Leadership and Artificial Intelligence

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Abstract: Artificial intelligence (AI) is of rising importance in these days. AI is increasingly used in various company fields. Nonetheless, no high-quality scientific sources could be found stating the use of AI in the field of leadership. This research gap is addressed with this elaboration by performing expert interviews with leaders. In total seventeen companies could be questioned. The results indicate that AI is not widely used in leadership yet since only one company uses it currently and just about 10% of the participants plan the implementation in the closer feature. While the following items explain why companies want to use AI in leadership: Chances for automation, time and cost savings, many important disadvantages and issues prevent companies from actively using it now: No areas of application are known, no need justifies the use, human interactions as a key aspect of leadership is reduced and it is hard to collect all necessary data. Beyond that, it was aimed to identify changes in the field of leadership through the use of AI. This objective could not be addressed due to the limited number of participants using AI in leadership.

Keywords: Leadership, artificial intelligence, transformation, state-of-use

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List of Abbreviations

AI ..... artificial intelligence
HI ..... human intelligence
HR ..... human resources
IoT ..... Internet of Things
RO ..... research objectives
RQ ..... research questions

1 Introduction

Leadership as a well-known topic and the rising influence of artificial intelligence (AI) lead to scientific and practical interest in the combination of both topics. AI as "the capability of a machine to imitate intelligent human behavior" (Merriam-Webster, 2020) has several possible applications in leadership. Potential benefits include rehumanizing work since AI can perform many tasks. Thus, there is more time to be social and human (Daugherty & Wilson, 2018). AI can be used to generate direct value for companies by automating processes for example in combination with robotics, enabling more cost-effective and precise predictions by data analysis or simply by social interaction with employees or customers in form of a conversational agent (Verhezen, 2019). Nevertheless, it is clear that the use of AI in leadership will change the way people are led. It is described as wise leadership by Verhezen (2019).

Applications in the field of leadership are discussed in detail in the paper and are verified by interviews with experts. The term leadership is used to describe the functions of a leader. The act of leadership is often associated with leading teams or individual employees (Bruch et al., 2006). Leaders can convince others of their own visions, goals, values, or actions. Therefore, they often have the vocation to be an inspiration to peak performance. They take the individual wishes and needs of the employees into account and provide incentives to achieve the company's goals (Bruch et al., 2006; Peters, 2015).

The terminations leadership and AI are explained in further detail in chapters 3.1 and 3.2. Next, the relevance of the topic is highlighted.

1.1 Relevance

The relevance of both topics of interest is highlighted separately whereas their connection is already indicated through the explanations in this chapter.

Artificial Intelligence

Sales of AI applications are prognosed to rise from about $93 million in Europe in 2016 to nearly $7,876 million in 2025 (see Figure 1). This corresponds to a growth rate of over 8400% and illustrates the potential of using software supported by AI. Worldwide it is prognosed to increase from nearly $360 million in 2016 to over $31,000 million in 2025, a growth rate of nearly 8730% (Tractica, 2019). Furthermore, a Deloitte-study revealed that about 80% of 200 companies questioned in Germany count AI to their crucial success factors (Birkner, 2020).

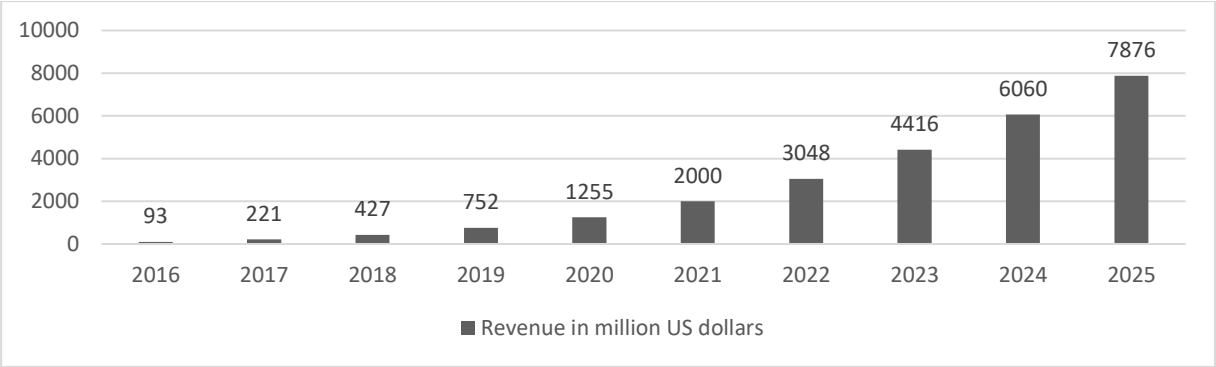

Figure 1 Sales of AI Applications in Europe until 2025. Own Illustration based on Tractica (2019).

