to gather and form new ones.
- **Shared Values** are the core beliefs that form the corporate culture. They are the linking part for all other elements in the 7-S Model.

The 7-S model provides a framework for understanding organizational change. It allows for an examination of the current state of the organisation and as structured approach to change planning, focusing on the defined aspects and possible integration into the change strategy.

Phase of Planned Change (1985)

The Phase of Planned Change is a 4-Phase model that was first developed by Bullock and Batten [73] in 1985. The model provides a structured approach for the development of organisational change initiatives. They describe the four phases as:

- **Exploration:** In this phase, the need for change is identified and possible solutions are explored. Activities in this phase may include the assessment of the change readiness of the company and the definition of objectives and the scope of the initiative.
- **Planning:** After the objectives are put down, an action plan and integration strategies are formulated and developed. This phase also includes the identification of risks and the connected mitigation strategies.
- **Action:** With the approval of the decision makers, the action plan and strategies are implemented. This often includes restructuring processes and/or the introduction of novel technologies.
- **Integration:** The change process does not end with the implementation, stabilization, diffusion and renewal are necessary for sustainable change implementation. The goal of this phase is to ensure sustainability. Continuous evaluation and feedback are assessment tools in this phase.

Change Formula (1987)

The Change Formula, developed by Beckhard and Harris [74] in 1987 is a formula that identified elements of change and their relatedness to each other in order to affect change. It is considered as operational framework to understand and manage organizational change. The formula itself is used to assess the possible success of a change initiative in

an organisation. The formula is defined as:

$D \times V \times FS > R$

D = Dissatisfaction with the current situation
V = Vision of a desired future state
FS = First Steps towards achieving the vision
R = Resistance to change

The formula describes that the level of dissatisfaction with the current situation, the future vision and the steps to achieve that vision have to be high enough of an incentive for the employees in order to overcome their resistance to change. If the current situation is well received, the vision not compelling and/or the first steps not well-executed, the change initiative is unlikely to succeed.

Eight Step Model (1996)

Kotter's Eight Step Model [75] is a model that was developed from research into multiple dozen business that were undergoing change management. The goal was to determine lessons learned and develop a procedural approach to managing the change process, based on the conglomerated findings. The eight steps that were identified are as follows:

1. **Create** a sense of urgency. This step is done to reduce the resistance to change and motivate the initiation of a change implementation process.
2. **Build** a guiding coalition. This includes the formation of a support system to enable effective change leadership.
3. **Form** a strategic vision. A vision is necessary to create an understanding across all affected parties, unrelated to their organisational position. The strategic vision also includes a change management plan with a roadmap and key project milestones.
4. **Enlist** a volunteer army. This may be done by continuous communication and transparency throughout the change process. Addressing employees' concerns and lead change by example are necessary steps.
5. **Enable** action by removing barriers. Possible barriers that reduce the chances for success have to be identified and overcome, using available resources.
6. **Generate** short-term wins. A change process usually takes a longer period of time, depending on the size of the company. To keep employees motivated, recognition of progress throughout the implementation phase is necessary.
7. **Sustain** acceleration. This step explains the urgency to continue change initiatives after successful development of individual change milestones in order to reduce the possibility of complacency or disheartening of employees.

8. **Institute** change. In order for change to be fully integrated into the organisation, it needs to be adapted into the organisation's culture and processes. This can be done by upskilling employees and provide change management training

2.2.3 Change as a response for resistance

Change Curve (1969)

The change curve, also referred to as the Kübler-Ross model, first mentioned by Kübler/Ross [76] in 1969, stems from her analysis that the five stages of grief are similarly applicable to the way people react to change, providing insights into organisational responses. The five stages of grief are: (I) *Denial*, (II) *Anger*, (III) *Bargaining*, (IV) *Depression*, (V) *Acceptance*. These stages may be applied to organisational change and follow a similar pattern:

1. **Denial:** Employees might ignore new changes or policies with the believe that they are only temporary or will not be implemented.
2. **Anger:** Employees might react with high levels of frustrations and direct their anger towards management or different departments
3. **Bargaining:** Employees might suggest alternative solutions or try and engage in negotiations for adjustments.
4. **Depression:** Employees might feel discouraged from work, low morals and lower productivity.
5. **Acceptance:** Employees begin to accept the change and adapt accordingly, finding ways to work within their new surrounding.

Systemic Model (1999)

The systematic model was developed by Senge, Roberts, Ross, Roth and Smith [77] in 1999. It is a non-formulaic approach to organisational learning and change. The focus lies on long-term sustainability issues and the renewal process, which considers redesigning and rethinking change at its base. The systematic model outlines an approach for managing the complexities of an organisational transformation. The key components of the model come from one of Senge's earlier works, called "The Fifth Discipline" [78], in which five core disciplines are identified. These are essential for a learning organisation:

- **Personal Mastery:** Focusing on continuous personal growth and self-improvement.
- **Mental Models:** Challenging internal pictures of the world in order to improve the decision-making capabilities.
- **Shared Vision:** Building a common sense of purpose and direction within the whole organisation.

- **Team Learning:** Improving the ability and skills of teams collectively in order to achieve desired outcomes.
- **Systems Thinking:** Understanding patterns and interrelationships of the organisation.

In addition, Senge et al. identified system archetypes, which are recurring patterns of behaviour in organisations. These archetypes can help diagnose problems and design possible solutions. Other aspects, like the challenge of sustaining change over time are identified and tools and techniques for the support of organisational learning and change are elaborated.

ADKAR (2003)

The ADKAR model [79] was developed in 2003 by the founder of Prosci [80] and is a result-oriented change management tool which maps enablers of change to change management activities. It is based on the principle that organisational change can only happen when individuals change. The goal is to reduce the resistance to organisational change. The acronym ADKAR stands for:

- **Awareness** of the need for change
- **Desire** to participate and support the change
- **Knowledge** of how to change
- **Ability** to implement desired skills and behaviours
- **Reinforcement** to sustain the change

The five aspects are split into three phases: **Current**, which includes *Awareness* and *Desire*, **Transition**, which includes *Knowledge*, *Ability* and **Future**, which includes *Reinforcement*.

Management of Transition Model (2003)

The Management of Transition model, also known as Carnall's Change Management Model [81] is a model, focusing on the key management aspects of politics, culture in the context of a change process and skills development. It also provides an understanding and addresses human and organisational challenges that may arise during a phase of change. Key elements of the model are:

- **Managing the Transition:** Focusing on gaining an understanding of the change process that individuals go through and support accordingly.

- **Organisational Culture:** Recognizing the importance of the organisational culture and regard it in the change.
- **Communication:** Clearly communicating in a transparent and consistent way throughout the change process.
- **Leadership:** Providing leadership and guidance to employees in the organisation during the change.
- **Evaluation and Feedback:** Gathering feedback continuously and evaluating the change process to improve it.

A distinctive feature of model by Carnall is that it focuses on both organisational and individual aspects of change.

2.2.4 Change as an interpretive process

Transitional Phase Model (1991)

The Transitional Phase Model, developed by Bridges [82] in 1991 is a model that focuses on the psychological transition of the individual. It acts on the theory that change often happens to people even when they do not agree with it and that the transition that follows is internal. The change can happen quickly, while the transition may take time. The model focuses on the transition of the individual and consists of three different stages:

1. **Ending, Losing, and Letting Go:** This stage describes the process of an individual letting go, which often leads to a sense of loss. This stage happens early on and marks a decrease in moral.
2. **The Neutral Zone:** In this stage, the moral of the individual is usually low. They have let go of old beliefs and personal values, but are not yet familiar with the new way, creating a feeling of "being lost". In this stage, the individual explores new ways of being.
3. **The New Beginnings:** New ways of being are developed and a new understanding of beliefs and personal values is created. The individual can see a different future and integrated into the change. The moral is high.

Bridges demonstrates how the model may be applied to organisations and explained solutions and guidance for management for each of the three phases.

Causal Model (1992)

The Causal Model, developed by Burke and Litwin [83] in 1992, also known as the Burke-Litwin Change Model, focuses on the analysis of drivers of change and creates a ranking of them. The model includes 12 critical factors that are necessary for the success of change initiatives.

Input: The input is the origin of the change. Burke and Litwin argue that change originates from the external environment and is unexpected. These may include the introduction of novel technologies or developments in the economy. The following critical factor is part of the input: **External Environment**

Throughput: Transformational Factors: The Transformational Factors are factors that are of high significance to the structure of the organisation. Implementing a change initiative would thus result in addressing these internal factors. Burke and Litwin argue that in order for the change to show a significant effect, these factors need to be aligned. Factors: **Mission and Strategy**, **Leadership**, **Organisational Culture**

Throughput: Transactional Factors: The Transactional Factors are factors that are easier changed within the organisation, but also have a less significant impact on the performance of an organisation, in contrast to the Transformational Factors. **Structure**, **Systems**, **Management Practices**, **Work Climate**, **Task and Individual Skills**, **Individual Needs and Values**, **Motivation**

Output: The Output describes the outcome of the change initiative. It focuses on the effect the change has on the performance of an organisation. Burke and Litwin argue that the outcome affects the external environment (Input) and thus creates a loop, where all factors are in a constant form of change. The critical factor in *Output* is **Individual and Organisational Performance**. This factor is also the measure for the effectiveness of the change initiative.

The Causal Model also shows how the critical factors affect each other. It also shows that, while the change in Transactional Factors can have an impact on the performance of the company, these changes are only temporary if the underlying Transformational Factors are not aligned accordingly.

Congruence Model (1997)

The Congruence Model, developed by Nadler and Tushman [84] in 1997 is a model which connects organisational sub-systems with changes to the external environment. Nadler and Tushman based the creation of the Congruence Model on the principle that an organisation can only succeed when the **people**, the **work**, the **structure** of the organisation and the **culture** are congruent. The model shows the interrelationships between these key components and their impact to each other. In contrast to the Causal

Model, the Congruence Model does not include the external environment.

Sustainability Change Matrix (2014)

The Sustainability Change Matrix, developed by Dunphy et al. [85] in 2003, revised in 2007 and 2014 describes a six-phase process that leads to organisational sustainability by using change. These six phases are introduced as "Waves of Change" and represent different levels of the organisational response to sustainability.

- **Wave of Rejection:** In the first wave, the organisation actively resists the significance for sustainability, the focus is on traditional economic goals.[]
- **Wave of Non-responsiveness:** In the second wave, the organisation recognises issues of sustainability but without any considered significance. There is a lack of strategy for sustainability
- **Wave of Compliance:** In the third wave, the organisation has to comply with social or environmental regulations in order to avoid penalties
- **Wave of Efficiency:** In the fourth wave, the organisation realises the cost benefits and increased efficiency of sustainable solutions
- **Wave of Strategic Proactivity:** In the fifth wave, the organisation integrates sustainability into the core strategic planning and recognises it as source of innovation
- **Wave of the Sustaining Corporation:** In the sixth wave, sustainability is fully integrated into the organisation and their core values and operations.

CHAPTER 3

Research Methodology

3.1 Thesis Approach

This master thesis will work within the qualitative research methodologies and conduct a qualitative single case study 3.2.1 at the largest Austrian railway operator. The research team has access to multiple large subcompanies within the group, as well as to the largest digitalisation program within the group, which focuses on the implementation of AI into the complete resource planing process across the 3 main subsidiaries (PV, Rail Cargo, INFRA) as well as their respective subsidiaries each 1.5. Interviews will be conducted across all hierarchies and within the program team.
Following the phase plan for qualitative research, the following section describes the fulfillment of the master thesis in accordance to the individual phases. The details are explained in sections 3.2 to 3.5.
The research questions and goals may be found in section 1.1. The process strategy is described in figure 3.1. Since the program has had a focus on change management, which strongly correlates to the research questions, the strategy includes the usage of Triangulation, combining the quantitative evaluation of existing data and qualitative data gathered and created during the master thesis. The sampling method used is a stakeholder analysis 3.3. The evaluation method is in the form of a document-analysis 3.4.1 of already existent materials and semi-structured single expert interviews 3.4. The interviews are conducted in person. The data basis for the interview are based on the IEEE 7010-2020 Standard "IEEE Recommended Practice for Assessing the Impact of Autonomous and Intelligent Systems on Human Well-Being" [86]. The data storage are in the form of audio recordings of the full interviews, following a transcription of the audio recordings. The transcription will be a literary transcription. The evaluation follows the qualitative content analysis, in concrete the qualitative structured content analysis by Mayring [12] as described in section 3.5.1.

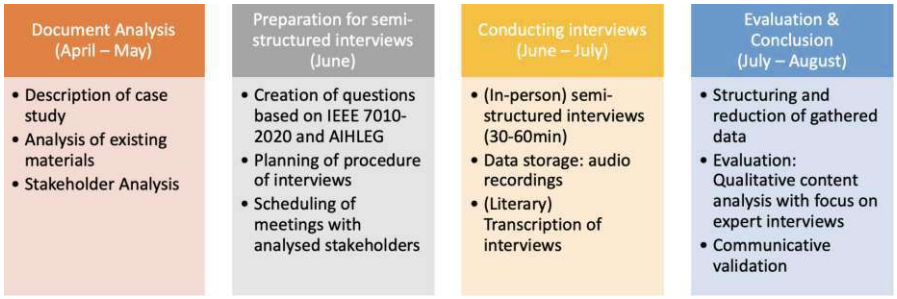

Figure 3.1: Process Strategy

3.2 Research Design

This master thesis uses qualitative research methodologies. Qualitative research methodologies focus mainly on inducting general occurrences and practices based on the methodical analysis of an individual case. Compared to empirical research, where a concrete hypothesis has to be formulated in advance, which is then checked for correctness, qualitative research is distinguished by a generally more open approach. The basis for this open approach is the assumption, that complex phenomena have to be researched and understood, and that they cannot be categorised by "external" theories. Thus, the focus lies on understanding phenomena from the inside out and be open to unexpected viewpoints or any surprises that may occur during research. This approach makes qualitative research more open and flexible. The focus does not lie on hypothesis testing, but on hypothesis generation. The research process should be defined in such a way, that revisions of the presumption and methodologies are continuously possible, if that is required [87].
Due to the increasing speed of which our society changes and adapts, as well as the rapid growth of technological advancements, models that explain certain behaviours are prone to getting outdated as time moves on. For this reason, qualitative research focuses on theories that are locally applicable (and are not a universal claim of validity) in order to gain practical knowledge in a specific area or context. Qualitative research is used to create "empirically justified formulations of subject-and situation-specific statements"[88].
One specific of qualitative research is that the data basis is usually textual (e.g.: transcripts of interviews). On the foundation of a theoretical knowledge-basis, interviews are conducted and transcripts of these interviews are created, which are then interpreted, resulting in new, differentiated theories. The approach and handling of such data is different from e.g. data related to concrete measurements, where the latter needs correct application and exactness, the first requires language know-how and developed interpretation skills [88].

A leading factor for empirical research is the evaluation of results based on certain quality factors. Because quantitative quality factors are only partially applicable to qualitative research, there have been various studies on which quality factors are to be used for qualitative research [87][88][89]. The following quality factors are often

recommendation as core factors for qualitative research:
Transparent process documentation as basis for inter-subjective traceability: Focus lies on proper documentation of the research process and a transparent description of various aspects, e.g.: theoretical foundation of research team, description of evaluation method, evaluation context, sampling strategy and definition of transcript rules. This should ensure, that the research procedure may be checked for plausibility.
Argumentative interpretation reasoning: Qualitative research does not only rely on the presentation of statements, but also on the interpretation of them. Thus, there is always a certain degree of subjectivity involved. This also means, that the quality of the interpretation strongly depends on the knowledge and experience of the evaluator, known in American literature as "Connoisseurship" [90].
Communicative validation: Following the classical quality factor of validation, qualitative research often uses a communicative validation step to check whether the structure and interpretations are in alignment with what the researched subjects meant to convey. This is done by talking to the affected parties. [91]
Self reflection: Since the foundational knowledge and mindset of the researcher affects the quality and type of interpretation and thus the results, the researcher or research team should focus on critically define and reflect on their sympathies, worries and relatedness towards different perspectives [92].
Triangulation: Triangulation describes the "combination of different methods, researchers, research groups, local and timely settings as well as different theoretical perspectives during the analysis of a phenomenon"[88]. Methodical triangulation is the combination of different qualitative and quantitative methods. Researcher triangulation is the combination of different researchers, interviewees and evaluators in order to allow for a systematic comparison of the gained results.

The phase plan of qualitative research includes six different stages. The qualitative process does not require these stages to be conducted sequentially. During the research process, it is not uncommon to further develop research questions, change them or adapt certain methodologies if the need arises. New, or unexpected, relevant aspects may arise which require the researcher to dive deeper into certain aspects of the researched context. The following are stages of the phase plan of qualitative research:
Definition of research questions and research goals: In qualitative research, the results are often related to two main topics: (i) a description of a specific type or figure or (ii) a process and its dynamic. The research question serves as guidance point throughout the rigorous research process and should be formulated clear, simple and structured. It should be an actual question, which may contain further sub-questions.
Definition of the process strategy, plan of procedure and sampling: In this phase, a general plan, including necessary steps and a time plan should be created. A question that often arises within this phase is the amount of interviews that should be conducted. This question cannot be answered generally and depends on preferences of the research team and environmental constraints, like available time, resources and budget.
Definition of elicitation method and execution of elicitation: The elicitation

method can be categorized into two general categories: (i) non-reactive procedure or (ii) reactive procedure [93]. The non-reactive procedure focuses on analysing and interpreting data and materials that already exist (e.g.: audio records of discussions, documents of executed projects). A typical form of analysis is the document analysis. Reactive procedures are procedures that also include data and material generation (e.g.: in the form of conducting interviews). Section 3.4 gives a detailed view on elicitation methods.
Storing of data: In order to be able to evaluate the gathered data, it needs to be stored in a fitting form. This means, that specifically social interactions are "fixated" in a certain way. There are various ways to store data (e.g.: creating transcripts of interviews). Transcribing a social interaction also means a reduction in complexity, since it is not possible to fully transcribe all aspects of an interaction, like smell, background noise or physical reaction.
Analysis: Structuring and interpretation of data basis: The central element of qualitative research is the analysis of the data basis. It can be assumed, that the analysis and interpretation of materials pursue two different goals [88]: (i) The reduction and structuring of the original text and finding the common denominator (e.g.: using the qualitative content analysis [12]). (ii) Uncovering of latent content of statements. This includes interpreting data and concludes in an increase of textual material (e.g.: using Grounded Theory [94]). Section 3.5 gives an overview of analysis methods and a detailed look into the qualitative content analysis.
Concluding research: In this phase, the research is finalised. Researchers may use this phase to discuss their evaluation results with the conducted target group in order to create a "communicative validation" of the findings.

3.2.1 Qualitative Case Study

A case study is a scientific methodology that focuses on qualitative research of a single, specific case at a specific point in time or over a longer duration [95]. This allows researchers to gain a deep understanding of a research problem while also being a popular tool for either organisational learning or evaluation. A case study can be categorized into 6 types of case studies. *illustrative* (descriptive in character, used for adding in-depth examples or realism to information), *exploratory* (descriptive, used for generating hypothesis that are then later investigated), *critical instance* (examination of a single, unique case to critically test an assertion of a program, strategy or problem), *program implementation* (investigation of operations, often at multiple locations), *program effects* (testing of causality, often involves multi-method assessments and multi-sites), *cumulative* (bringing together findings of multiple case studies) [96]. The qualitative case study can be described by the universally accepted six-stage study process by Yin [97] and further adapted by Baskarada [96].
(1) Plan In this step, the research question is identified and specified. This is often done in combination with a literature review.
(2) Design In this step, the case study design (single, multiple, holistic, embedded) is chosen. It also defines the unit of analysis and the case that is to be studied with the goal to identify issues, developing theories and propositions and procedures to ensure quality.

(3) Prepare In this step, the investigators focus on acquiring skills and knowledge that are required to perform the case study. An understanding of the main concepts within the domain and of methodological/theoretical issues should exist. Preparations for data collection activities should be performed.
(4) Collect In this step, a case study database is created, and the collection of relevant data itself through interviews, documents, direct observation, physical artefacts and archival records [97].
(5) Analyse In this step, the gathered data may be examined, categorized, tested or otherwise used in order to draw empirical evidence for the underlying research question.
(6) Share In this step, the audience is defined and the information about and of the case study, including the results and findings are presented in a way that allows for the reader to reach their own conclusions.

3.3 Sampling Methods

One major aspect of the qualitative research methodology is the determination and process of choosing a sample for the study. The chosen population is often a subset that is representative for a wider population. The goal of sampling is to determine suitable populations in order for the study to be be conducted appropriately. Sampling strategies and sample sizes are often adapted to the qualitative approach that is being used. Qualitative sampling methods differ from quantitative ones by being non-random and not using non-probability sampling methods [98], which means that the a specific population is recruited to investigate a specific topic. The researcher identifies participants who have "direct and personal knowledge" [99] and are willing to share, reflect and discuss the studied topic. The sampling process may be adapted during the research and is further refined as data is elicited and analysed [100]. In general, there are four different types of non-probability sampling [101].

- **Convenience Sampling** Convenience sampling is the most common form of non-probability sampling [101]. The researcher chooses participants based on their availability of location, access, willingness and time. Advantages of this sampling are the straightforward approach and ease to build up a sample size high enough to saturate the research topic. Disadvantages are the possibility of under-or over-population of certain groups within the wider population and that the sample(s) are less likely to be representative of the population being studied, which makes it more difficult to make generalisations of the findings [102].

- **Purposive Sampling** Purposive Sampling includes the recruitment of participants according to pre-selected criteria, which are relevant to particular research questions. This means, that participants have special knowledge and/or the necessary experience to provide detailed information for the specific topic. The goal of purposive sampling is to gain in-depth information for the study. Within purposive sampling,

there are two specific types of sampling: (i) *Maximum Variation Sampling*, which focuses on having a full representation of a certain phenomena and (ii) *Quota Sampling*, where the researcher decides on the number of participants and characteristics needed for the elicitation of data and materials.

- **Snowball Sampling** Snowball Sampling is also known as "chain referral" or "networking" sampling. This is due to the nature of the process of this sampling method, which starts by the researcher gathering information from a limited number of participants and relies on them to further guide the researcher to additional contacts by referral. This sampling method is used when individuals for the representative population are difficult to reach or when there is a hidden population [103]. This could include people who are generally reluctant to share experiences or information.
- **Theoretical Sampling** Theoretical Sampling is most commonly used in Grounded Theory. The researcher starts with a small number of participants and gradually moves to a larger number of participants [102]. The sampling occurs sequentially with the data analysis. This means that data is analysed after which a new participation group is defined for further data elicitation.

3.3.1 Stakeholder Analysis

Stakeholder Analysis is part of purposive sampling and a systematic process of gathering and analysing qualitative data in order to determine which actors are of interest for a specific topic. Actors are not only individual people but could also be organizations, units, states and other entities and in general can be categorized into the following categories [104]: international, public, national, commercial/private, political, non-governmental organization, users/consumers or labor. There are multiple steps to conducting a stakeholder analysis [104].

- **Planning the process** In this step, the purpose of the analysis should be defined. A general plan and timeline is identified.
- **Selecting and defining a policy** This step, the general topic of interest is selected. Policy refers to either a document, an issue, a program, law, legislation or other appropriate topics.
- **Identifying key stakeholders** In this step, stakeholders are identified. During this process, the conductor should define a maximum number of stakeholders to be interviewed. In a first step, existing information surrounding the topic of interest is compiled and reviewed and all actors who could have an interest are defined. The next step entails the prioritisation of stakeholders. The last step includes finding concrete names for the defined and prioritised stakeholders for future contact.
- **Adapting the tools** In general, little secondary information is available on stakeholders. For this reason, the conductors should focus in this step on preparing

materials in order to interview priority stakeholders to gain insight and information on their positions, and ability to affect the topic of interest. Tools that can be used to elicit information are a stakeholder table, interview questionnaire, definition of characteristics or reference chart.

- **Collecting and recording the information** This step includes the interviews with stakeholders to gain additional insight on their interests for the topic. Based on the prepared material, notes should be used to fill out missing information.
- **Filling in the stakeholder table** The stakeholder table includes various information about the stakeholders. This includes knowledge, position, interests, alliances, resources, power and additional information. Information gathered during the analysis and interviews should be used to fill out the stakeholder table.
- **Using the information** With all the compiled and gathered data, the next step is the analysis. The focus is on comparing information and developing conclusions on the stakeholders interests, positions, importance and knowledge.

3.3.2 Sampling in this Thesis

In this paper, we use the stakeholder analysis in order to evaluate possible candidates for the semi-structured interviews. The process of the definition of interview partners was an initial stakeholder analysis to gain an overview of involved parties within the given use case. This was necessary due to the size and complexity of both the organisation and the program analysed. The stakeholder analysis followed specific criteria as described in section 4.1. Following the stakeholder analysis, additional criteria were defined to narrow down on concrete individuals for the semi-structured interviews. This process is described in section 3.4.3. The reason for purposive sampling in this study is the gain in-depth and representative information with a limited subset of the total population. The stakeholder analysis was chosen because it presents a targeted approach for selecting participants who are in direct contact with the research topic, as well as to gain a wide range of different perspectives within the company.

3.4 Elicitation Methods

Elicitation methods can be categorized into two different main procedures: (i) non-reactive procedures and (ii) reactive procedures [93].
Non-reactive procedures are characterized by being unrelated to the research in terms of their origin. They are not evaluated or generated during the research process, but already exist beforehand. This means, that the data is completely unaffected by the research object and thus allow for a more objective analysis and reflection. Because of this attribute, non-reactive data are often analysed in the context of quantitative research methodologies [93]. Non-reactive data can be any data that is produced by people, ranging from art to documents, but also unintentionally created data, like wear and tear on objects [105]. An example of a non-reactive elicitation method is the document analysis, which is further described in section 3.4.1. In qualitative research, the non-reactive procedures are often used as supplement to reactive procedures. In this thesis, the document analysis will be used.

Reactive procedures can be further categorized into interviews and observations. Interviews are either individual interviews or group interviews. There are two different main approaches to conducting interviews, which apply for both individual and group interviews: focused or narrative [106]. Focused interviews are characterized by having a pre-defined set of questions, that are to be followed during the interview. This allows for an easier comparison between the conducted interviews and a clear guideline throughout the interview process. Disadvantages of this method are a lower to no way for interviewees to further develop a train of thought related to the topic, which results in a lower possibility for the researcher to hear completely new thoughts. The level of saturation is reached faster. Focused interviews are structured and are often conducted for market analysis [93]. Narrative interviews differ from focused interviews that they do not follow a concrete guideline. The interviewer opens the topic with a discussion- or thought-provoking question, which then results in an interview that further develops freely. The overall process is unstructured, the interviewer is in the role of listener. A methodology that incorporates both the focused and narrative approach are the semi-structured interviews. Semi-structured interviews are build by creating a framework with different categories that are to be discussed during the interview, but no concrete question line. The goal is to create an environment, where the interviewee follows a general line of topics, but has the freedom to elaborate and further develop their ideas, thoughts and interpretations based on their own preferences.

3.4.1 Document Analysis

[107] The document analysis is a systematic procedure for the evaluation or review of documents. It is a qualitative elicitation method, which includes the examination and interpretation of data in order to gain an understanding and develop empirical knowledge [108]. Documents for systematic evaluations include notes, agendas, brochures, books,

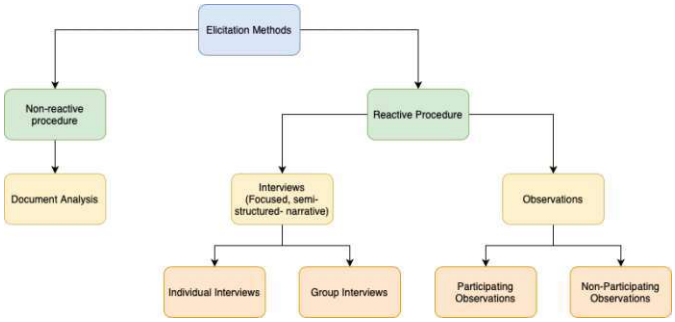

Figure 3.2: Elicitation Methods

minutes, newspapers, program proposals, summaries and more. The document analysis is often used with other qualitative research methods in order to allow for triangulation. Advantages of the document analysis according to Bowen et al. [107] are the (i) *efficient method*, which means that it is less time-consuming than other research methods with no need for a data collection, the (ii) *availability*, which is enabled through the internet, where an enormous source of documents is available to the public, the (iii) *cost-effectiveness*, with reduced costs because the data contained in documents has already been gathered, (iv) *lack of obtrusiveness and reactivity*, which means that the documents are unaffected by the research process, since they have already existed beforehand, (v) *stability*, which comes with the lack of reactivity, (vi) *exactness*, which mean the inclusion of references and details with documents and (vii) *coverage*, with the broad availability of public data over multiple years and many events in many settings. Disadvantages include insufficient details, since they are independent of a research agenda, biased selectivity and low retrievability.

The document analysis consists of three different main steps: skimming, reading and interpreting, which combines elements from both the thematic analysis and the content analysis. Similar to the qualitative content analysis, the document analysis organises information into categories. In a first step, the documents should be skimmed for passages and segments that are relevant and/or meaningful, separating pertinent from non-pertinent information [108]. This should be done in alignment with the conceptual framework of the study. In addition, it is necessary to determine accuracy, representativeness and completeness (covering all aspects of a topic and balance of described content) of documents. Following the Thematic Analysis, based on the characteristics of the data, categories are constructed in order to uncover themes to a phenomenon [109]. During this creation, pre-defined codes (e.g.: from interview transcripts) can be used and applied to the content of the documents. The data analysis can follow the constant comparative method [94], but may also follow a different evaluation methodology (e.g.: qualitative content analysis). For the document analysis, there is no specific minimum or maximum amount of documents that should be reviewed and analysed, rather it strongly depends on the quality of the documents and the evidence they contain in alignment with the purpose of the study [107].

3.4.2 Data Elicitation in this Thesis

In this paper, we conduct semi-structured individual interviews. Since the focus of the data elicitation lies on the person itself, their thoughts, feelings and knowledge, individual interviews were chosen as format in order to focus on these aspects in detail. The structure of the interviews is semi-structured, a detailed explanation of the questionnaire and the process may be found in section 3.4.3. This structure was chosen in order to allow for interviewees to elaborate on topics open-ended to gain in-depth knowledge, while still following a general schema to detect and analyse trends among the interview candidates during the data analysis and evaluation. In addition, we conduct a document analysis. This is done for two reasons: (i) The program analysed has existed for 2 years prior to this thesis. There is a significant amount of relevant documentation and data in existent materials. (ii) In order to increase the objectivity and reliability of the defined measures of this thesis through triangulation, explained in section 3.6.2.

3.4.3 Interview Process

Candidate Selection

The first limitation of possible candidates was done using the stakeholder analysis sampling method. A detailed description of the results of the stakeholder analysis can be found in section 4.1. The selection of interviewees was done by following the optimization of time, budget and quality. Quality focused on the following criteria:

(i) **Knowledge about the company (KC):** Focusing on finding participants who have been at the company for decades or a very short time. This criteria aims to understand differences in opinions, barriers, problems and mind set between new and old employees.

(ii) **Attitude towards the program (AP):** Focusing on personnel who are strongly opinionated towards or against the program. This criteria should create an understanding of the thinking process of enablers and disruptors within the program.

(iii) **Influence on the success of the program (IP):** Focusing on personnel who are of critical level for the success of the program.

(iv) **Magnitude of change for the person (MP):** Focusing on personnel that are highly impacted by the change resulting from the introduction of the new software developed within the program.

(v) **Experience in their current position (EP):** Focusing on employees who are very experienced within their role, especially process knowledge and/or political knowledge.

(vi) **Diversity in perspective (DP):** Focusing on general attributes; gender, age, background, seniority.

(vii) **Cross-functional representation (CR):** Selecting participants from different functional teams.

(viii) **Geographical diversity (GP):** Considering personnel from different geographical locations within Austria.

Since the limitations within this thesis are due to time and budget, the goal for the selection of the stakeholders is maximising the fulfilment and diversity of the quality criteria while minimizing the number of interviewees. The following list shows the concrete stakeholder positions for which one person each was defined as interviewee and their respective fulfilment of the defined quality criteria:

Interviewee	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
CIO	X	X	X		X	X	X	
Planner	X	X		X	X		X	X
Change Manager	X		X				X	
Product Manager	X	X	X	X	X		X	
Workers' Council	X	X	X		X		X	X
Dep. Lead (Prod.)	X	X			X		X	
SWARP Product Owner	X	X	X	X		X		

Table 3.1: Selected stakeholders for interview according to the defined quality criteria

The following list provides additional information about the stakeholders, elicited during the stakeholder analysis and through the knowledge of the authors.

- **CIO** The CIO is decision maker in the program and has vocalized their positive attitude towards the ARP program during various internal press conferences, calling it "the most important digitalization program of the company". They joined the company in 2022 and are thus one of the newer employees. While their future work is not directly influenced by the results of the ARP program, they influence the success of the program directly. Their headquarter is in Vienna.
- **Planner** The planners are the end users of the software developed within the ARP program. This planner has been in the company for more than 3 decades and has seen various introductions of new software tools and solutions and organizational restructurings. They have in-depth knowledge about work processes and cultural developments within the company. They are acting as enabler of the program. Their place of work is in Carinthia.
- **Change Manager** The change manager is from a newly built department within the internal IT service provider that focuses on guiding end users through change resulting from digitalization projects and programs within the company. The department was established in 2022 and has been acting as change management

office for multiple different projects since. They have been supporting the ARP program since October 2023, superseding an external company. Their place of work is in Vienna.

- **Product Manager** The product manager has been in the company for over 30 years. They have in-depth knowledge on technical processes surrounding resource planning. While they are new in the "SAFe" framework, they have extensive knowledge about leadership and political developments within the subcompany "Production". Their place of work is in Vienna.
- **Workers' Council** The workers' council has been in the company for more than 2 decades. They are very well connected and are critical towards the ARP program. Their place of work is in Tirol. The workers' council is powerful in the company and hold significant decision making powers.
- **Department Lead IT (Production)** The department lead of IT in the subcompany "Production" has been in the company for more than 2 decades. They have in-depth knowledge of current IT services and processes relevant for the software developed within the ARP program. They are vocally against the ARP program.
- **SWARP Product Owner** The product owner of SWARP has been at the company for 2 years, joining directly after the completion of their Masters. They are positive towards the ARP program and are well connected with the end users of the software developed in the ARP program. Their workplace is in Vienna.

Interview Preparation

The interview preparation included the creation of the questionnaire. The questionnaire was created on the basis of the four aspects (I) Human agency, (II) Human oversight, (III) Stakeholder participation, (IV) Social impact of the Ethics Guidelines for Trustworthy AI by the AI HLEG [6] and the Well-being Domains as defined in the IEEE Recommended Practice for Assessing the Impact of Autonomous Intelligent Systems on Human Well-Being [86], limited to the (I) Domain of Psychological Well-Being, (II) Domain of Community, (III) Domain of Affect, (IV), Domain of Government and (V) Domain of Work, (VI) Domain of Education. Some questions were also formulated based on the Domain of Belonging and Domain of Economy. The questionnaire consists of two main parts: (i) Introduction, which focuses on gaining general information relevant to AI, IT and the company about the interviewee and (ii) ARP Program, which contained general questions about the program with focus on the research questions. In addition, individual questions for each participant were created, depending on their respective position within the company and the ARP program, with the exception of the CFO due to time constraints of the interviewee. Table 3.2 shows a list of all the questions and the respective origin from the IEEE 7010-2020, mapped to the Ethics Guidelines for Trustworthy AI.

	Questions	IEEE 7010-2020	AI HLEG
	Introduction		
1.	How do you see the culture at company? Do you think the motto 'Us before me' is lived?	Belonging	Societal and Environmental Well-Being
2.	How knowledgeable do you think are you in regards to IT?	X	X
3.	What do you think are the biggest challenges for company in the future?	Work / Economy	X
4.	What are your experiences with AI so far? What do you think about everything you have heard about it so far? Does it live up to its hype?	Education	Diversity, Non-Discrimination and Fairness
5.	Do you think that AI rises ethical concerns? How do you define trustworthiness and human-centricity in regards to AI?	Psychological Well-Being / Government	Human Agency and Oversight
6.	How do you think AI will be (or is) perceived at company?	Community	Transparency
	Do you think that company focuses on these aspects already?		
	Questions about the ARP program		
7.	Thinking of a ship in the water, how would you describe the ARP program, if it was one?	X	X
8.	When you think of the ARP Program, what kind of feeling do you get?	Affect	Societal and Environmental Well-Being
9.	How big would you say is the impact for you?	Work	Societal and Environmental Well-Being
10.	What do you think are the biggest challenges for the ARP Program?	Work	X
11.	Thinking of the structure of company, its people, the culture, its processes. What do you think are internal barriers?	Community	Accountability
12.	What is your biggest fear when it comes to the ARP Program?	Psychological Well-Being	Societal and Environmental Well-Being
13.	What is your biggest expectation towards the ARP Program?	Work	Transparency
14.	Circling back to the question about ethical concerns and how you define trustworthiness / human-centricity. Do you have the feeling that the AI developed in the ARP program will have issues with that? Why yes / no?	Psychological Well-Being / Government	Human Agency and Oversight
	Specific Questions		
15.	Do you trust the software to make you good recommendations? Do you know how it works? Would you want to know?	Work / Education	Human Agency and Oversight / Transparency
16.	Do you think that the new software and processes will help you in your work?	Work	Transparency
17.	Do you think that management, program team and company in general is doing enough to guide you through the change? What else could be done?	Community	Diversity, Non-Discrimination and Fairness
18.	Thinking of the software, do you have the feeling that you will be able to make informed, autonomous decisions regarding the software?	Psychological Well-Being / Work	Human Agency and Oversight
19.	What are the stakeholders of the program? Which ones are the most relevant ones?	Community	Diversity, Non-Discrimination and Fairness
20.	How are these stakeholders consulted?	Community	Diversity, Non-Discrimination and Fairness
21.	Do you think the software will have an effect on the mental well-being of the affected users? If yes, what measures can be taken to reduce the effect? If no, why?	Psychological Well-Being	Societal and Environmental Well-Being
22.	What are the most important change management aspects in this program?	Work	Diversity, Non-Discrimination and Fairness
23.	To which level will humans be able to intervene with the system?	Work	Human Agency and Oversight
24.	What are the primary concerns of the workforce regarding the integration of AI and the ARP program?	Psychological Well-Being / Work	Diversity, Non-Discrimination and Fairness
25.	How transparent is the communication from management about the ARP program and its impact on employees?	Community	Transparency
26.	How does the Workers' Council ensure that the ethical implications of AI integration are considered and addressed?	Psychological Well-Being / Government	Human Agency and Oversight
27.	How do you envision your role in facilitating the ARP program's success within your department?	Work	Diversity, Non-Discrimination and Fairness
28.	How do you think the ARP program will impact day-to-day operations in your department?	Work	Societal and Environmental Well-Being
29.	What are the main operational challenges you anticipate with the implementation of the new software?	Work	Technical Robustness and Safety
30.	What feedback have you received from your team regarding the ARP program?	Community	Diversity, Non-Discrimination and Fairness
31.	How do your colleagues think of the coming change? What are the biggest arguments for and against the program/software?	Community	Societal and Environmental Well-Being
32.	Do you think people are afraid of the coming change? What could be done in your opinion to ease the transition?	Psychological Well-Being	Societal and Environmental Well-Being / Diversity, Non-Discrimination and Fairness
33.	How do you plan to drive user acceptance and adoption of the SWARP product among planners and other end-users?	Work	Diversity, Non-Discrimination and Fairness
34.	What strategies are in place to ensure that the AI recommendations are transparent and understandable to users?	Psychological Well-Being / Education	Transparency / Human Agency and Oversight

Table 3.2: Questions of the Questionnaire, mapped to IEEE 7010-2020 [86] and the Ethics Guidelines for Trustworthy AI [6]

Interview Execution

The interviews were conducted in person. The date, time and place of the interviews was set via E-mail in communication with each interviewee. The interview itself was set for 60 minutes for every stakeholder with the exception of the CFO due to availability constraints. Each interview was recorded with two different devices: (i) a digital voice recorder (AGPTEK Digital Voice Recorder A11) and (ii) an iPhone 13 Pro Max in order to minimize the possibility of any errors. Before the interviews were started, each interviewee was informed about the reason of the interview, its duration, the agenda points, the topic of research, data anonymity, the interviewer, the type of interview and the next steps, including the validation method "Communicative Validation" as described in section 3.2. In addition, an allowance for the recording of the interview was requested. The average duration of the interviews was 57 minutes and 23 seconds. The shortest interview was 48 minutes and 18 seconds, the longest interview was 1 hour 14 minutes and 53 seconds.