The development is described as follows: "[…] machine learning has at last hit the vertical part of the exponential curve […]" (Dewhurst et al., 2014, p. 76). Furthermore, they point out that it can influence many areas of work and that it can also change current working methods (Dewhurst et al., 2014). AI is used in human resources (HR) for example to reduce the time needed for administrative tasks, to reduce the number of employees, and to recruit new employees. In addition, it can be incorporated into the workflows of the employees, such as a program for further education. Beyond that, AI could be supportive in document verification processes that require employee reviews. When fed with enough data, it will recognize what the person who confirms is paying attention to and can make decisions independently (Pandey et al., 2018).

For example, software algorithms have changed the way of managing the increasing number of employees in recent years, which could be achieved using AI (Lee et al., 2015). Examples are the emerging area of crowd-sourced workers in platforms like Uber, Lyft, TaskRabbit, and Amazon mTurk. These workers do not have human managers assigned to them, they are mostly independent. Rather, they use management through algorithms that allows the parent company to supervise their employees to a large extent. Uber for example leads thousands of drivers globally, which is relatively unlikely in a company without AI. The ridesharing services increased transparency and is able to assign work easier. Thus, AI can be used as a competitive advantage. One problem to be recognized is the acceptance of the use of AI since AI algorithms can still make wrong decisions if they lack information (Lee et al., 2015), it is important to have a good and extensive data basis (Dewhurst et al., 2014). It must be available in the best possible form to maximize accuracy. If that's the case, ambiguous decisions can be made by intelligent algorithms which machines could not do before (Dewhurst et al., 2014; Pandey et al., 2018). Thus, AI is related to big data. Furthermore, real-time data plays an important role as well (Dewhurst et al., 2014).

A further barrier is that jobs may be lost through the use of AI. Brougham and Haar (2018) estimate that by 2025 almost one-third of the jobs could be performed by smart technology, AI, robotics, and algorithms (Brougham & Haar, 2018). This problem was also known to Stephen Hawking. In an interview, he noted that "if machines produce everything we need, the outcome will depend on how things are distributed. Everyone can enjoy a life of luxurious leisure if the machine-produced wealth is shared, or most people can end up miserably poor if the machine-owners successfully lobby against wealth redistribution. So far, the trend seems to be toward the second option […]" (Brownstein, 2018). In Dewhurst et al. (2014) it is also mentioned that the technology will rather affect the less qualified than the highly qualified employees. The qualified employees in the company will be able to make more and better decisions on their own and thus increase quality and productivity (Dewhurst et al., 2014). In addition, Bill Gates noted in an interview in 2019: "The world hasn't had that many technologies that are both promising and dangerous […]" and "so incredible, it will change society in some very deep ways […]" (Clifford, 2019). These quotations show quite clearly that AI could have positive but also negative consequences for the public interest and thus have high relevance for scientific and practical considerations.

Leadership

In Germany, the terms "leader" and "leadership" are associated primarily with leadership, management and leadership qualities in recent years. The German translations of the words "Führer" and "Führerschaft" tend to be associated with negative qualities due to the Nazi historical background. Therefore, the terms "leader" and "leadership" have become influential in Germany in the last few years (Peters, 2015).

Regarding the use of AI in organizations, 63% of the executives taking part in a survey replied that they expect AI to have a huge impact on their company till 2022 (Ransbotham et al., 2017). In addition, they found that in all industries surveyed, AI is likely to influence information technology, operations and manufacturing (Ransbotham et al., 2017). This impact also applies to leadership areas.

The importance of leadership and the subconcepts are constantly increasing, which can be determined by the number of emerging approaches such as *new leadership* or *neuroleadership*. Leadership will therefore also change through the use of AI *(Peters, 2015)*. As unqualified measure, it can be added that about one third of the google search results for the topic of *AI leadership* is from the last year. As a related indicator, the vast amount of new articles about

the topic can be used to highlight the relevance. Several are published by well-known sources like the Forbes Magazine (Dhanrajani, 2019; Meister, 2019), SAP (Hunt, 2020), Harvard Business Review (Fleming, 2020) and McKinsey & Company (Bourton et al., 2018). The advantages of using AI in leadership are higher capacities, more time and a bigger budget. Further improvements can be the availability of more information in a higher quality. The efficiency of AI depends on various factors such as processes, people, and technology which is sometimes one of the biggest challenges of utilizing it (Pandey et al., 2018).