Adaptations and Challenges

The interview process in general worked as planned. An adaptation of questions included the change of the order of the questions depending on the interviewee. Some interviewees opened up early on about their challenges and thoughts on the ARP program. The approach of the interviewer was to skip the introduction part and lead the interview to the questions about the program and individual questions of the interviewee. The introductory questions were then asked at a later point during the interview. In addition, some questions that were planned for specific roles were also relevant for different roles. These questions were then asked additionally to the planned ones.
Challenges included the inexperience of the interviewer during the first and second interviews. While the interview order was planned so that the first few interviews are with employees familiar with the interviewer, a guidance throughout the interview was not always straight forward. Another challenge was also the retrieval of relevant information of interviewees, who did not talk freely and were short with their responses while also dodging the questions (="political answers"). The strategy for these cases was to ask in more detail and focus on their personal opinions to reduce generalisations or evasions of the answers. On the contrary, interviewees who were very open and communicative were guided less. Even if the topic was not directly relevant to the interview, they were not interrupted and only slowly guided back to the topic at hand in order to not disrupt the flow of the conversation. Often, these semi-related topics contained information that turned out to be relevant for the research subject.

3.5 Analysis Methods

Central element of the qualitative research methodology is the analysis of the data and materials. In general, the analysis and interpretation of data follows two different goals [88]: (i) reduction and structuring of the original data and material or (ii) finding and revealing hidden (or latent) content of the underlying material. (i) focuses on categorizing data. The goal is to find a common denominator across a large number of material and data sources. An example, which is further described in section 3.5.1 is the qualitative content analysis. (ii) focuses on the interpretation of the data material. The goal is to gain a deep understanding of the data basis. This usually leads to an increase of material due to the additional creation of interpretation. An example is "open coding" of the Grounded Theory [94].
Structured approaches are commonly used when concrete processes or experiences should be traced, or when arguments and assessments are examined. Interpretative approaches are commonly used, when the research focuses on parts which are not directly known to the interview partner or respondents. Examples for this are social structures or stereotypes.

3.5.1 Qualitative Content Analysis

The qualitative content analysis by Mayring et al. [110] presents a structured and systematic approach to the analysis of data and material. By using a category-system, the goal is to make the data more manageable and clear. There are three different techniques for the qualitative content analysis.

- **Summarising Content Analysis** is used to reduce the data basis to the core content, but abstract it in a way that allows for a summary that represents the underlying data. This is done by paraphrasing the whole content and abstracting it to a defined abstraction level. Irrelevant paragraphs and content is removed and similar paragraphs are combined during this process. The summarising content analysis is often used when the underlying dataset is open, unstructured and different within its content. The summarising content analysis is also often used as pre-step to the actual analysis. The general steps are the (i) paraphrasing of the original content, (ii) generalisation of the paraphrased content, (iii) reduction of the generalisation.

- **Structured Content Analysis** is a technique, where the analysis is based on an underlying criteria catalog or system. The goal is the filtering of content based on predefined order criterion or the categorization of the content. This is done for the whole dataset and all materials. The result should be a defined category system in which all data and material are clearly mapped to individual categories within the system. The steps of this technique are the (i) definition of categories based on existing theory, the (ii) creation of concrete examples out of the underlying data set for each category and the (iii) definition of coding rules, if there are any

dependencies between categories. The category system may be further developed during the analysis of the given data and material.

- **Explaining Content Analysis** is a technique with which additional material is acquired for parts of the basis material that are too few to interpret. In the first step, additional context material is acquired (e.g.: by conducting more interviews or specific interviews for the required parts). The optional second step is the acquisition of data that is not directly related to the topic at hand but goes beyond it (e.g.: gathering of information related to the origin of the topic at hand). The result of the explaining content analysis is a paraphrase that is used instead of a specific textual part.

3.5.2 Analysis Method in this Thesis

In this paper, we follow the qualitative structured content analysis by Mayring to analyse the elicited data. The qualitative content analysis was chosen due to the goal of this thesis - which is to find common denominators across multiple different perspectives and data sources in order to deduce measures for an alignment of relevant stakeholders. The goal of this thesis is not to build new theories from the ground up, but to deduce measures and insights based on theory. The structured content analysis was chosen over other qualitative content analysis methods because of its clear and defined approach to the analysis, which allows for better evaluation and higher degree of objectivity.

3.5.3 Approach to the Content Analysis

The content analysis was done using a category system. The system was created deductively, based on the relevant aspects of the research questions 1.1. The research questions focus on three different aspects: (I) Impact on Work Processes and Job Security, (II) Internal Barriers to AI Integration, (III) Human Centric and Ethically Responsible AI Integration. While these three aspects are not exhaustive, the other aspects are described in different sections. This includes the Stakeholder Analysis 4.1 and the deduction of measures 5, which are based on the results of the qualitative content analysis.
Table 3.3 shows the deductively created category system for the document analysis 4.2 and interview analysis 4.3.

Coding Guidelines

The following guidelines explain the categories in detail. The categories are defined, an anchor example is given for each category, which represents the category from a content viewpoint and additional, optional coding rules, if the category is not clearly separated from other categories. The following list already includes categories that were changed or added during the document analysis and interview analysis. This follows the deductive-inductive research methodologies. The categories are thus different from table 3.3, changes are mentioned as *Notes* below the name of the respective category.

Category	Management	Employees	Source
Impact on Work Processes and Job Security			
Fears			
Experiences			
Expectations			
Ethical Concerns			
Internal Barriers to AI Integration			
Organisational Barriers			
Financial Barriers			
Regulatory and Compliance Barriers			
Technical Barriers			
Human Centric and Ethically Responsible AI Integration			
Human Agency			
Human Oversight			
Stakeholder Participation			
Social Impact			

Table 3.3: Basis of the category system for the document analysis 4.2 and the summary of the interviews 4.3

Impact on Work Processes and Job Security

- Name of the Category: **Fears:**
  - Definition of the Category: This category represents a conglomeration of content that is about fears of stakeholders towards the ARP program. The clear separation from this and other categories is that this category deals with thoughts and feelings, not experiences. The origin of these thoughts and feelings could stem from experiences, but are then separate from each other.
  - Anchor Example: "My biggest fear is that the program team collapses somehow."
- Name of the Category: **Experiences:**
  - Definition of the Category: This category represents a conglomeration of content that is about experiences with the ARP program of stakeholders. Experiences are concrete examples and/or contact that the company has had with the ARP program.
  - Anchor Example: "The ambassador network works well."
  - Coding Rules: (I) Experiences can also include contact points that are not direct. That means, if a stakeholder has received positive or negative information from any second-hand source and specifically mentions that in the interview (which the authors translate as memorable information for the interviewee), the information will be coded to the category. (II) Experiences can also contain feedback from events or interactions from stakeholders.
- Name of the Category: **Expectations:**
  - Definition of the Category: This category represents a conglomeration of content that is about expectations towards the ARP program of stakeholders. Expectations contain concrete outcomes that stakeholders believe to happen through or during the ARP program. This category also includes thoughts and feelings towards the meeting of such expectations - which means that low expectations or expectations of failure are also part of this category.
  - Anchor Example: "I expect the system to be faster than its predecessor."
  - Coding Rules: (I) Expectations are separate from experiences that they do not originate from concrete experiences. That means, if a person does not believe that the software works after having seen it, it would be part of experience. If they have not interacted with the software and expect it to not work, it would be part of expectations.

- Name of the Category: **Ethical Concerns:**
  - Definition of the Category: This category represents a conglomeration of content that is about ethical concerns stakeholders have.
  - Anchor Example: "I see the training of datasets as critical, because it is possible to manipulate through that."
  - Coding Rules: (I) Ethical concerns are not focused on the ARP program and its AI part. Ethical concerns are about general concerns stakeholders have towards Artificial Intelligence.

Internal Barriers to AI Integration

- Name of the Category: **Organisational Barriers:**
  - Definition of the Category: This category represents a conglomeration of content that is about organisational barriers. Organisational barriers are hindrances that might arise during or after the implementation of the ARP program, which originate or result in structural or hierarchical challenges.
  - Anchor Example: "The biggest challenge will be the organisational structure after the ARP program is completed."
- Name of the Category: **Cultural Barriers:**
  This barrier was added later during the interviews, since several interviewees mentioned barriers which are separate from organisational barriers and focus more on the cultural background of the company.
  - Definition of the Category: This category represents a conglomeration of content that is about cultural barriers.
  - Anchor Example: "The company culture is very hierarchical, while the program is agile. This leads to "young vs. old".)
  - Coding Rules: The cultural barriers focus on individual people or groups within the company and their thinking or setting towards topics. In the anchor example, the hierarchical aspects focus on the thoughts of the employees (=cultural), not on the actual structure of the company (organisational).
- Name of the Category: **Financial Barriers:**
  - Definition of the Category: This category represents a conglomeration of content that is about financial barriers. This also includes feelings towards the financial attributes of the ARP program.
  - Anchor Example: "The costs of the program are very high. Is it really worth it?"

- Name of the Category: **Regulatory and Compliance Barriers:**
  - Definition of the Category: This category represents a conglomeration of content that is about regulatory barriers or barriers surrounding compliance. Since the focus of this study lies on internal barriers, only regulatory requirements or compliance requirements set forth by the company itself are in this category.
  - Anchor Example: "The biggest aspect for us (the worker's council) is the data privacy of our employees."
- Name of the Category: **Technical Barriers:**
  - Definition of the Category: This category represents a conglomeration of content that is about technical barriers. These are about implementational parts of the software and/or systems, but can also include technical details such as roll-out or system detachments.
  - Anchor Example: "The success of the program stands and falls with the training concept."
  - Coding Rules: Training for the end users are also part of this category, because they focus on the technical aspects of the software.

Human Centric ad Ethically Responsible AI Integration
Note: All of the following categories have been name-changed. There are three reasons: (1) The categorization of the elicited data was too often not clear, especially between Human Oversight and Human Agency. (2) The defined categories turned out to be not sufficient to represent the underlying dataset. (3) There was a mix between granular requirements of the Ethics Guidelines for Trustworthy AI and the main requirements as defined. Thus, the authors decided to abstract the granular requirements to their respective main requirements. The changes are remarked in the notes of the categories.

- Name of the Category: **Human Agency and Oversight:**
  Note: Formerly separeted into two categories: Human Agency and Human Oversight
  - Definition of the Category: This category represents a conglomeration of content that is about the human autonomy and decision-making when using AI systems. Human agency and human oversight have been defined in 1.1.
  - Anchor Example: "The system is a support system. The user has the last decision."
  - Coding Rules: This category contains data related to the support of the system, the decision making process and the intervention possibilities. For example: The end user does not see how the software generates recommendations is considered as part of (in this case limited existing) oversight possibilities of the system, not transparency and is thus part of Human Agency and Oversight

- Name of the Category: **Diversity, Non-discrimination and Fairness:**
  Note: This category was formerly named Stakeholder participation, a sub-requirement of this requirement.
  - Definition of the Category: This category represents a conglomeration of content that is about the inclusion and consideration of all affected stakeholders throughout the process.
  - Anchor Example: "The ARP program includes end users and process insiders into the development of the program and process."
- Name of the Category: **Transparency:**
  Note: New category, added due to high amount of data pointing towards this category within the Ethics Guidelines.
  - Definition of the Category: This category represents a conglomeration of content that is about explicability and transparent elements of the system. It contains traceability, explainability and communication.
  - Anchor Example: "End users do not understand how the software works."
- Name of the Category: **Societal and Environmental Well-Being:**
  Note: This category was formerly named Social impact, a sub-requirement of this requirement.
  - Definition of the Category: This category represents a conglomeration of content that is about the principles of fairness and prevention of harm.
  - Anchor Example: "The affected stakeholders will probably have increased levels of stress after the implementation of the software."

3.6 Evaluation

3.6.1 Communicative Validation

In order to validate the adequacy of the reconstruction of the subject theory, we used communicative validation. This method is representative of the quality criteria reproducibility. The communicative validation was conducted through 30-minute interviews with stakeholders. The stakeholders interviewed were part of the sample group and had experience with the master thesis topic and the questionnaire. In addition, we also conducted interviews with stakeholders that had created documents and data analysed during the document analysis to fully capture the triangulation approach and evaluate using a larger pool of resources. During the interviews, the interviewees were presented with the results of the discussion section and the results section. This included the mapped category systems, the figures of barriers, fears, expectations and experiences and the resulting measures. The interviewees were asked to give feedback whether the shown results captured were in alignment with their expectations, thoughts and feelings surrounding the presented topics. In detail, table 4.2, 4.3, 4.4, 4.5, 5.1, 5.2, 5.3 and 5.5 were shown and discussed.
The results of the interviews showed, that the different perspectives were captured correctly. Figure 5.1 and 5.2 were representative of the thoughts of the interviewees. It is noted, that some of the interviewees mentioned, that the presented results are on a higher level of abstraction than what they initially conveyed. During the interviews, the topic job security lead to different opinions. This is in alignment with what was identified during the triangulation, that non-affected employees are not aware or do not believe the insecurity caused by the introduction of AI technologies in affected employees.

3.6.2 Triangulation

We are using Triangulation to combine the results of the document analysis and semi-structured interviews in order to test the correlation validity of the semi-structured interviews and increase the construct validity. In addition, we also use triangulation to increase the stability of the model by eliciting additional material for a more detailed level of information. By using Triangulation, we were also able to increase validity by addressing biases in the underlying datasets through the elicitation of different perspectives.
Triangulation was used during the creation and adaptation of the category system. This lead to the creation of the initial main stakeholder groups and the dimensional differentiation of the underlying datasets as shown in the mapped category systems. The data basis in the document analysis was strongly biased towards management. This has two main reasons: (I) A lot of the elicited data of the data basis of the document analysis were created for management or by interviewing / surveying management. This lead to the content being mainly targeted towards this group and thus adapted to cater to their respective needs and points of interest. (II) During the semi-structured interviews, the interviewees displayed focus on management. This also lead to a lower level of intersections between the document analysis and the semi-structured interviews.

Nevertheless, topics that intersected showed a similar or the same trend across both methods. One exception is the topic on job security. Data analysed during the document analysis specifically mentioned that job security is not a concern, while some of the semi-structured interviews specifically mentioned this being one of the most prevalent fears of the affected employees. Others said that job security was of no concern, highlighting a gap between affected employees and other stakeholders and among affected employees themselves towards this topic. Since the trend showed, that this topic was of interest, no matter the opinion towards it, we focused on job security specifically during the creation of concrete measures as explained in section 5.2.

3.6.3 Quality Criteria of the Qualitative Content Analysis

Mayring et al. [12] have defined quality criteria for validity and reliability of the qualitative content analysis. These are shown in graphic 3.3

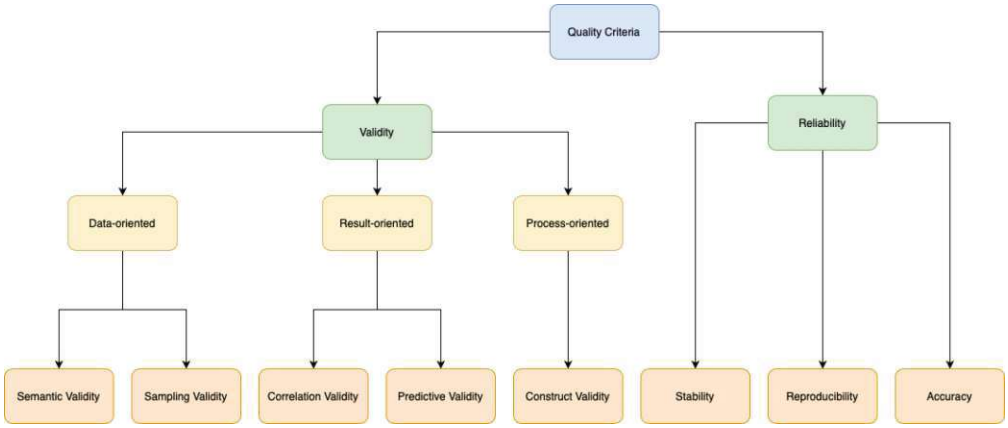

Figure 3.3: Quality Criteria for Qualitative Content Analysis by Mayring et al. [12]

- **Semantic Validity** is the correctness of which material is categorized as well as the definition of the categories themselves. Testing can be done by expert judgement or checks, which check for homogeneity of passages, construction of problem cases.
- **Sampling Validity** is the check of the correct usage of the sampling strategy. Testing is done by looking at the population, representative, and control whether the selection applies to the sampling method.
- **Correlational Validity** is the validation of results with studies or results that have similar research questions. The testing is done by comparing results, methodologies and interpretation similarities and differences.
- **Predictive Validity** is a criterion that checks for the quality of prognosis. Testing is done by checking for correctness of prognosis.

- **Constructive Validity** is the qualitative check whether the construct is represented accordingly. Testing is done by checking success rates of similar constructs or situations, interpretations by experts, established theories and models or experiences with the context of the data.
- **Stability** is the check whether the analysis instrument always leads to the same result. Testing is done by using the instrument on the same data again.
- **Reproducibility** is the correctness of the result of the analysis using different circumstances. Testing is done by measuring via the inter-code reliability, checking for the percentage of agreement. Krippendorff et al. [111] define the following coefficient for the measure of reliability: $R = 1 - \frac{(observedcoderdisagreemnt}{(expecteddisagreementbychance)}$.
- **Accuracy** is the degree of the analysis to which it conforms to a functional standard. The accuracy incorporates stability and reproducibility and is the most accurate indicator for reliability, but also the hardest to test. Testing can be done by e.g.: inter-coder reliability.

For the evaluation, following the quality criteria defined by Mayring, we conducted interviews with experts. In concrete, five different experts were interviewed: (I) Ex-C-Level manager of OMV with extensive knowledge in multi-million transformation programs, stakeholder and change management, (II) Expert in Data Science and Senior Researcher, with multiple years of experience in scientific research and optimization of processes using machine learning technical mathematics, (III) Manager in organisational change management, who built up a change management department for internal change management, (IV) Expert in Cyber Security and AI Safety, who has several years experience as penetration tester and ethical hacker and speaker about AI advancements and AI Safety, (V) Program Lead of large, complex (IT) transformational programs. Two of the interview partners have extended knowledge on the program and the company. The other three have basic knowledge of the company and were briefed of the approach and goals of the ARP program. In addition, two colleagues

Semantic Validity

The semantic validity was judged through the expert interviews. During the interviews, some changes in the the results of the fear analysis were requested due to inconsistencies in the definition of what constitutes as fear. These changes were incorporated into the final thesis. The categories and their adaptation throughout the research were accepted and the coding guidelines validated.

Sampling Validity

The sampling method used was purposive sampling. We used the stakeholder analysis to analyse relevant stakeholders and their impact on the ARP program to determine a representative subset of stakeholders for the semi-structured interviews. The level

of "representativeness" was defined through quality criteria 3.4.3. The focus was on optimizing time, quality and budget, while finding a highly diverse subgroup of interview candidates. Since the size of the total population of which the subgroup was defined of is limited to the number of employees in the company, which are all known (not as individuals, but in their job position), the quality criteria to define possible interview candidates can be set in a way to allow for a high degree of "representativeness". This was validated through expert interviews.

Correlation Validity

The correlation validity cannot be validated in this paper. There are no external studies that focus on human-centric and ethically responsible, concrete measures for transformational AI programs. The correlation validity was tested with different data sources and methodological approaches in the form of triangulation as explain in section 3.6.2.

Predictive Validity

The predictive validity cannot be fully validated in this paper. This is due to time constraints, which do not allow a validation phase of >3 years to comply with the quality criteria "Predictive Validity". Nevertheless, the results of the expert interviews and additional presentations of the measures to the program team, the program team is planning on implementing the defined measures. For this, concrete steps have already been defined to integrate the measures into the ARP program.

Constructive Validity

The constructive validity was tested through expert interviews, established theories and experiences with the context of the materials. The underlying theory of which the concrete measures are based on is the ADKAR model. The authors have in-depth knowledge on the materials, originating from their work experience in company-wide projects, knowledge of the company due to employment and direct contact with the ARP program. Expert interviews focused on the correctness of the content of the measures, barriers, experiences and expectations. In addition, triangulation was used to increase the constructive validity as explained in section 3.6.2.

Stability

We tested stability by starting the coding process anew, using tables 4.2, 4.3 and 4.4. The results were mapped to the final category system and compared to the results presented in table 4.5. The comparison showed little differences. It is noted, that the check for the stability quality criteria was done shortly after table 4.5 was created.

Reproducibility

For the testing of reproducibility, two colleagues were asked to create the mapping displayed in table 4.5. The materials received to create the mapping were tables 4.2, 4.3 and 4.4 and their respective source files in the form of the transcribed interviews. In addition, general information about the case study and the interviewees as described in section 1.5 and 3.4.3 were given. The results of the mapped tables were inherently similar. Main differences were the interpretation of barriers, challenges and fears as negative points towards the experiences; e.g.: Colleagues within the program have both positive and negative feelings (compared to positive work environment in the original results) due to the fear of program dissolving and high expectations resulting in a tenser work environment.

Accuracy

The accuracy cannot be fully tested due to constraints in time and resources. It is noted, that according to Krippendorff [111], the non-reliability can be distiguished by four different aspects: the assessment units, the analyst, the individual categories and the category differentiation. During the evaluation in reproducibility, we validated the reliability within the category differentiation and the individual categories through the coding guidelines in section 3.5.3.

CHAPTER 4

Results

4.1 Stakeholder Analysis

The management team of the ARP program conducted two stakeholder analysis between 2022 and 2023. The first stakeholder analysis contained 220 employees, all in management positions (department lead to board of directors) and spanned over all relevant subcompanies. Attributes of each were defined: Name, company, department, position in company, technical relevance for ARP (y/n), relevance for shift and deployment planing, relevance for support in controlling, involvement in the program (1-5), relevance for the program (1-5), mindset towards the program (1-5), impacted by ARP for that person (1-5), change readiness, email.
The second stakeholder analysis was more focused and contained 90 employees. The stakeholder analysis identified three different main areas: (i) *Top Management*, (ii) Management and (iii) *Personnel*. Within each of these areas, stakeholders of each participating sub-company (PV, RCG, INFRA + Production) were identified. Top Management includes managing director and members of the board of directors as well as the worker's council. Stakeholders in Management are employees of the company who are in a managing position higher than team lead. This includes department leads and area leads. The attributes were stakeholder name, time relevance for the program (<3 months, 3-12 months, >12 months) (focusing on when the stakeholders should be addressed during the change management process), influence on the success of the pilot in Carinthia (low, medium, high) (Reference:1.5.5), influence on the success of the program (low, medium, high), mindset towards the ARP program (positive, neutral, negative), impact by ARP for that person (low, medium, high), change readiness, comments. The information for the stakeholder attributes were gathered through a survey and interviews. In total, 20 interviews with managers that are area lead or higher and 21 survey participants of role department lead were conducted.
In detail, the analysis shows management that are related to the program, either by

being sponsors, making direct decisions through the program management committee or by having areas of responsibility that are affected by the results of the ARP program. Personnel is separated into key users, end users (planner and dispatcher, operative personnel) and the agile project teams (See: 1.5.3 and 1.5.4). Graphic 4.1 shows the results of the stakeholder analysis, including the different roles and additional information for roles in the 3 main subcompanies (PV, RCG, INFRA) and the subcompany Production. The total number of stakeholders identified are 150 people in 28 different roles. Graphic 4.1 shows a visual tree with the stakeholders in the individual subcompanies and their respective roles, as well as the interconnections.

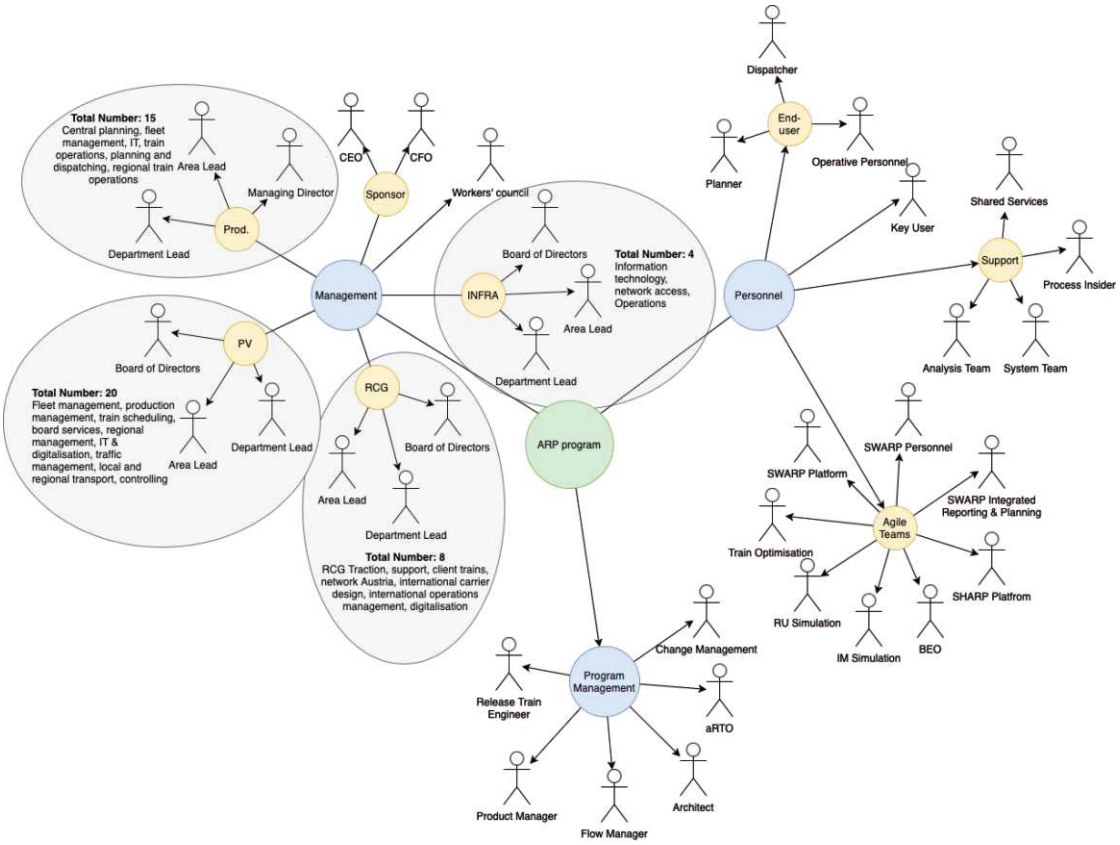

Figure 4.1: Stakeholder Analysis ARP Program

The following list gives insights into the results of the second stakeholder analysis, conducted in November 2023, split into the different categories.

4.1.1 Top Management

Top management contains a total of eleven people. Two of them are sponsors (CEO, CFO), the others are on executive/board of directors level in the respective subcompanies.

Time relevance for the program
Out of the eleven people, 10 have a time relevance of the program of less than 3 months, which means that the pilot in Carinthia is relevant for them and change management measures should be applied respectively. The last person has a time relevance of more than 12 months.
Influence on the success of the program
Six out of eleven people have a high influence on the success of the program. Five of them are part of the board of directors, one is managing director. Three have a medium influence, two low.
Mindset towards the ARP program
Six people have a positive mindset towards the ARP program. Three have a neutral mindset and two are unspecified due to successors coming in the near future.
Impact by ARP
Five people in top management are highly impacted by the outcome of the ARP program. Four have low impact. The two program sponsors are not included.

4.1.2 Managers

Managers are department leads or area leads. There are a total of 43 managers identified. There is no information for every position and every evaluated measure available. **Time relevance for the program**
Out of the 43 managers, 15 have a time relevance of less than 3 months for the program. One person has between 3-12 months and one more than 12 months. The rest is not specified.
Influence on the success of the pilot in Carinthia
Five managers have a high influence on the success of the pilot in Carinthia, six a medium level and five a low level. The rest is not specified.
Influence on the success of the program
Six managers have a high, nine managers a medium level of influence on the success of the program. Two have a low influence. The rest is not specified
Mindset towards the ARP program
Ten people are positive towards the ARP program, five neutral and two negative. The rest is not specified.
Impact by ARP
Ten are highly impacted by the outcomes of the ARP program. Two medium and three low. The rest is not specified.

4.1.3 Employees

The employees are not named individually but are categorized into their area of work. They also include the product teams of the ARP program. In addition, they are further distributed into Key user and End user (with additional, concrete end user segregation). There are 25 different categories in total.
Time relevance for the program

Out of the 25 employee categories, 16 have a time relevance of less than 3 months for the program. 3 employee categories have between 3-12 months and 6 more than 12 months.

Influence on the success of the pilot in Carinthia

Two employee categories have a high influence on the success of the pilot in Carinthia and two a medium level. The rest is not specified.

Influence on the success of the program

Fourteen employee categories have a high, three a medium level of influence on the success of the program. Six have a low influence. Two are not specified.

Mindset towards the ARP program

7 employee categories are positive towards the ARP program, 14 neutral and 4 negative.

Impact by ARP

17 are highly impacted by the outcomes of the ARP program and 6 medium. The rest is not specified.

The gathered data was used to create two stakeholder maps with different aspects. The first stakeholder map displayed a matrix representation, which shows different relevant stakeholders categorized into four different columns along two axis (x-axis: mindset towards the ARP program (positive/negative), y-axis: level of influence on the success of the ARP program(low/high)): supporter (positive, low), critic (negative, low), multiplicator (positive, high), show stopper (negative, high). The stakeholders were chosen based on the attribute "time relevance for the program", focusing on management employees categorized as <3 months or 3-12 months. Out of the seventeen displayed management employees, five are supporter, zero are critic, three are multiplicators, one is show stopper. The others are between supporter and multiplicator (three), or between multiplicator and show stopper (five). Interesting to note is that in total, ten people have a positive mindset towards the ARP program and five are neutral according to the analysis. Only two of the seventeen stakeholders are negative towards the program. The second map has the same structure and motivation, but only focuses on employees who are not in a management position. In addition, the mentioned stakeholders are not necessarily individuals, but also departments. Out of the 11 stakeholders, one is multiplicator. All other stakeholders are neutral towards the ARP program and have a high influence on the success of it. The results were used to plan continuous communication plans (4.2.2) and focus points for events and workshops (4.2.3).

4.1.4 Future Outlook

A short interview with one of the Core Management Team of the ARP program was conducted in order to analyse the current status of the stakeholder map. The interviewee specifically mentioned that the stakeholder analysis will be updated in the coming weeks. They noted, that there are little expected changes in the stakeholder analysis.

4.2 Results of Document Analysis

The document analysis was conducted on material elicited during the program, starting in 2021 up until the date of the analysis (June 2024). The material was created by different members of the program and external consultants. In general, the material can be clustered into the different stakeholders addressed and the respective communication method used. In total, 106 documents (word, powerpoint, txt, videos, audio) in 13 different categories were analyzed. The process of the document analysis follows the principles defined by Bowen et al. [107] as described in section 3.4.1. The relevant documents were first retrieved from various sources from the company. A first categorization was created, based on the research questions, the Ethical Guidelines for Trustworthy AI [6] 3.5.3 and first trends analyzed from skimming the data. It is noted that the gathered data for the document analysis was created by the ARP team, or external support, commissioned by the ARP team.

4.2.1 Change Readiness

One of the attributes elicited in the stakeholder analysis was the change readiness, which indicates the degree of readiness to accept the change resulting from the successful implementation of the ARP program. This elicitation was done by conducting qualitative individual interviews with a selected number of stakeholders and a quantitative evaluation in the form of a survey with all stakeholders in a leading position as department lead or team coordinator.
In total, 20 individual interviews were conducted with an average duration of 68 minutes. These interviews were conducted online from February to April 2022. Interviewees were only of position area lead or higher and participates are from six different subcompanies. The agenda to the interviews contained four main points: Current situation, ARP program, Leading and Communicating, Outlook. In 26 questions, the interviewee was asked about their mindset towards the ARP program, their contribution, possible communication methods, acceptance of employees for that topic, the understanding for the need of the ARP program, needed resources, chances, risks and general topics the interviewees are interested in within the company.

4.2.2 Continuous Communication

The ARP team uses different methods and tools for communicating with stakeholders. The form in which is communicated varies depending on topic and target group. Continuous communication is done in the form of newsletters, postings, live demos and interviews. Content includes textual media, pictures and videos. In concrete, the ARP program has several ways of continuous communication:

- **Executive updates:** The executive update focuses on the target group upper management. It includes a presentation in which various answers relevant for the

target group are answered. These contain questions from the topics Future Outlook, Change Management, Strategy, Co-operation between project and subcompanies, Risks and Chances, Communication and Information, Reasons for the ARP program.

- **Newsletters for company-internal communication platform and E-mail:** The newsletters focus on individual topics that come up as the ARP program progresses. Past newsletters gave an overview of the ARP program, infos about the change vision workshop 4.2.3, the ambassador network (4.2.2), management information about goals of the program and tasks for management, information about persona creation and research in connection to the ARP program. In total, five newsletters were published in 2022 and one in 2024. The reach of the internal platform spans across the whole company, but focuses mainly on German-speaking employees. In addition, the newsletters were also sent to employees who signed up to receive communication via E-mail about the ARP program.
- **ARP page on internal platform:** The ARP program also has their own internal link, which shows an overview of the different components of the program, goals, vision, program team and FAQ. The individual product teams and their tasks are explained and links to further resources and documents are displayed.
- **ARP one-pagers:** One-pagers were created, which summarise relevant topics on one page each. These topics include: The ARP program (goals, vision, change vision), the structure of the program, which shows the different agile teams (as described in 1.5), information on the agile approach and an explanation on agile release trains, the ambassador network (4.2.2), information about artificial intelligence, the ARP user centered design (4.2.4), information and results of the third change readiness survey (4.2.1), the PI planning process, an overview of the agile teams, and a description of the planned pilot run in Carinthia (1.5.5). The one-pagers were partly outdated and regularly contained empty fields.

The Ambassador Network

The Ambassador Network is a subset of employees at the company who act as multiplier for the vision, strategy, approach and current status of the ARP program to their peers. In addition, they also voice opinions, thoughts, problems, opportunities and information gathered from their peers to the ARP program team. The goal is for the network to represent their colleagues in front of the ARP team.

Being in the ambassador network allows for the following options:

- Regular meetings, in which ambassadors are informed about challenges, resistances and new developments in regards to the ARP program
- A central point of communication to which questions can be asked
- An information hub, which includes relevant content surrounding the ARP program

- Options to influence the development of the ARP program as ambassador
- Being part of trainings and coaching

The time effort required for ambassadors was guessed by the program to be around 2-4 hours per month as baseline, increasing depending on the additional effort that is put in by individual ambassadors. Currently, the ambassador network includes 42 employees, working in Vienna (30), Graz (2), Innnsbruck (2), Linz (2), Salzburg (2), St. Michael (1), Villach (3) and are distributed across 5 subcompanies.

4.2.3 Events and Workshops

The ARP program has had various events and workshops so far. Depending on the target group and event, they ranged from content creation workshops to communication events. The following list provides an overview of the conducted events and workshops:

- **Change Vision Workshop (2022):** The goal of the change vision workshop was the creation of a change vision which is "inspiring, understandable and relevant for all stakeholders of the ARP program". 19 employees, as well as the core program team and external coordinators and partners participated. Concepts of Industry 4.0 / 5.0 were presented and a study by Frey and Osborn (Technological Forecasting & Social Change [112] was discussed. For the creation of the change vision, design thinking approaches were used. The workshop resulted in the following change vision: "ARP enables future-oriented and professional opportunities for the self-controlled development of employees - and environmentally friendly companies. ARP facilitates employees in their work and reduces job complexity through innovation and user-friendly solutions and understandable, reliable and accessible information.".
- **Railshows (2024):** The ARP Railshow is an event which is organised with the goal to inform stakeholders who have had little contact with ARP about the goals of the program, the approach and software. It is organized in regular intervals, the first railshow was conducted in Q2 2024. The number of employees who attend is between 20-40. Main stakeholders who have attended so far are planners and dispatchers. The name "Railshow" is not only used because of the company, but also of the concept - they are conducted at various locations in Austria. So far, there were 4 Railshows in Vienna, Upper Austria and Carinthia. The contents of the Railshow are the introduction to the ARP program, information about the ambassador network, Q&A and a demonstration of the current status of the developed software in SWARP.
- **Product Increment Events (PIP):** The Product Increment Planning (PIP) is a reoccurring 2-day event for the program team. It is part of the agile framework "SAFe" [43] and is organized every four sprints, so every three months. The event is

split into two parts. The (i) Inspect & Adapt Workshop and the (ii) PI-Planning. (i) Includes a review of the last period for each product team and the ART retrospective, which has the goal to identify barriers and challenges of the program. Participants of this workshop are all product teams and their members and all stakeholders interested in the program. The format is in hybrid and the number of participants tends to be between 40 - 90 people. The duration is 5.5 hours. (ii) Focuses on the next working period for each product team. The aim is to define goals and collaboratively work on the creation of plans to successfully complete the goals until the next PIP. The agenda includes the work in breakout sessions, the presentation of intermediary and final results, risk planning and PI Planning retrospectives. The number of participants tends to be between 25 - 50 people. The duration is 12 hours.

4.2.4 The ARP User-Centered Design

The ARP program uses a user-centered design approach in order to define concrete requirements for the graphical user interface and user-oriented system attributes. The focus of this method is on the end user. The methodology follows the Double Diamond approach and is separated into four steps: (1) User Research: Interviews & Personas, (2) User Experience: User Journeys, (3) User Interface: UI Design and Prototyping, (4) User Testing: Validation of UX and UI and processes. To gather data and requirements, the ARP team has two different approaches: (i) a field study, where members of the different agile teams spend a day with the end users, following their day-to-day activities. The goal is to gain an understanding of their challenges of their daily business. The participants for the field study were selected based on their technical and thematic knowledge. (ii) individual interviews with selected end-users to gather additional information on the usage of systems, tools, practices, preferences, ideas, fears and more. The results will be used to further develop the software to fit the needs of the end users. Interviewees are selected based on their tasks and position within the company. The results of the interviews are clustered into these positions and "Personas" [113] are created for each. So far, 24 interviews have been conducted. This has resulted in 12 different personas. The interviews were analyzed and summarised in a non-anonymous form. Citations, preferences and critical points are partially mapped to individuals.
In addition, the ARP program uses the design process method "Double Diamond" as first defined by Banathy [114]. The approach has four main steps: (1) *Discover:* Gaining of an understanding of requirements by talking and interacting with affected users, (2) *Define:* Definition of challenges based on findings, (3) *Develop:* Concrete development of solutions to challenges in cooperation with different people, (4) *Deliver:* Testing of different solutions. The ARP-adapted process is explained in graphic 4.2.

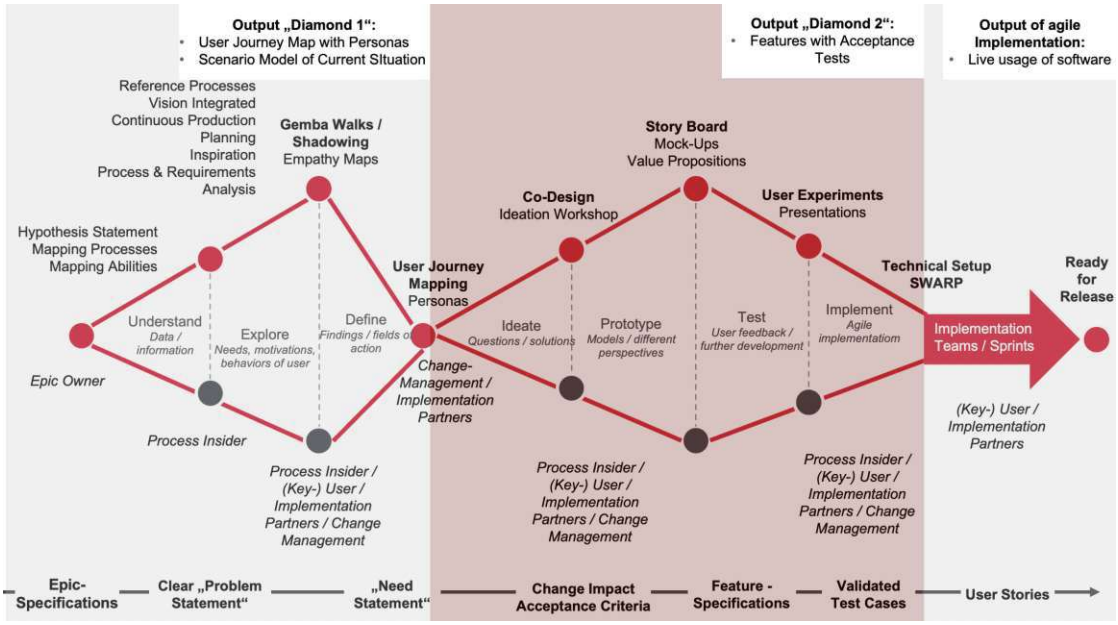

Figure 4.2: ARP Double Diamond Approach

4.2.5 Future Plans

General Measures

General future measures are separated into 5 categories. (I) Events: It is planned to increase the number of railshows and integrate learnings from past railshows into future events. These railshows should be done in different locations all over Austria. (II) Ambassador Network: Future ambassador network meetings are planned to be in person. A focus to ambassadors in Carinthia is planned during the integration of the pilot. (III) Communication through management: Concrete information on the timetable of the roll-out of the pilot is planned to be communicated to management with the idea of further distribution to their respective teams. This detailed overview and time table plan should be continued in future program phases. (IV) Information Hub: For general information, an "infohub" should be created. This infohub includes information about the user-centered design approach, pilot Carinthia, information about the naming conventions of SWARP and SHARP, and other generally relevant information. (V) Other information materials and measures: Testers of the developed software should be included and informed about the roll-out plan. Additional videos with focus on SWARP are planned. Additional communication channels of the company are planned to be used for further reach of employees.