1.2 Problem Statement

Despite the relevance of AI and leadership in this day and age, there are only a few scientific papers focusing on how the use of AI in organizations transforms leadership. Nonetheless, there are many articles in magazines contributing to this topic. The major part of the literature is concentrating on aspects like HR, algorithms (e.g. Dietvorst et al., 2018), machines or robots (e.g. Le Clair et al., 2016), future workplaces (e.g. Brougham & Haar, 2018) or simply the use of AI in organizations in general such as the article of Brynjolfsson and McAfee (2017). There are a few that focus on the links between AI and leadership, but these are single cases that do not describe the change in leadership (e.g. Daugherty & Wilson, 2018; Dewhurst et al., 2014). It was not possible to find any recent qualitative scientific article that deals with the change of leadership through the use of AI. Nonetheless, many magazines such as Forbes Magazine, Harvard Business Review, McKinsey Quarterly, or the Journal of Business Strategy have included the topic in the last years. Therefore, the topic is of interest as the concepts introduced in those sources can be validated and used for triangulation.

The generated knowledge may be applicable for researcher in other fields. Furthermore, our results should enable further research in this area. Beyond that, practioneers will benefit since the results could have a major impact on how they deal with AI in leadership and what changes they can expect from the use. As the field of AI in leadership is quite new, it is of interest for companies to know about possible changes preceding the implementation of AI in those fields.

From a critical point of view, it is possible that AI has no application in the field of leadership or that it does not influence leadership. This could explain why there are currently no scientific articles in this area. Thus, one possible result is that there are no relevant use-cases for implementing AI in the leadership area.

1.3 Research Aim

The results of the literature analysis show that it is a quit unexplored research field. Thus, the following rather broad research aim was set: *Identify how artificial intelligence is used in leadership and its impacts.* The methods proposed in chapter 2 are used to answer this research aim. Therefore, the following research objectives (RO) and research questions (RQ) are chosen.

Research Objectives	Research Questions
RO1 - Identify the current usage status of AI in leadership	RQ1 - How is the usage status of AI in the leadership area? RQ2 - If AI is used, in which leadership areas is it used? This question refers to areas of work such as further training, career planning and personnel recruitment.
RO2 - Identify the reasons for use and non-use of AI in leadership	RQ3 - What are the reasons for the use of AI in leadership? RQ4 - What are the reasons for not using AI in leadership?
RO3 - Investigate the advantages and disadvantages of AI in leadership	RQ5 - What are the benefits of using AI in the leadership field? RQ6 - What are the disadvantages of using AI in the leadership field?
RO4 - Identify how leadership has changed through the use of AI	RQ7 - How does the use of AI change the way leaders lead? RQ8 - In how far does Leadership change in general and how does AI support this?

Table 1 Research Objectives and Research Questions. Own Illustration.

1.1 Research Outcomes

The expected outcomes are that the RQ are answered and thus the research aim should be answered by a theory, based on the interview analysis which will be validated with a triangulation of the literature analysis. As the research gap is not being considered in detail so far, a theory will be developed at the end of the research discussing if and how leadership has changed using AI. Due to the mixed methods approach used with a large amount of qualitative data but only a small quantity, it is not assumed that it is possible to answer the research aim finally and generalize the theory. Furthermore, it is not clear how many interview partners can be found. This also influences the quality of the results to a large extent and cannot be precisely determined at this point in time. Future research could try to validate the identified results by using the knowledge from other research areas which use AI to perform a second round of theory

triangulation. Thus, general assumptions about the use of AI from HR management or management in general could be used to verify the findings.

1.4 Structure of the Paper

The structure of the paper is built according to Webster and Watson's guidelines (Webster & Watson, 2002). The introduction is used to preface the topic with the relevance of the topic and research aim and outcomes containing the RO as well as the corresponding RQ. In the second chapter, the methodology used for the creation of this elaboration is highlighted. The chapter pays special attention to the literature analysis according to Webster and Watson (2002) and the interview procedure according to P. Mayring (2010, 2014); P. Mayring and Fenzl (2014); Mayring and Philipp (2004). They are both explained and justified. The next chapter contains a literature review which especially focuses on leadership and AI. Another subchapter is used to identify related ideas in a concept matrix. In the fourth chapter the authors explain the creation of the two questionnaires and which results emerged from the analysis of the interview transcription’s codes. Subsequently, the results are discussed. Further focus is placed on implications, limitations and future research arising from the elaboration. At the end there is a conclusion where the RO and RQ are explicitly summarized and answered.

2 Methodology

The literature analysis is performed according to the guidelines of Webster and Watson (2002). It is discussed in chapter 2.1. Below, the analysis of the interviews is described based on the findings of P. Mayring (2010, 2014); P. Mayring and Fenzl (2014); Mayring and Philipp (2004).

2.1 Literature Analysis

The guidelines of Webster and Watson (2002) are used because they have created a research guide for information systems. This includes literature search and analysis as well as directives and thoughts on how to write the article. In the field of information systems, many articles were published in the last years, but only a few enable making an overview of this multiplicity possible. The paper has been frequently cited on many platforms and was published in a high-quality journal (MIS Quarterly). Therefore, it can be assumed that it is of high quality, and the concept is representative. In relatively unexplored fields such as AI in leadership, there is often a degree of uncertainty about the quality of literature. There are only a few journals in the field of information systems that are dedicated to reviewing articles.