4.2.6 Mapped Results of the Document Analysis

Figure 4.1 shows the results of the document analysis mapped to the categories as defined in

Table 4.1: Mapped material to the developed category system

Category	General	Management	Employees
Impact on Work Processes and Job Security			
Fears	- Resistance within the affected employees due to reduction of familiar systems - Negative attitude towards change of employees - Too high expectations and conflicts of interests between departments and sub companies - Lack of resources and expert knowledge - Increasing number of involved people in the program - Lack of knowledge of suppliers of the program	- Railway-specific knowledge is too limited within the program team - Too little integration into the program - Political influences and power games could affect the progmam - Perception, that some sub companies are to committed to the program - Fear of uncontrolled extension of program scope - Top-down program that is a result of board of directors 'want' it - 'Standard software' will replace all existing systems - Not enough resources for the implementation and continuation of the program	- Sceptic towards a 'standardized solution' which covers all specifics of different departments - Transformation is tiring and creates uncertainty - New systems are more complicated and require more effort - New systems might not be able to provide expected results - The program might result in a significant amount of additional work - Loss of individual expert knowledge because of higher degree of automation - The new system might block employees in performing their tasks - The new system might not have all functionalities of the already existing systems
Experiences	- High expectations of process and efficiency optimisation through digitalisation	- Significant differences between sub companies in terms of support for the program - Digitalisation and automatisation affects core processes stronger - Skepsis increases the further the 'distance' between board of directors and employee is - Limited detailed knowledge about the program - Limited knowledge in terms of the 'standard software', but high interest in it	Positive: - Employees are generally motivated - Higher acceptance with early involvement of employees - Employees hardly fear for losing their job - Subgroup of affected employees are looking forward to the changes that are to be expected from ARP Negative: - Employees are generally reserved towards change - Bureaucracy slows down processes and work - Employees feel like they are not involved enough in the ARP progmam Neutral: - Change readiness declines the longer the employee has been at the company - Affected employees do not know about the program
Expectations		Towards the program: - Necessary for digitalisation for production planning - Necessary to tackle resource bottlenecks - Necessary for competitiveness - Improved and E2E processes - Optimisation of data and system structures - Better fulfilment of market requirements Towards the team: - Better overview over program, including milestones - Better planning for their resources - More individual exchanges with program team - Interactive media for continuous communication with program team - Continuous involvement of thematic experts	- Want to understand their future role and affects on their current one through ARP - Clear communications of expectations - Clear framework conditions - Realistic expectations towards end users - Faster learning curve for new employees
Ethical Concerns			- Doubt that AI allows for the consideration of social aspects
Internal Barriers to AI Integration			
Organisational Barriers	- Creation of new recruiting strategies to fit new requirements - Structural planning for organisational chart after the completion of the program	- Higher degree of individual exchanges between program team and management	- Planners will have to develop new skills, new competencies have to be recruited
Cultural Barriers	- Too little focus on processes within the company culture		
Financial Barriers			
Regulatory and Compliance Barriers	- Fear that regulatory requirements are not fulfilled		
Technical Barriers	- Fear that security aspects are not fulfilled		- Full automatisation is not imaginable due to too many relevant factors during decision-making - Data quality (and amount) of data basis and performance could prove to be problematic
Human Centric and Ethically Responsible AI Integration			
Human Agency and Oversight			- The final decision should lie with the employee, not the system - The human should be the core of the system
Diversity, Non-Discrimination and Fairness			
Transparency		- Knowledge limited to goals of program and sporadic detailed information - Knowledge differs from department to department	- Limited knowledge about the program, mostly communicated from their manager
Societal and Environmental Well-being			- Employees generally feel good

4.3 Summary of Interviews

The interviews were transcribed using WhisperAI. After the transcription, all transcripts were re-read and sorted according to the questions of the questionnaire. Relevant content was marked and categorized according to the questions of the questionnaire. Individual phrases were marked for possible citations. Content, which was deemed off-topic for the research questions was removed. The relevant content was then mapped to the questions of the questionnaire. The results can be found in table 4.2 for the introductory segment, table 4.3 for the ARP segment, table 4.4 for the specific questions and table 4.5 for the final mapping to the defined category system. As adoption to the the document analysis, the tables as created during the analysis of the interviews is not separated into management and employee, but in ARP team and employees. This is because the interviews displayed a system where ARP employees described different perspectives from non-arp employees, compared to the document analysis where the requirements were separated between management and employees.

4.3.1 General Results

Starting with the self-assessment, most interviewees were confident in their IT-related skills, they did not identify as experts or inexperienced users. In AI-related skills, a lot had basic knowledge, with only 2 exceeding to private usage. Out of the 7 people asked, 5 had tested ChatGPT. 2 had no experience with AI technologies. 2 out of the 5 who tested ChatGPT were active users. 4 employees had been at the company for a very long time (between 30-40 years), 3 for a shorter time (between 1.5 - 3 years).

Focusing on the company culture, only 2 people stated that the motto "We before us" is lived. The other 5 people expressed negative concern towards it. Interesting to note is that the 2 people positive towards the motto were the youngest ones and had not been at the company for long. Interviewees who argued that the motto is not lived in the company mentioned that results for this occurrence is lack of management initiatives and an increase of competition in the railway sector. People who had been at the company for a long time were also asked about the development of this motto over the years. The statements were indecisive, ranging from no changes over the years to a negative trend recently. Generally, the consent was that the motto was not lived in the company.

Some of the reasons for the motto not being lived reoccurred in the general challenges of the company. These could be separated into internal challenges and external challenges.

Internal challenges:

1. The current management style, which is not in alignment with the values the company has defined within its culture and vision

2. A reduction of benefits the company offers over the recent years, stating that this has been one of the main incentives for new employees to join the company

3. A reduction of subject-matter experts. Reasons for that lie in the training and eductional processes that the company has developed to. Some interviewees mentioned, that the training are less intense, shorter and do not focus on the creation of a general understanding of the company anymore

4. No or few career paths for employees

5. The "dynamisation" of the company, where old structures, processes and hierarchies will have to be optimized and modernized for increased operability and competitiveness

6. The future existence as one corporation, referring to the cooperation between subcompanies in a highly regulated and increasingly competitive environment

7. Generational change. A fact that thousands of employees are a few years short of their pension and one of the biggest current challenges of the company

External challenges:

1. Increasing competitiveness in the railway sector

2. High level of regulation and introduction of new regulations

3. It is difficult for the railway sector to compete with transportation via street. This is due to high regulations of border-crossing trains and the complexity of planning processes for resources and shift planning compared to e.g.: trucks who are not bound by these regulations

4. The market positioning of the company compared to competitors

5. Increasing market liberalisation

6. The recent change of direct awards of transport service contracts, which will not be possible anymore in the future and allows global competitors to compete in the local market

7. The separation of the infrastructure from the other subcompanies due to regulatory requirements

In general, the main challenges focus on the core points of: Higher regulations and increasing competition and the resulting internal changes (organisational, structural and cultural) required to stay competitive.

4.3.2 ARP-related Results

The metaphorical question resulted in very varied results. 3 interviewees thought critically of the program, describing it as either insignificant or negative. 4 described it as gigantic ship with little possibility for external disruptions. This tendency towards two extremes also shows in the other answers. The feelings are, with the exception of one, either very positive or very negative.

4.3.3 AI Ethics Results

The main concerns from the interviewees regarding AI dealt with replacements of the human. Out of the 7 interviewees, 4 were mainly sceptical of technologies using AI. 6 imagined AI is prevalent and will stay for the time to come. Concerns also dealt with data accuracy and the validity of results provided by AI systems. 2 interviewees also specifically mentioned that they are worried about the decline in creativity and critical thinking in humans due to either the high level of assistance that AI provides and their unexpected capabilities in subjects that are defined as creativity (e.g.: Creation of art, songs, ...). This lead to a generally low trust in existing AI technologies from the interviewees.
The interviewees were also asked to define the word human-centric and ethically responsible AI themselves. The results were the following points: (I) Humans should have the upper hand and AI can and should *support* in subject-specific topics and daily activities, (II) Users should have trust in the results of the AI system, (III) No definition or understanding of the words.

The interviewees did not show any particular worries or fears when it came to the ethical aspects of the ARP-developed software and systems. Out of the 7 interviewees, 3 specifically mentioned, that they do not believe that the systems developed in the ARP program are using AI at all. It was also specifically noted, that the end users do not understand how the software works. As technical aspect, the development is fully in-house. It was mentioned, that the training data used is gathered from within the company and thus transparent.

Questions	Answers
Introduction	
1. How do you see the culture at company? Do you think the motto "Us before me" is lived?	Not lived. "I have the feeling that the opposite is being lived.. me before us" - In recent years, subcompanies have started acting more towards their individual goals - Difficult for newer employees - Different 20 years ago Generally lived. - Some edge cases, where motto is not lived - Personal experiences where it was not lived Yes. 80-85% are helpful, friendly, passionate Not really lived. - Thinks that in less political/hierarchical positions probably more lived - More present in operative units - Less present in strategic or tactical units Not lived. Not lived, only if advantageous for department - "The willingness of the individual to take responsibility does not exist" Reasons: - Liberalisation of railway transportation, Fourth Railway Pact - High fluctuation on top management level due to short contracts (3-5 years) - Upper management does not live the motto - Increased difficulty the more you operate in a company-wide environment
2. How knowledgeable do you think are you in regards to IT?	IT operator Confident 7/10 Enabler and User of IT
3. What do you think are the biggest challenges for company in the future?	Internal: - Management style - values of the company culture are not being lived - Eliminations of benefits - Subject-matter experts not available on market - Missing perspective (future career path) for employees - "Dynamisation" of company –>replacing old structures, modernizing company - Existence as one corporation (split into individual companies?) - Generational change External: - Higher competition on railway - Higher competition from competitors of individual subcompanies –>Very difficult to compete with transportation on street ("You can't compete with the street") - Positioning of the company on the market - Market liberalisation - Direct award of transport service contracts - Separation of Infrastructure and everything else
What are your experiences with AI so far? 4. What do you think about everything you have heard about it so far? Does it live up to its hype?	- has used ChatGPT once to try it. not familiar with it, but appeared curious - 7-8/10, is using various AI tools at work and privately - Experience with AI, usage also privately - User, but not a lot - No experience
5. Do you think that AI rises ethical concerns? How do you define trustworthiness and human-centricity in regards to AI?	Worries: - AI could completely replace the human at some point - Data accuracy and validity - data sources and data validity and thus does not e.g.: trust ChatGPT Definition: human-centric: - Humans should have the upper hand over AI, but AI can support in subject-specific topics - AI should support us in daily activities - Worried that AI already takes over a lot of creativity of humans –>creativity and critical thinking is lost - Human-centric means having a system that supports me - Does not know what to understand under human-centric - There has to be trust in the system so that the results produced by the AI are correct and accurate - "Human-centricity sounds a bit weird to me. The term does not fit to AI for me." - "I would prefer if we had a dual control system by humans for decisions."
6. How do you think AI will be (or is) perceived at company? Do you think that company focuses on these aspects already?	- Does not exist in their current work environment - Company will have to use AI due to not finding employees with subject-specific knowledge on the market anymore - Company currently does not implement enough AI, not really known in company - A lot do not understand AI at the company and are thus sceptic - Employees are interested in the topic - Expects to take a long way until fully adopted - Expects for AI to 'definitely' arrive at company - Experience and knowledge strongly depends on department - Relevant for the company - Management interested and aware - Uncertainty of usability and functionality of AI - Ethical problems can arise through the training of the datasets - Question whether humans will be able to make the final decision in the future

Table 4.2: The introduction segment of the questionnaire including the mapped responses of the interviews

Questions	Answers
Questions about the ARP program	
7. Thinking of a ship in the water, how would you describe the ARP program, if it was one?	Dinghy to a sailing ship (I can use it if I want to and I can still manoeuvre it), they would be on the sailing ship - stormy weather Mixture of sailing ship and holiday ship, their role is providing wind for the sails - wavy, but further out clear weather Freigther, responsible for machine room - Waves and weather irrelevant because the freigther drives over them either way AIDA, colorfoul and big, a lot going on on the ship, responsible for the ship (captain) - sunny weather As a ship on the ocean, you cannot even see it. Color is pitch black
8. When you think of the ARP Program, what kind of feeling do you get?	- Neutral feeling, does not know any details of the direction the program will go to - Proud feeling - Very positive feeling, loyal feeling - Does not believe the program affects or creates any kind of feeling - Not very positive, because there are no working use cases ("It (the results and progress of the program) is not tangible.") - Uneasiness/discomfort. - Very critical - "Why? Because they have no idea about the business."
9. How big would you say is the impact for you?	Not asked
10. What do you think are the biggest challenges for the ARP Program?	- Technical implementation - Political barriers - Barriers between company and international vendors - Company culture - Clear role distribution within the program team - Vendor communication and cooperation - Fulfillment of self-set deadlines within the program team - Sufficient management awareness - Weakening of certain subcompanies and political barriers resulting from that - Upskilling - Consideration of all relevant stakeholders for parameterisation and development - People partially cannot talk positively about the program because they do not know whether the ARP program is working or not (not enough information) - "The employees are so far away from the ARP program, they do not even know whats coming. They know nothing.") - All critical voices were removed from the program - A lot have critical thoughts, but do not voice them - Meeting of data quality standards - Removal of all currently existing tools and systems after the introduction of the ARP systems - Creation of desire and reason for the ARP program
11. Thinking of the structure of company, its people, the culture, its processes. What do you think are internal barriers?	- Refusal towards acceptance of new things - Personal feelings of management+ - Critical that the software works, otherwise end users will not accept solution - Missing acceptance due to bad communication (one manager bragged that jobs will be reduced) - Political discussions surrounding which systems to integrate into the software and which not - Cultural barriers: difficult to overcome inert culture - Good training concept ("(the success of the program) stands and falls with the training concept") - Barriers between company and international vendors (of the standard software) - Company culture (very hierarchical, program is agile) - Weakening of certain subcompanies and political barriers resulting from that - Training of employees - Acceptance of end users - First-level and second-level support (24/7) - Parameterisation of all relevant parameters - Reach of affected employees company-wide - Missing subject-matter knowledge within the program team
12. What is your biggest fear when it comes to the ARP Program?	- Says no fears, but talks about what management said about job loss (->fear of loss of job) (Heard in rail show that no jobs will be lost) - That the end users do not provide the information needed to configure the (standard) software - That the program team dissociates - Very few negative feelings - None - Bad quality of the delivered product - Relevant stakeholders not reached at the right time - Worried about the costs and the results of the ARP program
13. What is your biggest expectation towards the ARP Program?	- Faster software - Increased quality and security (accuracy) - Active integration of the planners and disposition because they have all the subject matter knowledge - Decision towards go or no-go in 2026 for the ARP program - Positive outcomes of the pilot in Carinthia - Usability and improvement for different departments - No expectation - we do not know how it works
14. Circling back to the question about ethical concerns and how you define trustworthiness / human-centricity. Do you have the feeling that the AI developed in the ARP program will have issues with that? Why yes / no?	- Positive feeling about the software and the ARP program - Does not believe that the software is actually an AI software and more of a recommender system - End users do not understand how the software works - End users do not see how the software generates recommendations - Increased transparency of the planning process of employees - No, because during the development there is a focus on training the data within the company and thus knowing, how the system operates - Not worried, because the system is a recommender system

Table 4.3: The ARP segment of the questionnaire including the mapped responses of the interviews

Questions	Answers
Specific Questions	
15. Do you trust the software to make you good recommendations? Do you know how it works? Would you want to know?	- If the parameters that are being used are good, then yes.
16. Do you think that the new software and processes will help you in your work?	- They hope so, and argue that its going to be necessary because the complexity of planning and disposition has been increasing
17. Do you think that management, program team and company in general is doing enough to guide you through the change? What else could be done?	- Informing employees in a timely manner that something new is coming - Need for tangible examples (mentioned multiple times) - Recommendation: Full communication across all channels to reach employees - Short videos for explanations (1.5-2mins) (has worked well before)
18. Thinking of the software, do you have the feeling that you will be able to make informed, autonomous decisions regarding the software?	- Yes, hope so, but too little information as of now
19. What are the stakeholders of the program? Which ones are the most relevant ones?	- Board of directors - Regional managers - End user and process insider - Department leads and area leads - Worker's council - CEO, CFO - Colleagues, who work in the program
20. How are these stakeholders consulted?	- Following the ADKAR-Model - Conducting interviews with end-users (total of over 35 interviews) to understand their processes and work - Workshops - Double Diamond - Executive Summary - ARP Information Hub - Private channel for management and ambassador network - ("I have to say that there (Info Hub) is very little interaction. I am not even sure if people look at that") - Article in employee magazine - Railshows
21. Do you think the software will have an effect on the mental well-being of the affected users? If yes, what measures can be taken to reduce the effect? If no, why?	- Yes - Shock curve: people will be afraid –>will happen at one point in the ARP program - Stress - In the beginning: afraid of "the new" - Later: positive emotions - Strongly depends on the user Measures: - transparent communication - direct involvement of program team with end users - avoid parallelism of old and new systems
22. What are the most important change management aspects in this program?	- 'It is important to talk with the people before a spark becomes a fire' (Context: negativity towards new/unknown things) - System demos within the Railshow - Teach users to use software - Give stakeholders the feeling that they are not left alone - Receiving acceptance from the employees - Focus on communication towards the two main groups: Management and End Users - Active involvment of end users
23. To which level will humans be able to intervene with the system?	- The system is a support system: The human has the last decision - Intervention possible during parameterisation
24. What are the primary concerns of the workforce regarding the integration of AI and the ARP program?	- AI-scepsis in general –>less prevelant within the end-user group - Data privacy
25. How transparent is the communication from management about the ARP program and its impact on employees?	- Transparent communication through multiple different channels
26. How does the Workers' Council ensure that the ethical implications of AI integration are considered and addressed?	- Regular reporting - Worker's council has to be allowed to conduct certain checks according to the Labour Relations Act - Data privacy is the most important aspect
27. How do you envision your role in facilitating the ARP program's success within your department?	Not asked
28. How do you think the ARP program will impact day-to-day operations in your department?	- Current rols will change - Competence will change
29. What are the main operational challenges you anticipate with the implementation of the new software?	- The planning, development and implementation of the training concept - The ongoing support of the system
30. What feedback have you received from your team regarding the ARP program?	- Positive thoughts - Motivated team - Negative, critical towards the program - Worried of additional work after the conclusion of the program
31. How do your colleagues think of the coming change? What are the biggest arguments for and against the program/software?	- Disinterested, not tangible (greifbar) for the employees "because nothing is there to judge". - Generally: colleagues expect and hope that new software solves problems that exist within current software - Does not believe job loss is too big of topic due to increasing work load - People within the program team partially do not know their own concrete role in the program - Origin because of cultural differences ("young vs. old; agile vs. hierarchical") - Laugh about the program
32. Do you think people are afraid of the coming change? What could be done in your opinion to ease the transition?	- People are afraid to lose their jobs - People do not understand the impact the ARP program will have on processes, tasks and themselves after its completion
33. How do you plan to drive user acceptance and adoption of the SWARP product among planners and other end-users?	- Use positive and constructive personnel and employees to broadcast news and progress of the ARP program to colleagues - Prove that the developed software works - Involve sceptics actively
34. What strategies are in place to ensure that the AI recommendations are transparent and understandable to users?	- Does not think it is relevant that a user understands it and also represents the opinion that they are not interested in it ("I also would not understand it")

Table 4.4: The specific segment of the questionnaire including the mapped responses of the interviews

Category	ARP Team	Employees
Impact on Work Processes and Job Security		
Fears	- Fear of the strong culture, very inert and low level of change readiness - Fear that the end users do not provide the information needed to configure the (standard) software - Fear that the program team dissociates - Fear that relevant stakeholders are not reached at the right time	- Fear of job loss - Fear that AI could replace human at one point - Fear that the ARP system cannot replace existing tools - Fear that the quality of the product is not sufficient - Fear of additional work short-term - Fear that new system repeats mistakes of old system - Fear that the ARP program is not sufficient to sustain the generational change
Experiences	Positive: - Colleagues are very motivated (ARP Team) - Positive work environment - Transparent communication - Worker's council partially positive and supportive towards the program Negative: - End users not interested in how the AI works - End users want to see the system ("They (the end users) do not want to see any more slides, noone likes that anymore. They simply want to see the system.") - Employees are only interested in how the system works, not the vision ("(...) they are not interested in the business bric-a-brac") - Lack of knowledge of end users towards topics related to digitalisation Neutral: - Fear of job loss is not real and used as leverage/argument to resist the incoming change ("I think the fear of job loss that is often addressed in our communication is not real.") - Partial uncertainty whether AI usage in program is really AI - Railshows: 180 people invited, 40 participated	Positive: - Transparent communication - Integration of end users and process insiders into the development of the program and process - Little worry of end users towards AI - Ambassador network works well Negative: - Not clear how the standardised software should work; Railshows not sufficient - Unclear how software will work in the future ("just the user interface was shown") - Too little focus on the content for the end-user - Do not believe that the software is actually self-learning (I do not believe that the system is self-learning as of now.") - But: are also open to get proven otherwise - Not tangible for the employees - Incressed difficulty the more you go towards short-term planning - Missing trust into the system - Program team is not knowledgeable enough (subject-matter) - Targeted removal of critical voices
Expectations	- Decision towards go or no-go in 2026 for the ARP program - Positive outcomes of the pilot in Carinthia	- Want to see how the standardised software looks like - Faster software and system - Incressed quality and security (accuracy) - Active integration of the planners and disposition because they have all the subject matter knowledge - Some do not believe the program will work because they do not trust that AI can provide results that consider all aspects needed for planning and disposition - Some do not believe the program to provide usable results because of high amount of parameters needed for recommendations - Providing results that reduce the work load of the end user, the quality of the recommendations has to be sufficient -Pilot in Carinthia important to make the progress and system tangible Training concept: - no frontal lessons - practical examples - contact person - in-person- test environment to train
Ethical Concerns		- Worried that AI could completely replace the human at some point - Fear that creativity and critical thinking is lost because of AI - Fear of AI when "emotional capabilities" are developed for AI - Ethical problems can arise through the training of the datasets - Question whether humans will be able to make the final decision in the future
Internal Barriers to AI Integration		
Organisational Barriers	- Blockage of change progress through worker's council ("They (the worker's council) can destroy everything that we have built so far with just a few sentences") - Creation of desire for the solutions developed within the program - Partial disinterest because of lack of concrete examples of software - Interplay and cooperation between subcompanies - Fulfillment of self-set deadlines of program timetable - Upskilling - Weakening of certain subcompanies and political barriers resulting from that - Sufficient management attention - Finding enough personnel	- Personal feelings of management+ - Critical that the software works, otherwise end users will not accept solution - Missing acceptance due to bad communication (one manager bragged that jobs will be reduced) - Political discussions surrounding which systems to integrate into the software and which not - Consideration of all relevant stakeholders for parameterisation and development - Reach of employees company-wide
Cultural Barriers	- Barriers between company and international vendors - Company culture (very hierarchical, program is agile) - People within the program team partially do not know their own concrete role in the program - Origin because of cultural differences ("young vs. old; agile vs. hierarchical")	- Company is not ready for the English language ("(...) If you use English, it is the language of the devil anyway") - Refusal towards acceptance of new things - AI scepsis in general
Financial Barriers	- No barriers	- High costs ("Is it worth it?") - "The only thing thats tangible for me are the costs. And these are insanely high")
Regulatory and Compliance Barriers	- Worker's council may block certain possibilities of the system	- Concerns regarding data privacy
Technical Barriers	- Retrieval of relevant aspects from key users for system integration - Good training concept ("(the success of the program) stands and falls with the training concept") - Parallelism of old and new systems - Some members do not think there will be technical barriers	- Technical implementation - Consideration of all parameters needed for planning and disposition
Human Centric and Ethically Responsible AI Integration		
Human Agency and Oversight	- End users do not see how the software generates recommendations - The system is a support system: The human has the last decision - Intervention possible during parameterisation	- Humans should have the upper hand - Some do not believe that the software is actually an AI software and more of a recommender system - Trust towards good recommendations, if the parameters that are being used are good - Hope that software will support work, but too little information
Diversity, Non-Discrimination and Fairness	- Use positive and constructive personnel and employees to broadcast news and progress of the ARP program to colleagues - Prove that the developed software works - Involve sceptics actively	- Integration of end users and process insiders into the development of the program and process
Transparency	- End users do not understand how the software works - Believe that it is not relevant that a user understands the system and also represents the opinion that they are not interested in it ("I also would not understand it") - People do not understand the impact the ARP program will have on processes, tasks and themselves after its completion	- End users would not know it was AI if not specifically mentioned - End users want to know how the standardised software produces the results through AI
Societal and Environmental Well-Being	- With the backing of the board of directors, blocking personnel can be overruled - Current rolse, competences in many departments will change	- Positive feeling about the software and the ARP program - Impact on mental well-being: Initially: afraid, stress, later: positive emotions

Table 4.5: The responses of the interviews mapped to the defined category system

CHAPTER 5

Discussion

In this section, the findings of the document analysis and interviews are discussed and interpreted. The goal of this section is to answer the defined research questions 1.1. The overarching challenge that is left to be answered is to deduce a way that defines which stakeholders are to be addressed with which methods at what point in time and a definition of the methods themselves. These methods should be based on the internal barriers for the program. They should also incorporate solutions for the fears, expectations and experiences of the respective stakeholder group. The methods should further include ethical and human-centric approaches according to the Ethics Guidelines for Trustworthy AI [6].

5.1 Barriers and Challenges

The barriers and challenges are separated into three different blocks: (I) Program, (II) Management, (III) Employees. They are further categorized according to the categorization and mapping system of the content analysis as described in section 3.5.3. Figure 5.1 shows the barriers, challenges and results, including their interplay with the different environmental actors. The environment includes barriers and challenges that are not directly originating from individuals, but are occurrences and developments originating from structural or organisational systems. Barriers and challenges identified in the environment impact the program, including all actors and are categorized into organisational, cultural and regulatory and compliance barriers and challenges. Organisational barriers and challenges mainly deal with the communication between the subcompanies and political interests impacting the program. Cultural barriers and challenges include the generally low change readiness and scepticism towards new technologies. Regulatory and compliance describe barriers and challenges in regards to security aspects and data privacy.

Category	Program	Management	Employees
Internal Barriers to AI Integration			
Organisational Barriers	- Blockage of change progress through worker's council ("They (the worker's council) can destroy everything that we have built so far with just a few sentences") - Creation of desire for the solutions developed within the program - Partial disinterest of stakeholders because of lack of concrete examples of software - Interplay and cooperation between subcompanies - Fulfillment of self-set deadlines of program timetable - Upskilling - Weakening of certain subcompanies and political barriers resulting from that - Sufficient management attention - Finding enough personnel	+ Creation of new recruiting strategies to fit new requirements + Structural planning for organisational chart after the completion of the program + Needed higher degree of individual exchanges between program team and management	- Personal feelings of management + - Critical that the software works, otherwise end users will not accept solution - Missing acceptance due to bad communication (one manager bragged that jobs will be reduced) - Political discussions surrounding which systems to integrate into the software and which not - Consideration of all relevant stakeholders for parameterization and development - Reach of employees company-wide + Skill and competency development of planners after implementation of new software
Cultural Barriers	- Barriers between company and international vendors - Company culture (very hierarchical, program is agile) - People within the program team partially do not know their own concrete role in the program - Origin because of cultural differences ("young vs. old; agile vs. hierarchical")	+ Too little focus on processes within the company culture	- Company is not ready for the English language ("(...) If you use English, it is the language of the devil anyway") - Refusal towards acceptance of new things - AI scepsis in general
Financial Barriers	- No barriers		- High costs ("Is it worth it?") - "The only thing thats tangible for me are the costs. And these are insanely high")
Regulatory and Compliance Barriers	- Worker's council may block certain possibilities of the system	+ Fulfillment of regulatory requirements	- Concerns regarding data privacy
Technical Barriers	- Retrieval of relevant aspects from key users for system integration - Good training concept ("(the success of the program) stands and falls with the training concept") - Parallelism of old and new systems - Some members do not think there will be technical barriers	+ Fulfilment of security aspects and requirements	- Technical implementation - Consideration of all parameters needed for planning and disposition + Consideration for all relevant technical aspects of the decision-making process + Lack of data quality and amount of data + Lack of performance of the new software

Table 5.1: All identified barriers of the document analysis and the interviews.
"-": Identified during interviews
"+": Identified during document analysis

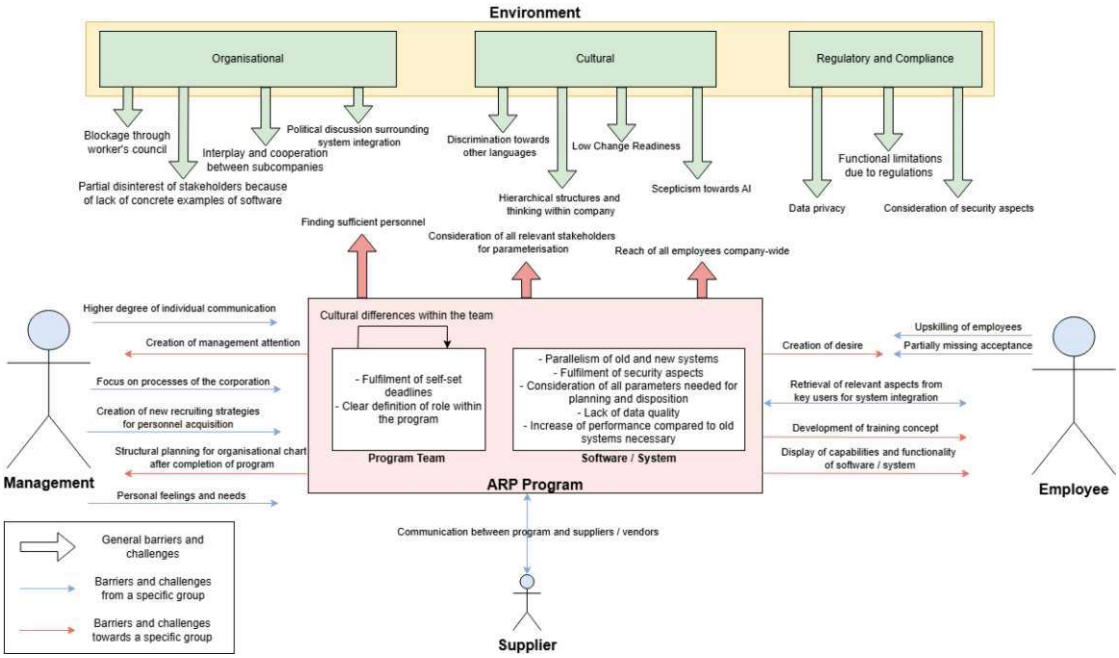

Figure 5.1: Identified Barriers and Challenges of the Program

5.2 Impact of AI on affected employees

The impact on the employees is separated into multiple different aspects. During the research, the phrasing "impact of AI" turned out to be not correct. The impact, that affects employees is through AI, but not only or directly. Fears, feelings and emotions, experiences and other human aspects are originating from the change and with that the connected uncertainty that comes with the introduction of novel technologies, in this case AI. Thus, the right wording should be: Impact of the introduction of AI (novel) technologies on affected employees, which is correctly reflected in the research questions of this paper.
The following sections are separated into a logical flow with the goal to (i) give insights on fears, expectations, experiences and ethical concerns and (ii) measures, that can be taken to address them during the integration process of the AI technologies and systems. For this, we will focus on four main actors: (I) *Affected Employees*, (II) *Management*, (III) *General Employees* and (IV) *Program Team*. *Affected Employees* are employees who are directly impacted through the changes originating from the ARP program. *Management* are employees who are C-level, department lead or area lead. *General Employees* are employees who should be reached through communications channel, but neither the impact through the program on them, nor their power or influence on the success of the program are substantial. *Program Team* are employees directly involved in the ARP program and considered as part of it. This does not include external suppliers. Additionally, since the worker's council is very strong in the company, we will also give a special focus to the worker's council during the development of measures, since they have the power to significantly influences the outcome of the program. This view was shared throughout the interviews. A citation that supports this statement was *"They (the worker's council) are able to destroy what we have tried to build up, just with a few sentences."*, which pronounces the capability of the worker's council to impact initiatives.

5.2.1 Discussion of current situation

In the current situation, the ARP program entertains several hundred stakeholders. A limited subset of these stakeholders are either positive or negative (in differing degrees) towards the program and/or their goals. Most of the stakeholders, and this specifically includes the end users, are currently neutral towards the program. The main reason being, that the end users do not know about the program. However, this occurrence is limited to the geographical position of the end users, who are already well-informed in certain areas in Austria (surrounding the location of the headquarters, where the program team is stationed and in Carinthia, where the pilot is planned). In addition, this fact is already known to the program team. The change management team has planned concrete measures to reach end users in different geographical locations using Railshows 4.2.3. Nevertheless, this neutrality creates the special challenge (and opportunity) to address these stakeholders at the right time with the correct amount and type of information in order to shift from neutral to positive. This is especially important for the end users, since they are impacted by the implementation of the ARP program the most.

Focusing on the management, the stakeholder analysis conducted by the ARP team shows a strong tendency towards the focus on management (C-level, area lead, department lead). This is also reflected in the document analysis, which shows that most of the data gathered during change management initiative analysis was from and for management. Also during the interviews, mentioned stakeholder groups were mainly in management positions. Recent developments of the new change management team focus, however, strongly on the end users and process insiders. This development is also now in alignment with the agile framework "SAFe" [43], which is used within the program 1.5.
The current state of communication materials and channels is two-sided. Current change management initiatives are based on the ADKAR model (2.2.3). Source material is created extensively and communication strategies are planned. During the document analysis, the change from the previous change management team to the new one shows a separation of procedures and information. While the current developments are qualitatively good, the old data sources, which contain detailed information on stakeholders and concrete measures to address them seem to be disconnected from current plans. This is also visualised in section 4.2.2. Materials are partially outdated and communication sources that were created before the change of the change management team are often not used sufficiently or with actual information, resulting in little communication and low maintenance of general communication channels, also due to the fact that the new change management team is in a strategic development phase. This is also in alignment with the gathered data from the interviews, where the following statement was made: *"One has to say that there is very little interaction with these info hubs and so on. So I'm not sure if people even look at them"*, and the sinking number of responses in the change readiness surveys, which highlight the low engagement of general communication measures. There are also discrepancies between data created in 2022 and elicited data from the interviews. Data from the document analysis shows, that the fear of job loss is insignificant/non-existent. The main fear of affected employees through interviews was the fear of job loss. A concrete measure that was also planned in 2022 was the elucidation of AI technologies within the program. Through the interviews, however, a reoccurring point of expectation was to understand the AI of the ARP program, hinting that the measures set in 2022 have not been fully implemented and subsequently the absence of KPIs for all change management plans. Thus, we will also focus on defining KPIs, which should support in the evaluation of effectiveness and progress of change management aspects.

5.2.2 Fears towards the introduction of (AI) technologies

For the analysis of the fear, we will focus on the four main actors as defined in the introductory section. The fears are a conglomeration of the data elicited in the document analysis 4.2 and the semi-structured single interviews 4.3. Graphic 5.2 depicts the fears of the different actors and shows interconnections between them. *Internal Fears* refers to the fears of the individual actor towards the program or the environment. *External Fears*, represented through the arrows, mark fears towards a specific actor.

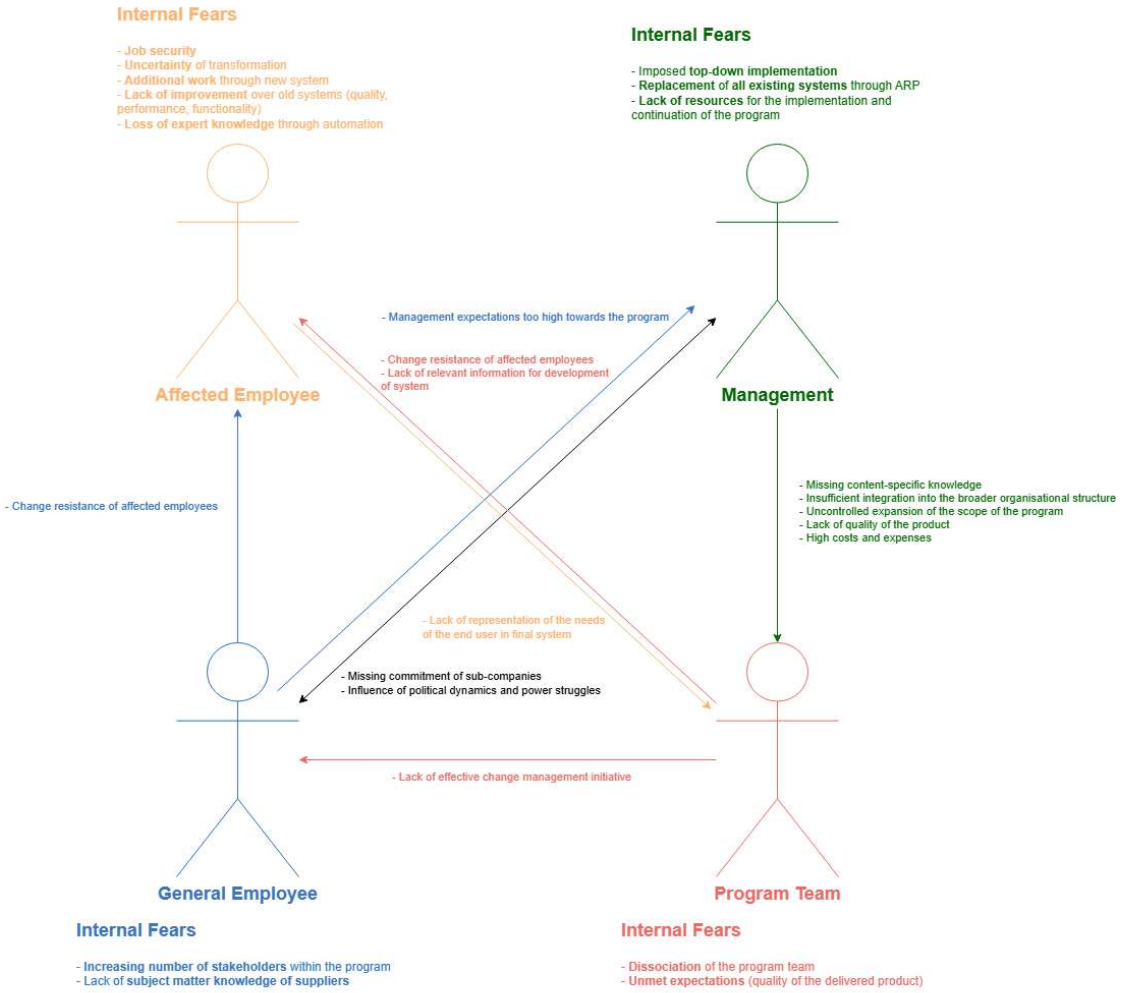

Figure 5.2: Identified external and internal fears of the main actors

Abstracting the program-specific fears for each actor, we can see a trend and focus points for each of them.
The **Affected Employee** has a *fear of personal and professional displacement*. The main focus of the fears lies on their work and attributes related to their individual work. Job security, job changes, job relevance and the connected knowledge and resources are of interest. This also includes technical attributes of the software, like performance, quality and feasibility. The aspects surrounding the program structure and their team, as well as political or organisational aspects are less relevant. Some of the origins for these fears were also highlighted in the document analysis and mentioned during the interviews - programs and introductions of systems with similar goals in the past, which negatively impacted the work of affected users. This subsequently originated from a lack of involvement and consultation of end-users in the development processes and insufficient

communication.
The **Management** has a *fear of strategic failure and resource constraints*. Failure of the transformation by not meeting strategic goals due to different reasons (organisational, structural, cultural) are sources of fear. Broader topics and longevity challenges are in focus. The management has high expectations towards the ARP program, which results in various fears surrounding the quality of developments within the program, as well as fears towards the program team and their respective capabilities to deliver according to the expectations. Origins for these fears are similar programs, which have resulted in failure due to high costs and failed expected results.
The **General Employee** has a *fear of uncertainty and inadequate support*. They are regularly impacted by transformational changes and face an increasing complexity in their work environment. This leads partially to the development of low change readiness and fear of the unknown. Origins are mainly due to a lack of communication and transparency by management during a time of change, with unclear visions and strategies and a mapping of these experiences onto future transformational projects.
The **Program Team** has a *fear of lack of alignment*. These fears are surrounding the fulfilment of goals and deliverables within the expected frame. This leads to fears in the success of system developments and quality requirements, which are in direct correlation to the quality and quantity of communication with affected employees (process insiders and end users). Origins of that are failed initiatives in the past and the mistakes, which are also reflected in the fears of the affected employees.