As described by Webster and Watson (2002), their method is suitable for conducting a literature search before conducting a qualitative analysis like expert interviews. According to Webster and Watson (2002), there are two types of papers. The first variant deals with a topic in which a lot of research articles are published that require analysis and synthesis. In this case, a thorough literature analysis is carried out. Based on this, a conceptual model is built that synthesizes and extends the existing research. In this paper, we refer to the second type since the analysis is carried out in a new topic area and is used as a basis for further research. Since this is a new topic with less representative articles, the literature analysis is shorter in this case (Webster & Watson, 2002). A graphical representation of the methodology is shown in Figure 2.

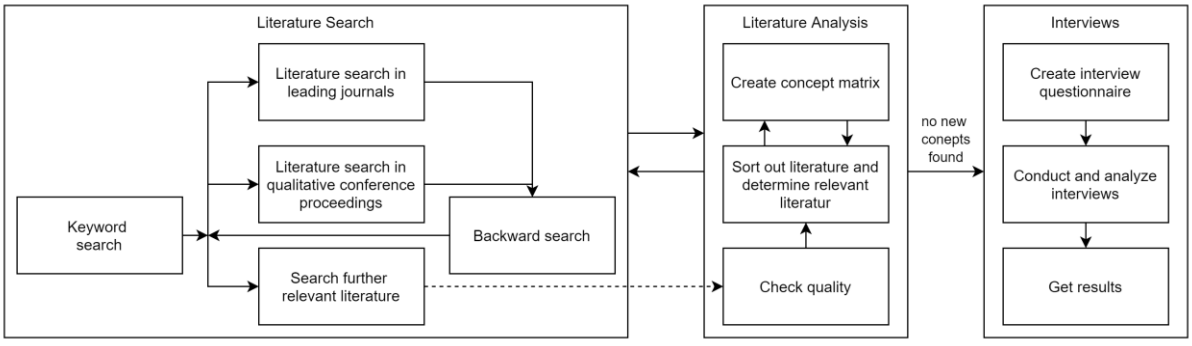

Figure 2 Overview Literature Analysis. Own Illustration.

As recommended by Webster and Watson (2002), the literature search was not only done in top journals but also in representative elaborations like newspapers, conference proceedings or books, regardless of their place of publishing. Nonetheless, top journals and qualitative conference papers are preferred. However, this is a relatively unexplored area and other sources are used if they are of sufficient quality. The search was done based on keywords such as AI leadership and combinations and variations of both. The literature research was conducted through research in online databases, namely Google Scholar, Emerald Insights, ResearchGate, and Google.

Also, a reverse search should be used based on the proposed and found articles. However, this could not be done due to insufficient literature. Iteratively, irrelevant literature was sorted out and a concept matrix was created. In the concept matrix, the relevance of each paper regarding the concept of focus was documented. Furthermore, it highlights the research gaps since it shows which areas have been studied less so far (Webster & Watson, 2002). Because the literature analysis in this paper is only made as a basis for the interviews, the results will be analyzed in the interview chapter by using Mayring's method. During the analysis of the results, findings from the literature analysis are taken into consideration for verification purposes. In summary, the results of the literature research are used for the theory triangulation.

Since the RQ pay much attention to current use-cases, only papers from the last five years are sought. In total 35 articles have been scanned, while only the fourteen most promising ones are used in the concept matrix. The complete matrix is developed in chapter *3.3*.

2.2 Interview Analysis

Different theoretical foundations had been taken into consideration for this elaboration. Finally, the qualitatively oriented content analysis according to P. Mayring (2010, 2014); P. Mayring and Fenzl (2014); Mayring and Philipp (2004) is used. It is chosen because the analysis is transparent, comprehensible, and intersubjectively verifiable through it’s fixed rules. The rules are defined in a table and revised in feedback loops. A further advantage is that several researchers can be involved in the coding process, which increases the overall quality of the analysis (Mayring & Philipp, 2004). Creswell and Creswell (2018) have distinguished between qualitative, quantitative, and mixed methods approaches. According to them, a mixed methods approach is used in this paper. It consists of qualitative and quantitative research and can deliver results exceeding the ones of a single approach. As part of the qualitative analysis, interviews are conducted and coded. The frequency distribution of these codes also generates quantitative data. The available data was not sufficient for quantitative analysis since it is a relatively

unexplored area. The results of the qualitative research are examined more closely by a mixed methods approach. This way the results can eventually be generalized (Creswell & Creswell, 2018; P. Mayring & Fenzl, 2014). P. Mayring (2010) describes this analysis as a qualitatively oriented category-driven text analysis. He justifies it by stating that quantification is possible by making use of frequency distributions (P. Mayring, 2010).

The content analysis according to P. Mayring (2010, 2014); P. Mayring and Fenzl (2014); Mayring and Philipp (2004) is an instruction for rule-guided, intersubjectively comprehensible working through extensive text material. In this case, the reviewed resources are the transcriptions of the interviews (Bortz & Döring, 2006). The aim of the qualitative content analysis is to draw conclusions from the interviews to answer the RQ and RO (P. Mayring, 2010). One advantage is that the analysis is more detailed compared to other qualitative methods, such as the global evaluation, which allows a quick overview of the texts. This is achieved by the elaborate category system, which improves verifiability and further research (Bortz & Döring, 2006). It is guided by rules and is verified through repetitions which differentiates the analysis from other methods (P. Mayring, 2010).

The goal of the literature analysis described in the previous chapter is the development of suitable definitions and a basic understanding of the transformation process in Leadership and AI. The questionnaire is created based on the findings of the literature analysis and the RQ developed in chapter 1.3. Afterwards the coding guidelines are developed. P. Mayring (2010, 2014); P. Mayring and Fenzl (2014); Mayring and Philipp (2004) refer to them as *category systems*. These contain the coding rules, which are exactly defined and created by the following specifications (P. Mayring, 2010). A code should consist of one or more words for a better overview and should always clearly show the same context after the coding process. The categories are determined based on the interview question, but the codes are still not only used in the according transcript sections. This is necessary since an interviewee might anticipate a question. The interview time is kept as short as possible since the interviewee partners usually have time pressure (P. Mayring & Fenzl, 2014). By using those rules, the different statements can be treated under one code. These rules are important since every interviewee formulates concepts differently. The creation of them is based on the findings of the examination of theoretical material in the literature analysis. It is revised or specified during the coding process (P. Mayring, 2010). In summary, there are pre-defined categories, while a category can contain several codes. Categories are predefined according to the interview questions (P. Mayring & Fenzl, 2014).

After the interviews are conducted, they are transcribed. It is sufficient to use a partial transcript in this case since the analysis focuses on the core statements of the interview partners and not on linguistic nuances. For this purpose, e.g. embellishments, repetitions, and clarifications are omitted in the transcription process according to P. Mayring (2010). Due to the limited resources of this work, the time-consuming transcription process can be shortened, and thus more interviews can be conducted and analyzed (P. Mayring, 2010). Since it is a rule-based procedure, the subjective opinions of the researchers are reduced. The process can easily get complex if a code is used for several relevant text passages in an interview (P. Mayring, 2010), the coding rules must be defined appropriately, and previous decisions must be reviewed. These repetitions are visualized in Figure 3.

The revision process is important because coding rules are defined by the researchers and can only be improved by using them. They are tested and adapted in every iteration. Testing and revising is a basic principle of scientific methodologies for new instruments, such as the coding guidelines (P. Mayring, 2010). Revision of the rules is only performed in the first round of coding. Otherwise, it is not possible to keep a linear model in the second round of coding (P. Mayring & Fenzl, 2014).

The second coding round is performed by another researcher to further increase the quality of the analysis. Differences between both coders are discussed (P. Mayring, 2010). Since there is room for interpretation, not all differently coded parts are wrong. Therefore, they are discussed before revision. If there are discrepancies, they are corrected in the data set after a discussion (P. Mayring & Fenzl, 2014). After successfully coding all interview transcripts, the analysis of the data begins. The coded transcripts are analyzed in more detail by using the frequency distributions of the codes (P. Mayring, 2010). The whole process is shown in Figure 3.