5.2.3 Experiences and expectations towards the introduction of (AI) technologies

The elicitation of data surrounding experiences and expectations towards the introduction of AI technologies showed, that the reasons for which the ARP program exists and the connected necessity for it was clear for every stakeholder. This means that the motivation for the program is significant, communicated and known throughout the company. Focusing on the experiences and expectations, the following section explains the findings for each actor.

Actor	Experience	Expectation
Program Team	- Positive program atmosphere - Transparent communication - Support of relevant stakeholders for the program - Lack of digitalisation knowledge of affected employees	- Strategic decision towards future direction of ARP program - Positive functional outcomes during pilot phase
Management	- Limited detailed knowledge of the ARP program - Necessity of program clear	- Technical functionalities and improvements over current situation - More information on development and progress of the program - Better inclusion and communication with program team
Affected Employee	- Transparent communication and involvement in development processes - Scepticism about impact and functionality of the SWARP software - Partially low involvement in program	- Need for role clarity and future job function(s) - Clear communication - Display of functionality of software and improvements over old (current) systems by program team
General Employee	- General motivation towards the ARP program - Generally higher levels of change resistance - Low level of awareness of ARP program - High expectations of process and efficiency optimisation through digitalisation	- Communication of program goals

Table 5.2: General expectations and experiences for each main actor

Based on the experiences and expectations, 6 general categories could be derived based on the data of the document analysis and semi-structured interviews. The categories are ordered by the amount of responses that are related to that category.

1. **Technical Aspects [TA]:** This category is defined by experiences and expectations towards the implementation and impact of the created software and its technical aspects.

2. **Knowledge and Expertise [KE]:** This category focuses on the required knowledge, expertise and skills needed for the implementation and usage of the ARP software.

3. **Job Security [JS]:** This category is based on all aspects surrounding job security, including current and future job roles and job clarity.

4. **Communication [C]:** This category involves transparent and clear communication and involvement in the ARP program.

5. **Cultural and Organisational Resistance [R]:** This category highlights experiences and expectations towards cultural and organisational challenges

6. **Strategic Direction [SD]:** This category focuses on the clear and approved strategic decision-making and future direction of the ARP program.

Table 5.2 shows the general expectations and experiences per actor.

5.2.4 Measures for the integration of AI into existing business structures

The following section describes concrete measures that can be taken to integrate AI into existing business structures, based on the results of the analysis and discussions before. The underlying change management model for the creation of the measures is the ADKAR model. This model was chosen because it focuses on the needs of the individual and can be used to efficiently describe the current progress level of change readiness and change management of the defined main actors. Table 5.3 shows the concrete measures the company can take short-, medium-, and long-term for each individual main actor. Short-term describes the phase the program is currently in and ranges until the implementation of the pilot in Carinthia. Medium-term describes the second phase, which is until the completion of the training concept. Long-term is the third phase, which is until the go-live of the systems developed within the ARP program. The first column shows the main actor and the respective dimension according to the ADKAR model that the main actor is in *before* the respective measure phase is implemented, in which *Aw* stands for *Awareness*, *D* stands for *Desire*, *K* stands for *Knowledge*, *Ab* stands for *Ability* and *R* stands for *Reinforcement*. Each of the main actors represent a large group of stakeholders. This means, that not every stakeholder represented by each main actor is in the same dimension as the main actor. The dimension of the main actor is based on the dimension the majority of the stakeholders are in, derived from the document analysis and the semi-structured interviews. The second column *Measure* explains the concrete change management measures the company can take in order to

ease the implementation of the ARP program for each main actor. The first row of that column describes the dimensional development goal according to the ADKAR model. The third column *Channel* highlights the channels that are best fit to communicate the respective measure. Not all measures need communicative channels to be implemented. The fourth column *Goal* explains the goal of each measure, that should be reached by its implementation. In addition, each measure takes into consideration the barriers and challenges analysed in section 5.1 and is based on the fears 5.2, experiences and expectations 5.2 of the main actors. Each measure also shows the categories that were derived during the analysis of the experiences and expectations that each measure is part of and based on.

Short-term measures

The goal of the short-term measures is to address barriers and fears of the respective actors by taking appropriate communication measures.
Focusing on the **Affected Employee**, the Affected Employee is in the *Desire* dimension. This means, that the general awareness regarding the ARP program is given, as well as a communicated need for the developing systems, but also shows that the Affected Employee is in need of security and a concrete overview of the next steps relevant for them. The goal is to reduce fears and increase the trust of the Affected Employee into the capabilities and results of the ARP program. This also entails clear communication of a technical plan and the active integration of the Affected Employee into the development process. This phase should fortify the Desire for the systems developed in the ARP program.
The **Management** has ample information on the general strategic direction, the need for the program. Since the program spans over multiple different subcompanies, Management in each subcompany is interested in the influences of the ARP program for their respective area. This means, that communication should be tailored to the individual needs of Management and information should focus on a deeper level of detail. The goal is to address short-comings, increase communication with different management stakeholders and increase the display of core competencies and technical knowledge of the program team throughout different management hierarchies. This phase should fortify the Desire and increase the Knowledge of Management towards the ARP program.
The **General Employee** has a vastly different level of information about the ARP program, depending on their position, subcompany and physical location. The short-term goal is to increase awareness across the General Employee and generate a general understanding for the reasons, goals, vision, strategy and roadmap of the program. This awareness campaign should also be used to identify possible supporters and gather advisors to decrease the fear and risk of missing technical know-how and requirements for the system development. This phase should build and fortify the Awareness towards the program for the General Employee.
The **Program Team** is motivated and knows about the details of the ARP program. The short-term goal is to define clear roles, responsibilities and tasks within the team itself. In addition, the program team is responsible for measuring their own change

management initiatives and set goals for the completion of them. The internal alignment of personal measures and initiatives, as well as getting team members on the same level of information is required. This phase should fortify the Knowledge of all program members towards the ARP program and start developing Abilities needed to perform as needed.

Medium-term measures

The goal of the medium-term measures is to display the technical feasibility and capability of the systems and prepare structural and organisational frameworks to allow for internal development and company-wide measures for the implementation of all ARP-related components.
The **Affected Employee** is in the Desire phase. They know about the goals, the technical roadmap and are integrated in the development process of the program. The medium-term goal is to demonstrate concrete developed use-cases in the system in order to show that the new system not only performs from a technical point of view, but also delivers the expected improvements over existing systems. In addition, the target group should be extended to new geographical locations. In this phase, Knowledge about the systems should be build up in the Affected Employee.
The **Management** is knowledgeable about the affects of the ARP program on their respective area of responsibility and knows of the planned strategic directions. The medium-term goal for Management is to define a clear technical roadmap to reduce parallelism after the go-live phase and the organisational and structural basic conditions needed for the time after the implementation of the ARP program. This includes the new task areas of affected employees and the connected upskilling and reskilling. In this phase, Management should deepen their Knowledge of the program and gain the Ability to enact and enable the required changes in the future.
The **General Employee** is aware of the program and knows about the goals and directions. The medium-term goal is to display the capabilities of the developed systems and create the desire within the General Employee to support the advancements of the ARP program. This includes an active ambassador network and recruiting process for supporters. In addition, cultural barriers towards transformation, digital change and multi-lingual systems can be approached and reduced through highlighting functionalities and improvements to the current status by the usage of these methods. In this phase, the Desire for news and the success of the ARP program should be developed within the General Employee.
The **Program Team** is aligned in their goals and have a clear separation of roles, responsibilities and tasks. Similar to the Management, the medium-term goal for the program team is to start preparing for the post program phase. This includes a definition of the internal structures and the knowledge of the respective roles needed to perform within that structures. In addition, the program team should deepen their technical knowledge in their respective area of responsibility through training. This should also provide the program team members a long-term perspective and way of growth, which reduces the possibility of key personnel leaving during advanced program phases. In this phase, the Program Team should deepen their Ability to implement the ARP program

successfully.

Long-term measures

The goal of the long-term measures is to prepare for the go-live and post-program phase. This means, that the main focus lies on structural and organisational preparation and training of affected employees, including management and the program team.
The **Affected Employee** has knowledge of the functionalities of the systems and the status and next steps of the program. The long-term goal is to gather feedback on the planned roll-out phase and training concept and communicate clear areas of responsibilities and tasks for the post-program phase. The Affected Employee knows about the coming changes and is included in the change process. In this phase, Knowledge for the Affected Employee is deepened through training and the Ability to use the systems in their day-to-day activities is learned.
The **Management** is knowledgeable of the expected changes and has the abilities needed to enable and enact them. The long-term goal is to finalise the planned changes across all management hierarchies and develop the needed skill sets to manage in the new organisational structure. This includes the active communication with their employees and the reduction of change resistance and increase of change readiness within the affected departments across the subcompanies. In this phase, the Ability of management to manage during the integration and after the go-live phase is fortified.
The **General Employee** desires to be informed of the progress of the ARP program and its impact on the subcompanies. The long-term goal of the General Employee is to reduce the number of active stakeholders to stakeholders who have been identified as valuable multiplicators or knowledgeable personnel. This is done to not be overwhelmed by stakeholder management and other negative impacts of a large number of active stakeholders. In addition, the General Employee is informed of the general organisational and structural changes. In this phase, the Desire for the coming changes is fortified and knowledge of the post-program phase is build up in the General Employee.
The **Program Team** has the ability to successfully implement the requirements for the systems to be functional. The long-term goal is to prepare the Program Team in their new positions in the post-program phase. This includes the reskilling (and upskilling) of the Program Team to perform in their new roles. In this phase, the Program Team fortifies their abilities and moves to the internal Reinforcement of their new skills.

5.2.5 Key Performance Indicators (KPIs) for the integration of AI into existing business structures

Key Performance Indicators are used to measure the success and progress of implementations. In order to validate the functionality of the plan developed in this thesis, the following KPIs should be used to validate the progress and success.

- **Reach of communicative measures:** This KPI focuses on the percentage of targeted employees and stakeholders who receive and engage with communicative measures. The goal is to ensure that all actors are aware of changes and may access information in regards to the ARP program clearly and in a timely fashion. This KPI should be incorporated into the existing communication plan developed by the change management team. The concrete measurements are **Open Rate** and **View Rate**, which measure the percentage of employees who have opened or read information.

- **Employee participation and engagement:** This KPI focuses on measuring the percentage of employees who are participating in workshops, meetings and Railshows. The goal is to increase the employee involvement in the development of the ARP program. The concrete measures are the **Participation Rate**, which represents the number of employees attending, the **Feedback Submission**, tracking the number of feedback received and the **Engagement Quality**, which is measured through direct qualitative feedback of participants.

- **Change readiness:** This KPI focuses on the development of change readiness and the connected reduction in change resistance during the program live span. The goal is to minimize negative sentiment and improve the willingness to change. The concrete measures are **Sentiment Analysis**, which focuses on the analysis of language and tone used in surveys and feedback, **Change Readiness**, which compares resistance levels and stances towards the program periodically and before and after communication efforts and **Number of active Resistors**, with the goal to track how the development of employees who are negative towards the program.

- **Training and upskilling success rate:** This KPI focuses on the percentage of employees who complete training programs. The goal is to ensure a high level of quality of the training and upskilling initiatives. The concrete measures are the **Completion Rate**, which tracks the number of trained employees, **Pass Rate** of employees for each training and **Employee Satisfaction**, which focuses on gathering active feedback and continuous improvement of the training.

Actor	Measure	Channel	Goal
Affected Employee D	*Fortification of D* - [JS] Clear communication towards job security in cooperation with worker's council - [TA] Communication of concrete plan for technical implementation - [C] Communication of roadmap, focusing on integration of affected employees	- Railshows, Statement linked in all communication channels - Workshops, Railshows, PIP - Workshops, Railshows, PIP, Statement linked in all communication channels	- Drastic reduction in insecurities regarding job security - Build of trust in technical capabilities of developed system - Display of consideration and catering to the needs of end users
Management D / K	*Fortification of D and build-up of K* - [R][C] Individual communication with management and worker's council - [C] Communication of subcompany-specific updates, including strategic direction - [KE] Communicate with management through program team members	- Individual meetings, ideally in person - Executive updates, individual meetings, PIP - Individual meetings	- Active feedback gathering regarding current situation and mindset of management and catering to higher degree of individual communication - Present target group specific information without presenting general (known) information - Display of core competencies and technical know-how to management, optimization of resource usage for individual communication
General Employee Aw	*Fortification in Aw* - [C] Highlight reasons for the transformational change through ARP at decentralized locations - [C] Communicate vision, strategy and roadmap at decentralized locations - [C] Communicate positive developments and outcomes of the program - [KE] Advertise contribution in ARP program and show incentives of work in the program	- Hybrid meetings, communication campaigns - Hybrid meetings, communication campaigns - Ambassador network, information hub, confluence/intranet - Ambassador network, communication campaigns	- Create a sense of urgency and common knowledge basis for change initiatives - Increase knowledge about existence of ARP program and the approach within company - Decrease change resistance and general scepticism towards transformational initiatives - Recruitment of supporters in new locations
Program Team K / Ab	*Fortification in K, build-up of Ab* - [KE] Communicate clear definition of roles, tasks and responsibilities for program team members - [SD] Update of stakeholder analysis - [SD] Creation of change management KPIs	- Individual meetings - Internal program meeting / workshop - Internal program workshop	- Clear separation of work throughout the internal program team - Updated stakeholder map, definition of needed personnel for technical requirements - Definition of measurable progress values for change initiatives
		Short	
Affected Employee D	*Move from D to D/K* - [TA] Presentation of technical success of system and live demonstrations - [TA/SD] Clear communication of current technical capabilities and concrete next steps - [C/TA] Integration of additional affected employees of different geographical locations	- Railshows, hybrid meetings, videos - All communication channels - Railshows, local meetings	- Showcase that developed system is able to provide functional results (and thus can work) and highlight improvements - Concrete roadmap for affected employees and communication of vision of future work (preparation for re-organisation) - Inclusion of more affected users and increase of reach, consideration of unknown and new parameters for system development
Management D / K	*Move from D / K to K / Ab* - [TA] Communication of definition of systems that are to be replaced (and not replaced) by the ARP program - [SD] Approved plan of organisational and structural changes for live-phase of the program - [JS] Coordinate concrete upskilling and reskilling plan for affected employees - [SD/R] Plan and communicate the strategic direction of the ARP program to affected management in each subcompany (including management)	- Executive updates, individual meetings - Individual meetings - Individual meetings - Executive updates, meetings	- Concrete technical plan to reduce possibility and duration of parallelism of old and new systems - Groundwork for preparation for restructuring and change management for affected employees - Groundwork for training concept - Creation of focus on individual companies (targeted information) and reduction of political interferences
General Employee Aw	*Move from Aw to D* - [C] Communicate technical improvements and show system capabilities - [KE/R] Integrate ambassadors into development process (including worker's council) - [R] Highlight capabilities of agile approach and multi-lingual program	- Intranet/Confluence, information hub - Individual/group meetings - Intranet/Confluence	- Show technical feasibility and improvements over current systems - Gather new perspectives and focus points, positively reinforce multiplicator network - Reduction of cultural barriers in the program and live phase
Program Team K / Ab	*Fortification of Ab* - [SD] Planning and definition of internal structures and team management post program - [SD] Creation of knowledge management within program - [TA/KE] Training of program team for respective technical focus points	- Individual meetings - Internal meetings and communication - Trainings	- Clear career and future outlook for internal program team, reduction of probability of dissociation - Structured approach to internal knowledge storage in case of program members leaving during implementation phase - Development of program team to subject matter experts
		Medium	
Affected Employee D / K	*Fortification of K, move to Ab* - [KE] Training concept evaluations with affected employees - [C] Communication of new organisation and position - [R/JS] Presentation of concrete new jobs, tasks and responsibilities	- In-person - Online, in-person, intranet/confluence - Hybrid, in-person	- First training of affected stakeholders and testing of training concept for go-live - Showcase of new organisational chart and position of affected employees - Upskilling and reskilling plan, build of vision and trust in time after go-live
Management K / Ab	*Fortification in Ab* (- [SD] Creation of personnel acquisition plan) - [C][R] Preparation of company-specific changes	- Individual meetings	- Finalisation of the structural and organisational changes within each subcompany
General Employee D	*Fortification in D and build of K* - [SD] Reduction of numbers of active stakeholder involvement - [C] Communication of company-specific changes and outlook post-program	- / - Intranet/confluence, infohub	- Identification of relevant stakeholders outside affected employees and management - Outlook for each sub company and showcase of commitment of them
Program Team Ab	*Move to Ab / R* - [KE] Upskilling and reskilling of program team for post program phase	- Internal meetings	- Training and groundwork for live phase of the systems and post program management
		Long	

Table 5.3: Concrete short-, medium-, and long-term measures for company

5.3 Measures for human-centric and ethical AI

One of the main findings of this study is the missing know-how related to AI ethics and trustworthy AI. There was no clear definition of what AI ethics are and what they can entail. This occurrence was indifferent to the hierarchical position of the stakeholder within the company. While some showed basic knowledge towards ethical aspects of AI, the general consensus was that this topic has not been of interest or relevance to the company or to the individual. This resulted in a low amount of elicited data during the semi-structured interviews and highlighted the necessity to generally raise awareness in the field of AI ethics and trustworthy AI, unrelated to the context of business.
Table 5.5 is an adaptation of the table of concrete measures explained in section 5.2 and contains measures for a human-centric and ethical AI implementation during the integration of the ARP program, focusing on the four requirements as defined in the Ethics Guidelines for Trustworthy AI [6] and further described in section 3.5.3. The dimensions of the ADKAR model are not applicable for the measures developed for human-centric and trustworthy AI. The four requirements are defined in the table as **HAO:** *Human Agency and Oversight*, **DNF:** *Diversity, Non-discrimination and Fairness*, **TRP:** *Transparency*, **SEW:** *Societal and Environmental Well-Being*.
The key focus areas for human-centric and trustworthy AI have been adapted to each main actor. An overview of the focus areas for each main actor is shown in table 5.4. The measures defined for human-centric and trustworthy AI are often measures that exceed the framework the program operates in. This is due to the general lack of awareness and knowledge towards this topic within the company and thus would need additional effort from C-level stakeholders of the individual subcompanies.

Short-term measures

The goal of the short term measures is to inform and educate about AI technologies and their human-centric and ethical aspects.
The **Affected Employee** does not have deep technical knowledge or expertise in the field of AI. Short-term measures focus on informing the affected employee about AI in the ARP program. Thoughts, fears and feelings of the affected employee should be addressed and discussed. The goal is to provide insights on the program's use of AI and discuss ethical aspects for the development of the systems to increase trust in the program team and the systems.
The **Management** is aware of AI technologies and has the desire to use these to optimize internal processes and structures. Ethical aspects of AI are currently either unknown or basic knowledge exists. For this reason, short-term measures focus on the build-up of knowledge on the subjects of human-centric and trustworthy AI. The goal is to incorporate ethical AI aspects actively into the strategy of the company to create a common understanding and alignment towards the next steps for AI.
The **General Employee** has a diverse understanding of AI. They have heard of AI before and often tested famous tools like ChatGPT privately. They have heard partially heard of use cases within the company but no concrete implementations in their direct

work environment. Short-term measures focus on educating the general employee on current AI advancements with the goal to build a general level of knowledge towards AI. In this phase, fears, worries and scepticism towards AI should be reduced.
The **Program Team** has knowledge about AI and knows about concrete use cases at the company. They have not discussed ethical aspects about AI within their team yet. For this reason, the short-term goal is to understand the necessity of ethical AI gain knowledge on requirements for human-centric and trustworthy AI. In addition, short-term measures also focus on the inter-department collaboration on ethical AI to gain an aligned understanding and retrieve relevant business requirements for the further development of the systems in the ARP program.

Medium-term measures

The goals of the medium-term measures is to deepen the knowledge on AI, build a connection to the company and normalise the existence of ethical AI in business structures.
The **Affected Employee** understands how AI is used in the ARP program and is informed about its general ethical aspects. The medium-term measures focus on showing the affected employee the concrete measures developed in the ARP program to ensure compliance with human-centric and trustworthy AI requirements in the systems. In addition, they should be informed on the strategic directions of the usage of AI and gain an aligned understanding of the underlying vision. The goal is to include affected employees in the process of the incorporation of ethical requirements in the system and build of trust in the program team.
The **Management** has an aligned strategy on AI integration for the company and know about ethical related aspects. The medium-term goal is to integrate AI ethics into the managerial responsibilities and the establishment of an AI ethics committee with the goal to strengthen AI and its ethical aspects within the company.
The **General Employee** has a basic knowledge of AI technologies. Medium-term measures for the general employee focus on informing and educating them of human-centric and trustworthy concepts. In addition, approaches within the ARP program to ensure the compliance with ethical AI requirements should be highlighted and communicated to the general employee. The goal is for the program to establish and recruit AI ambassadors, who support and communicate positive developments in the program in their network.
The **Program Team** has an understanding of ethical AI requirements, both from a theoretical- and business-oriented view. Medium-term measures focus on the implementation of these requirements. In this phase, the program team also focuses on the establishment of direct feedback systems for the affected employee and the integration of ethical aspects into the training plan.