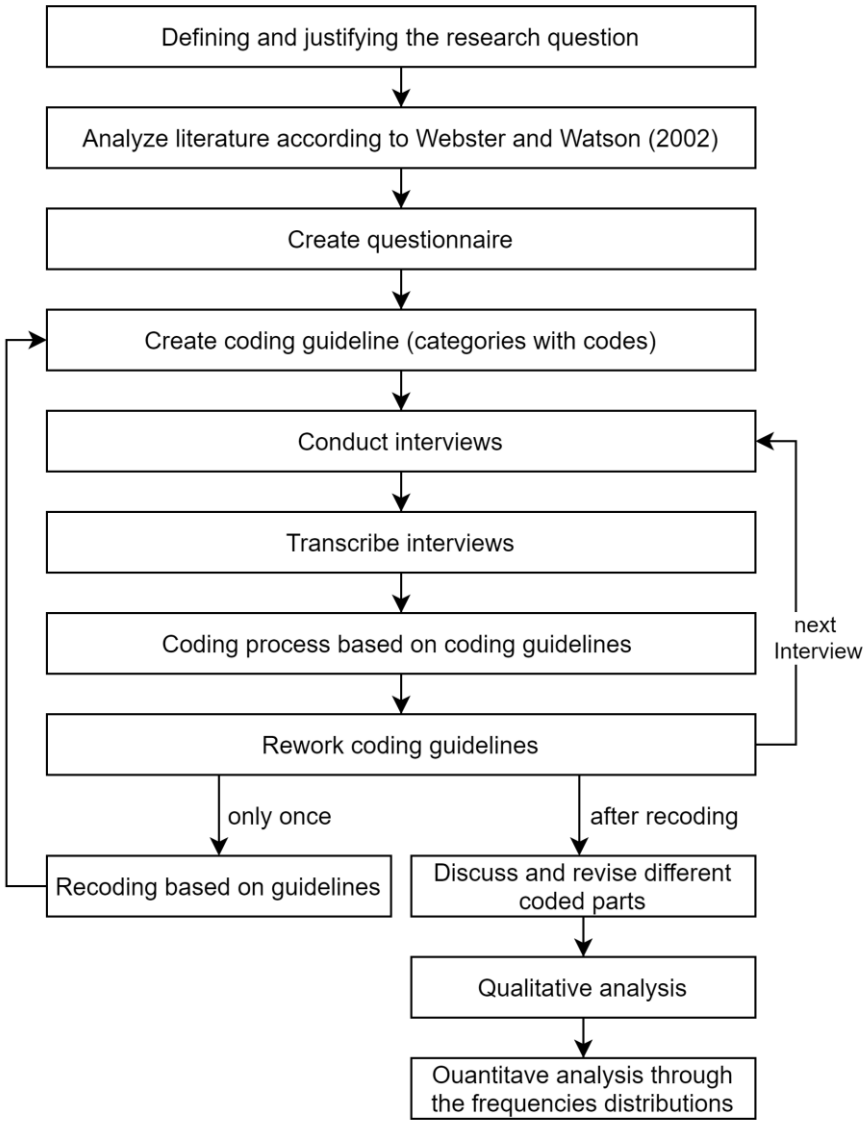

Figure 3 Theoretical Structure of the Interview Conduction and Analysis. Own Illustration based on P. Mayring (2010), P. Mayring (2014) and Mayring and Philipp (2004).

3 Literature Review

Grounded in the guidelines defined by Webster and Watson (2002), the following explanations are formulated. The first one is about leadership. The chapter is closed by a description of the AI.

3.1 Leadership

In the following, the five human images are explained. They have different characteristics and behaviors. Every leader has adopted his or her view of human nature and this has a significant influence on the form of leadership, i.e. how employees can be led, motivated, and convinced. A detailed differentiation of these human images of man is shown in Table 5 in the Appendix.

1. Economic man

   Taylor examined the economic man in *The Principles of Scientific Management* (1919). His core finding was that the economic man only has economic interests and can only be motivated by financial incentives. Humans are viewed as machine-like beings that should only perform operative and repetitive activities. However, this reduced the quality of work, job satisfaction. Furthermore, there was no trust in the employees, which means that external controls are an important part of the managemental activities. This way of working brought many advantages and improvements due to the high productivity. It was mainly used in the automotive industry and on assembly lines (Peters, 2015; Taylor, 1919).

2. Social man

   Here, the human being is perceived as a social being. Interpersonal relationships and social conditions at work are important to them. In summary, a better working atmosphere ensures satisfied employees and thus higher productivity. The leader has less control and perfect planning but should promote social interactions and a good working atmosphere (Peters, 2015).

3. Self-actualizing man

   In the next stage, man strives for self-realization. This is to be achieved by expanding his individual abilities to be able to use them fully and in the best possible way. In a company this can be realized by granting room for maneuver and autonomous work. According to Maslow's hierarchy of needs, a worker has different classes of needs (Appendix: Figure 20). When the lower classes are satisfied, the next higher class is targeted. A leader should aim for all employees reaching the highest class of the pyramid (Peters, 2015).

4. Complex man

   The complex man contains not only one focus and is flexible, learning, individual and situation-dependent being. In contrast to Maslow's, these needs vary depending on the person and can also change over time. Thus, there is no longer a fixed management strategy. The leader has to take care of each person and develop the best strategy for each of them (Peters, 2015).

5. Brain-directed man

   The brain-directed man is based on the complex man with his individual needs. This approach tries to explain the actions and decisions. Through the basics of brain research, it is now possible to partially decipher the processes in the brain. The human image of the complex man is tried to be described by neural brain research. Thus, a leader has to consider that a human being will never completely switch off his old behaviors and new ones should only be offered as alternatives. A reward system can be used for motivational purposes. In contrast to the economic man, further means have to be determined individually and do not consist of financial incentives only (Peters, 2015).

Based on the number of images of humanity, a variety of leadership variants arise. Some of them are illustrated in Figure 19 in appendix 7.2. The list is not exhaustive. In addition, there are many more types of leadership summarized under the term “New Leadership” (Peters, 2015). Since many different leadership concepts can overlap in reality, they are not described in further detail. Interviewees are only asked to evaluate the change in leading affected by the use of AI.

Furthermore, Burns (2010) distinguishes between transactional and transforming leadership. Transactional leadership is described by a leading person who wants to get in touch with others on purpose and on his own initiative to start an exchange on things of value like discussions on political, psychological, or economic topics. It is important to highlight that both parties see each other as human beings and are conscious of their individual and specific power as well as their attitudes towards each other. In contrast, leaders and engaged people are acting together towards reaching a higher level of morality and motivation in the transformational leadership style (Burns, 2010): To summarize, the transformational leader leads by using charisma and vision to influence followers (Burns, 2010; Lies, 2018).

In many sources, it is mentioned that there is a variety of leadership definitions. Burns (2010) mentions 130 definitions, while Silva and Alberto (2016) already analyzed 1400 definitions for their paper in 2012. The high number indicates the variety of different possible leadership

definitions. This indicates the relevance of defining leadership appropriately for this elaboration. Therefore, leadership is defined in the context of this elaboration as follows. At the beginning, a few definitions are shown to illustrate a range of differences and similarities occurring between different explanations.

- Bill Gates: “As we look ahead into the next century, leaders will be those who empower others” (Kruse, 2013).
- Warren Bennis: "Leadership is the capacity to translate vision into reality” (Kruse, 2013).
- John P. Kotter: “Leadership means inspiring and motivating those you lead with vision. Leadership creates creativity, innovation, meaning and change” (Hegele-Raih, 2004).
- Kevin Kruse: “Leadership is a process of social influence, which maximizes the efforts of others, towards the achievement of a goal” (Kruse, 2013).

Due to the vast amount of definitions of the term leadership and their various facets, the selection of a suitable definition turned out to be complicated. Nonetheless, it is notable that most common definitions like the ones above describe a relationship between leading and guided people with aim on motivating the guided person by visionary concepts and methodologies. The following definition combines those key aspects and should thereby be representative. Leadership is defined by Bruch et al. (2006) as follows: “*Leadership ranges from the leadership of individual employees and teams to the visionary thinking and acting of managers for the entire company. Leaders motivate and inspire employees and lead them to peak performance by recognizing their individual wishes and needs and by providing special incentive packages” (Bruch et al., 2006, pp. 4–5)*. This definition is used in this paper as it includes all terms that are important for further investigation. Beyond that, it leaves room for not yet known constructs that might be introduced during the interview process.

The tasks of a leader can be divided into employee-oriented-, task-oriented and leadership-specific tasks. Employee-oriented tasks include the needs and interests of the employee. Task-oriented leadership tasks are the correct handling of the leadership process. Examples of this would be defining goals and setting them for employees or delegating assignments and roles. Others are control, feedback, goals, planning, informing, communication and realization. A detailed differentiation of the terms management and leadership can be found in Table 6 in appendix 7.4 (Burns, 2010).

3.2 Artificial Intelligence

In 1967 Peter Drucker described the computer as follows: "[…] the computer makes no decisions; it only carries out orders. It's a total moron, and therein lies its strength. It forces us to think, to set the criteria. The stupider the tool, the brighter the master has to be—and this is the dumbest tool we have ever had" (Drucker, 1967, p. 8). By this quotation AI can be delimited from other algorithms very well, because it does not only follow the set criteria, but also creates them and can therefore make independent decisions without fixed parameters. The criteria are determined independently based on the stored data records. This is probably the most decisive feature of AI (Dewhurst et al., 2014). The term AI can be summarized as a machine that aims to simulate human intelligence (HI), which empowers the machine to select and utilize adequate knowledge when it is appropriate (Konar, 2018).

One key characteristic of AI is that the results are highly related to the set-up which includes the calibration as well as the available resources (Verhezen, 2019). Preparation of the data is the key: "garbage in/ garbage out". This highlights its relation to big data (Dewhurst et al., 2014). The term big data describes a large amount of data, whereas common definitions like the one by IBM characterizes big data with three words: Velocity, variety, and volume. Velocity is about the increasing speed in which data is created and spread with a focus on decision-making since every piece of data influences the next one. This high dynamic can be seen in social media for example. Second, the variety of published data, such as structured and unstructured data, as created by users and Internet of Things (IoT) device. Third, volume, which describes the amount of data being created in various sources like IoT or social media. Nevertheless, the scale in which those three happen cannot be ignored. Here, AI comes in since it can handle huge amounts of data and structure it. This is possible because it can decide very fast on clusters recognition for example and thereby handle the vast amount of big data (O'Leary, 2013). But there is always someone who has to set the targets and goals of the machine, thus it knows how to do its work (Dewhurst et al., 2014). Beyond that, it will always be necessary to manage, verify, and monitor the input and the output of the algorithms to ensure a well functionality (Daugherty & Wilson, 2018; Verhezen, 2019).