Long-term measures

The goals of the long-term measures focus on the integration of ethical AI into the strategy of the company and the establishment of respective organisational structures to focus on governance, knowledge management and support for AI projects and ethical AI

Main Actor	Focus Area	Key Activities
Affected Employee	Build of trust and transparency, showcase of practical use	Personalised information, trainings, trust-building initiatives
Management	Alignment of strategy, awareness towards ethical aspects of AI	Briefings, leadership workshops, change management training
General Employee	Education and awareness towards AI	Company-wide communication campaign, open forums
Program Team	Ethical design principles and technical aspects	Ethical alignment workshops, trainings, transparency

Table 5.4: Focus areas and key activities per main actor

requirements.

The **Affected Employee** knows about ethical considerations in the developed systems by the ARP program and is actively involved in feedback systems and during the development in the program. Long-term measures focus on training the affected employee on the usage of the ARP systems in a human-centric and ethically responsible way. Training initiatives demonstrate decision control and explainable AI and follow regulations set forth by ethical AI guidelines. The goal is to normalize ethical AI requirements in their work and communicate the plan forward for the post-program phase.

The **Management** has a strategic plan following an AI impact assessment and incorporates AI ethics in organisational structures. Long-term measures focus on the consolidation of knowledge of AI technologies and ethical requirements as well as the establishment of an internal knowledge base for topics surrounding AI. The goal is to integrate AI sustainable.

The **General Employee** knows about developments in AI, relevant ethical considerations and concrete implementation projects within the company. Long-term measures focus in integrating the general employee into established AI and AI ethics structures, like an AI committee or the AI center of excellence. The goal is to integrate AI into everyday work and establish a common strategy and platform to communicate on topics surrounding AI.

The **Program Team** has integrated AI ethics into the development of their systems and communicates actively with the affected employee about any considerations. Long-term measures focus on the creation of post-implementation evaluations and impact assignments. In addition, ethical guidelines for the post-program phase are developed. The goal is to establish measurable KPIs for the compliance with ethical AI requirements and lessons learned during the program to improve future incentives as well as ensuring continuous consideration of ethical aspects throughout the post-program phase.

Table 5.5: Adapted measures with human-centric and trustworthy AI considerations

Actor	Measure	Channel	Goal
Affected Employee			
	- [TRP] Communicate and explain AI usage in the ARP program	- Railshows	- Understanding of which components of the software are using AI technologies
	- [TRP] Address and communicate human-centric, trustworthy and ethical aspects relevant to the ARP program	- Railshows, Workshops, Intranet	- Transparency of AI requirements and alignment of understanding between affected employees and program team for human-centric and trustworthy AI
	- [DNF]SEW] Plan open discussions on the ethical aspects of the developed systems	- Railshows, Workshops, in-person meetings	- Build trust and discuss and adapt worries, thoughts and feelings of affected employees
	- [JS] Clear communication towards job security in cooperation with worker's council	- Railshows, Statement linked in all communication channels	- Drastic reduction in insecurities regarding job security
D	- [TA] Communication of concrete plan for technical implementation	- Workshops, Railshows, PIP	- Build of trust in technical capabilities of developed system
	- [C] Communication of roadmap, focusing on integration of affected employees	- Workshops, Railshows, PIP, Statement linked in all communication channels	- Display of consideration and catering to the needs of end users
Management			
	- [DNF] Organise leadership workshops on human-centric and trustworthy AI	- Workshops	- Raise awareness for human-centric and trustworthy AI among management
	- [SEW] Develop strategic plan for the ethical usage of AI within the company	- Workshops, individual meetings	- Align strategic direction and goals across management for ethical human-centric and trustworthy AI
	- [R][C] Individual communication with management and worker's council	- Individual meetings, ideally in person	- Active feedback gathering regarding current situation and mindset of management and catering to higher degree of individual communication
D / K	- [C] Communication of subcompany-specific updates, including strategic direction	- Executive updates, individual meetings, PIP	- Present target group specific information without presenting general (known) information
	- [KE] Communicate with management through program team members	- Individual meetings	- Display of core competencies and technical know-how to management, optimization of resource usage for individual communication
General Employee			
	- [TRP] Company-wide awareness campaign of AI and general technical advancements in this field	- AI literacy sessions (workshops), intranet, hybrid meetings	- Awareness and education to AI to reduce scepticism and fears
	- [C] Highlight reasons for the transformational change through ARP at decentralized locations	- Hybrid meetings, communication campaigns	- Create a sense of urgency and common knowledge basis for change initiatives
Aw	- [C] Communicate vision, strategy and roadmap at decentralized locations	- Hybrid meetings, communication campaigns	- Increase knowledge about existence of ARP program and the approach within company
	- [C] Communicate positive developments and outcomes of the program	- Ambassador network, information hub, confluence/intranet	- Decrease change resistance and general scepticism towards transformational initiatives
	- [KE] Advertise contribution in ARP program and show incentives of work in the program	- Ambassador network, communication campaigns	- Recruitment of supporters in new locations
Program Team			
	- [HAO][DNF][TRP] Conduct workshops of human-centric and trustworthy aspects for AI development for program team	- Workshops, hybrid meetings	- Education and basic training of program team for further considerations in ARP program
	- [SEW] Communicate and collaborate with departments regarding relevant AI considerations	- Individual meetings	- Ensuring of relevant aspects for AI integration in company (e.g.: Requirements of worker's council)
	- [KE] Communicate clear definition of roles, tasks and responsibilities for program team members	- Individual meetings	- Clear separation of work throughout the internal program team
K / Ab	- [SD] Update of stakeholder analysis	- Internal program meeting / workshop	- Updated stakeholder map, definition of needed personnel for technical requirements
	- [SD] Creation of change management KPIs	- Internal program workshop	- Definition of measurable progress values for change initiatives
	Short		
Affected Employee			
	- [HAO][DNF][TRP] Explain technical aspects in accordance with the requirements for human-centric and trustworthy AI	- Railshows, local meetings, videos	- Showcase that AI is not replacing the human, human agency and oversight of the developed system is given
	- [TRP] Communicate strategic plans of ethical deployment of AI technologies in the company	- Intranet, workshops, videos	- Align clear vision of affected employees to the future work environment with AI as envisioned by management
	- [TA] Presentation of technical success of system and live demonstrations	- Railshows, hybrid meetings, videos	- Showcase that developed system is able to provide functional results (and thus can work) and highlight improvements
D	- [TA/SD] Clear communication of current technical capabilities and concrete next steps	- All communication channels	- Concrete roadmap for affected employees and communication of vision of future work (preparation for re-organisation)
	- [C/TA] Integration of additional affected employees of different geographical locations	- Railshows, local meetings	- Inclusion of more affected users and increase of reach, consideration of unknown and new parameters for system development
Management			
	- [HAO] Integration of AI ethics oversight into managerial responsibilities	- Individual meetings	- Active involvement of management into decisions surrounding AI and ethical AI integration
	- [DNF][TRP] Review strategic plan for ethical AI and AI impact assessment	- Workshops	- Transparent communication and further development of company-wide AI integration plans
	- [HAO] [TRP] Create AI ethics committee	- Workshops	- Establishment of first AI ethics group within company (arguably also established by worker's council)
	- [TA] Communication of definition of systems that are to be replaced (and not replaced) by the ARP program	- Executive updates, individual meetings	- Concrete technical plan to reduce possibility and duration of parallelism of old and new systems
	- [SD] Approved plan of organisational and structural changes for live-phase of the program	- Individual meetings	- Groundwork for preparation for restructuring and change management for affected employees
D / K	- [JS] Coordinate concrete upskilling and reskilling plan for affected employees	- Individual meetings	- Groundwork for training concept
	- [SD/R] Plan and communicate the strategic direction of the ARP program to affected management in each subcompany (including management)	- Executive updates, meetings	- Creation of focus on individual companies (targeted information) and reduction of political interferences
General Employee			
	- [DNF][TRP] Enhance AI understanding and communicate human-centric and trustworthy AI concepts	- Intranet, workshops, hybrid meetings	- Education of employees on the importance of ethical considerations
	- [TRP] Communicate and highlight ethical AI approaches within the ARP program	- Intranet/Confluence, information hub	- Advertisement of program approaches and show feasibility of human-centric and trustworthy AI integration in business context
	- [DNF][TRP] Recruit and support AI ambassadors for the ARP program	- Ambassador network, confluence/intranet	- Active involvement of supporters and enablement of fairness and transparency
	- [C] Communicate technical improvements and show system capabilities	- Intranet/Confluence, information hub	- Show technical feasibility and improvements over current systems
Aw	- [KE/R] Integrate ambassadors into development process (including worker's council)	- Individual/group meetings	- Gather new perspectives and focus points, positively reinforce multiplicator network
	- [R] Highlight capabilities of agile approach and multi-lingual program	- Intranet/Confluence	- Reduction of cultural barriers in the program and live phase
Program Team			
	- [DNF][TRP] Develop feedback and explainable AI decision system for affected employees	- Workshops	- Ensure continuous feedback and consideration of affected employees in regards to ethical aspects of the system integration
	- [HAO][TRP] Create accessible documentation of AI algorithms and explanations for their functionalities	- Intranet/Confluence	- Ensure explainable AI, transparency in the developed systems
	- [HAO][DNF]SEW] Integrate human-centric and trustworthy considerations into the training plan	- Workshops	- Ensure full alignment on ethical considerations across technical implementation, stakeholders and post program phase
	- [SD] Planning and definition of internal structures and team management post program	- Individual meetings	- Clear career and future outlook for internal program team, reduction of probability of dissociation
K / Ab	- [SD] Creation of knowledge management within program	- Internal meetings and communication	- Structured approach to internal knowledge storage in case of program members leaving during implementation phase
	- [TA/KE] Training of program team for respective technical focus points	- Trainings	- Development of program team to subject matter experts
	Medium		
Affected Employee			
	- [HAO] Training on human agency and oversight aspects within the ARP program and demonstrate decision and control	- In-person, /	- Active integration of human-centric and trustworthy AI requirements into the training courses of affected employees
	- [DNF] Communicate feedback system and way forward	- Railshows, in-person, intranet/confluence	- Continuous, active openness to worries, thoughts and fears throughout ARP system usage for affected employees
	- [KE] Training concept evaluations with affected employees	- In-person	- First training of affected stakeholders and testing of training concept for go-live
D / K	- [C] Communication of new organisation and position	- Online, in-person, intranet/confluence	- Showcase of new organisational chart and position of affected employees
	- [R/JS] Presentation of concrete new jobs, tasks and responsibilities	- Hybrid, in-person	- Upskilling and reskilling plan, build of vision and trust in time after go-live
Management			
	- [HAO] [SEW] Incorporate AI and ethical aspects of AI into the company's strategic goals	- /	- Fortifying ethical AI as main goals of the company
	- [HAO] Create centre of AI excellence	- Workshops	- Fostering of in-house expert knowledge, active integration of AI into the core of the company
	(- [SD] Creation of personnel acquisition plan)		
K / Ab	- [C][R] Preparation of company-specific changes	- Individual meetings	- Finalisation of the structural and organisational changes within each subcompany
General Employee			
	- [SEW] Integrate employees into the AI ethics committee	- Meetings, intranet	- Growth of AI committee and general awareness towards ethical considerations of AI
	- [TRP] Inform employees on strategic goals and management alignment for human-centric and trustworthy AI	- Intranet, hybrid meetings	- Integration of employees into AI processes and knowledge management, information about centre of excellence
	- [SD] Reduction of numbers of active stakeholder involvement	- /	- Identification of relevant stakeholders outside affected employees and management
D	- [C] Communication of company-specific changes and outlook post-program	- Intranet/confluence, infohub	- Outlook for each sub company and showcase of commitment of them
Program Team			
	- [SEW] Develop post-implementation evaluations to assess impact of AI on the company through the ARP program	- Internal workshops	- Definition of KPIs and further analysis to define lessons learned and improve future AI programs
	- [TRP] Create ethical guidelines for the developed systems for the post-program phase	- Meetings	- Ensuring of continuous consideration of ethical aspects of AI though post-program phase
	(- [SEW] Engage in centre of excellence and AI ethics committee as pioneers in this field within the company)		
Ab	- [KE] Upskilling and reskilling of program team for post program phase	- Internal meetings	- Training and groundwork for live phase of the systems and post program management
	Long		

5.4 General Findings

General findings indicate, based on the responses of the interview candidates and the document analysis, that the topic of AI is of high interest to all stakeholders. However, results of this study showed that there is no correlation between the interest of the respective party on AI and their knowledge towards it. This leads to especially high emotions and expectations towards or against AI and a generally high level of illiteracy. This was also strongly reflected on the knowledge of ethical AI, human-centric AI, responsible AI and trustworthy AI. The document analysis did not show any indication of specific focus on the necessary requirements based on these concepts, but were rather partially fulfilled through identified change management measures for the program. During the interviews, the interviewees were not did not have any (detailed) knowledge on these subjects, but some indicated general knowledge as explained in section 5.3. This gap in knowledge was also visible in people in management positions.

There can be different reasons for the lack of knowledge towards trustworthy, human-centric and/or ethical AI. The possible reasons highlighted here serve as a first thought-provoking indication for this gap and thus present a very simplified view on the interplay of the real world. A detailed analysis and explanation for them is a limitation of this work.

- **Focus on monetary gains and efficiency:** Due to the nature of the capitalism and organisations operating within this system, companies (with some exceptions) exist to generate maximum profit. Guidelines and policies that focus on aspects that are not directly in alignment with these goals are in conflict with them and are thus often neglected for more profit-oriented measures.
- **Non-binding and ambiguity of policies and guidelines:** As mentioned in the problem statement (See: 1), policies and guidelines surrounding ethical and trustworthy AI are non-binding. This may lead to companies neglecting any requirements set forth by these guidelines that would impose additional work. In addition, a lot of high-level policies are formulated in an ambiguous and/or general way, creating a challenge for companies to interpret and define concrete measures based on these policies. This is the main problem and the reason of existence for this paper.
- **Lack of Awareness and Education:** Since AI is a relatively young and arising topic, the general public, which includes managers of various positions, have just not learned about trustworthy and/or ethical AI. This imposes a lack of awareness and a gap in education that could be deemed necessary for the sustainable integration of AI.

There are various other possible reasons for the lack of knowledge within companies when it comes to ethical and/or trustworthy AI, e.g.: misalignment of incentives, cultural and organisational barriers, siloed structures and underestimation of risks but are not left open to the reader and future work to be analysed in detail.

In order to tackle this gap in know-how, educational measures are necessary to be taken within the organisation. These measures exceed the capabilities of individual projects/programs and departments and have to originate from a general need across the whole business. Concrete measures that organisations may take to close these gaps are explained and showcased in this case study in table 5.5.

CHAPTER 6

Conclusion & Future Work

6.1 Conclusion

In this paper, we conducted a qualitative case study at the biggest railway operator in Austria to determine internal barriers and challenges to the integration of AI technologies into existing business structures, its impact on stakeholders and defined concrete measures that companies can take to implement AI technologies in a human-centric and ethically responsible way. Results were retrieved using a document analysis and semi-structured interviews, followed by a qualitative content analysis.
Focusing on the internal barriers and challenges, the content of the barriers and challenges was separated into four different categories, which were identified through the nature of the underlying data set. These four categories were (i) "Management", which includes all employees acting as supervisors, ranging from team coordinators to the board of directors, (ii) "Program Team", which includes all internal and external employees working in the AI integration program, (iii) "Employee", which represents all employees of the company, including the affected employees or key users and (iv) "Environment", which represents barriers that are not originating from a specific group but exist through the existence of the environment the integration is performed in. In this paper, we showed the interplay between these barriers and challenges and their origins based on these four main categories.
We also created a fear mapping of the integration of AI technologies within the company, based on the four main actors identified: the (i) affected employee, (ii) management, (iii) general employee and (iv) program team. These fears were separated into internal fears per main actor and their fears towards each other actor. They highlight the trends and focus points of each main actor. The affected employee has a fear of personal and professional displacement. The management has a fear of strategic failure and resource constraints. The general employee has a fear of uncertainty and inadequate support. The program team has a fear of lack of alignment.

In addition, this paper also evaluated the experiences and expectations of stakeholders towards AI integration projects. We derived six categories, which were derived from the gathered analysis and show the focus points of stakeholders for such projects. The six categories are (1) Technical Aspects, (2) Knowledge and Expertise, (3) Job Security, (4) Communication, (5) Cultural and Organisational Resistance, (6) Strategic Direction.
Based on the internal barriers and challenges, the fear mapping and the analysis of the experiences and expectations of the stakeholders, we created a table, which shows concrete change management measures companies can take to minimize fears, factor in barriers and challenges and use scientific change management measures based on the ADKAR model to ease the transition phase for employees. These concrete measures are defined for each of the four main actors and include short-term, medium-term and long-term measures. Each measure consists of the concrete measure itself, the ideal communication channel and the goal. In addition, the table shows the current dimension each actor is in based on the ADKAR model and the development of each actor for each term.
We also enhanced the table, focusing on four main requirements for trustworthy AI according to the Ethical Guidelines for Trustworthy AI [6], (i) Human Agency and Oversight, (ii) Diversity, Non-discrimination and Fairness, (iii) Transparency and (iv) Societal and Environmental Well-Being. Concrete measures for each main actor and term was defined to highlight the necessary measures companies can take to adopt a human-centric and ethically approach to the integration of AI technologies in existing business structures. The focus points for the affected employee are the build of trust and transparency and the showcase of practical use, the alignment of strategy and general awareness towards ethical aspects of AI for management, education and awareness towards AI for the general employee and ethical design principles and technical aspects for the program team. We also provided concrete KPIs to measure the change management initiatives developed within this paper.
Lastly, during this study we found out that ethical AI, human-centric AI and trustworthy AI are terms that are currently not familiar to the general employee, indifferent to their respective hierarchical position within the company, highlighting the necessity to further analyse reasons for this occurrence and possible measures that can be taken to close this gap in knowledge.

6.2 Future Work

In this paper, we focused on the Ethics Guidelines for Trustworthy AI [6] from 2019. During the research and writing of this master thesis, several other noteworthy guidelines had been developed, including the AI Pact by the EU [115], which include new perspective and governance attributes. Future work may focus on researching the development of such guidelines and their impact on current policies and frameworks, including the impact these changes have on the concrete implementations in companies.
This paper also only focused on specific aspects of the Ethics Guidelines for Trustworthy AI 1.3. Future work can focus on analysing the impact of the introduction of AI technologies on the basis of the other defined requirements.
This thesis also focused on social impacts of the introduction of AI technologies on affected stakeholders, not on technical attributes unique to AI. Future work could focus on technical aspects and their social and ethical implications, including technical requirements for the concrete system(s), like data anonymisation, bias in data and data collection.
Future work can also focus on the development of ideal human-computer interactions using AI systems as part of the change management process of AI technologies. Research could focus on evaluating the level of detail the training courses and AI applications should incorporate, optimising understandability/usability and performance.
Since we conducted a case study, we are limited to the area the company that was analysed operates in. Future work may also show limitations or similarities of the results of this work in other sectors. This may include a case study in a different sector, using a similar scientific approach to this master thesis. In addition, the case study was conducted at a large corporation with more than 45.000 employees. Future work could focus on analysing the differences in terms of approach, cultural impact, barriers, challenges and social aspects between differently sized companies and structures.
Future work may also focus on analysing external barriers, challenges and social implications. This includes specifically the analysis of external stakeholders, mainly suppliers and program contributors that are not part of the company the program is conducted in.
Since the concrete implementation of any measures of AI ethics is oftentimes in combination with organisational changes, future work could focus in detail on possible organisational and transformational aspects on building an AI ethics governance and consultation structure within companies of different sizes. This was only briefly described in the discussion section of this thesis.
One of the main findings of this study was, that stakeholders in general do not know about AI ethics or Trustworthy AI. While a first indication of possible reasons is described in section 5.4, future work could focus on identifying and analysis reasons in-depth for this occurrence and define approaches to bridging the gap between research, governance coverage and urgency for companies to incorporate ethical aspects of Artificial Intelligence.

List of Figures

List of Tables

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