Pandey et al. (2018) and Dietvorst et al. (2018) describe the advantages of AI with better accuracy and stability for all everyday processes. Crucial components to reach it are a basis of qualitative data and the necessary computing power (Pandey et al., 2018). AI and the related programming constructs like deep learning can be used to generate direct value for companies by automating processes for example in combination with robotics, enabling more cost-effective

and precise predictions by data analysis or simply by social interaction with employees or customers in form of a conversational agent (Verhezen, 2019).

The efficiency of AI depends on the combination of people, processes, and technology, which can be the biggest challenge as well. When deciding whether to use such a technology, the company must also decide whether the resulting benefits of the functions can cover the costs and how long the length of the payback period is. Further barriers are the talent gap, concern over privacy protection, ongoing maintenance, integration capabilities, limited proven applications, and the provisioning of data (Pandey et al., 2018). Another problem occurring regarding data is for example when using it in applications such as chatbots for example in career planning. It is important to include concepts to store personally identifiable information secure and law-conform, while still having enough data to further improvements of the services (Pandey et al., 2018).

The introduction of AI algorithms is not easy because users have to accept them. According to Dietvorst et al. (2018) the users would use an imperfect algorithm if they can modify the forecasts. This increased the acceptance and satisfaction with the forecasting process and therefore the users had been more convinced of the results (Dietvorst et al., 2018). A related concept is trust. It is central in the use of new technologies such as AI, where no one can trace how the information is transformed (Verhezen, 2019). Another issue regarding the amount of data is the handling and monitoring of errors (O'Leary, 2013).

3.3 Concept Matrix

The identified concepts are differentiated in the following matrix according to a concept-driven approach (Webster & Watson, 2002). The article list is ordered alphabetically descending by the author's name. The evaluation is made on a scale with three items and one empty field for not being addressed: high (H), moderate (M), and low (L). The terms refer to the depth of analysis regarding the presented concepts in the sources.

As a foundation for the concepts, the MELDS framework by Daugherty and Wilson (2018) was used: Mindset, Experimentation, Leadership, Data, and Skills. The term "leadership" was dropped, and the term "experimentation" was changed to "culture" to better fit to the field of interest and other sources. The items of leadership are included in other topics. Some of the categories transcend the concept of origin and some of the illustrations only focus on the leadership aspects since the origin is not limited to leadership. The order of the concepts in the matrix below is oriented on their structure. The ones oriented to the right refer to previous ones.

Transformation Concept	Productivity							
	Decision-Making							
Article	Data	Job & Team Creation	Mindset	Culture	Coexistence of AI & HI	AI Leadership	A Leader's Skill set	AI as a Challenges
Bourton et al. (2018)		M					L	
Brynjolfsson and McAfee (2017)	L	L					L	
Daugherty and Wilson (2018)	H	M	H	H	H		H	
Dewhurst et al. (2014)	H		L				H	H
Dhanrajani (2019)	L	M	M				H	
Fleming (2020)		M	M				M	
Fonseca (2020)						M	L	L
Hunt (2020)		M					M	
Lee et al. (2015)			L				M	L
Meister (2019)		H	M		M		H	
Pandey et al. (2018)	M		L					
Plastino and Purdy (2018)		L	L	L	M		M	
Verhezen (2019)	M	L	H		H		H	L
Walczak (2016)			L			H	H	

Table 2 Concept Matrix. Own Illustration based on Webster and Watson (2002).

According to the findings, the following concepts related to the transformation of leadership through the use of AI could be identified: *Data, job and team creation, mindset, culture,*

coexistence of AI and HI, AI leadership, a leader's skill set and AI as challenge. They are discussed in further detail below. Beyond that two concepts could be identified that are addressed by various concepts: *Productivity enhancements*, and *decision-making*. Thus, they are not listed separately.

Data is a crucial concept in every AI algorithm. When using AI in the context of leadership data should be prioritized high. The importance is highlighted as follows.

Data

Leaders are supposed to realize that all available data is crucial for the implementation of AI (Daugherty & Wilson, 2018). Furthermore, executives have to know which AI-driven data is available and how to use it properly (Dewhurst et al., 2014). Being serious about the importance of data is necessary for leaders in the age of AI. However, all data is of interest and not only the resources currently applicable to AI (Daugherty & Wilson, 2018).

Regarding the data itself, leaders should be aware of the following issues and address them: The dataset should be free of bias (Dhanrajani, 2019; Pandey et al., 2018), which can be hard because of hidden biases (Brynjolfsson & McAfee, 2017). The security and privacy of (training) data should be a concern as well (Pandey et al., 2018). Beyond that, the characteristic of AI algorithms named "garbage in/garbage out" (Dewhurst et al., 2014, p. 2) highlights that it is of even higher importance than ever before that the management knows its data and data sources (Dewhurst et al., 2014).

To address various problems arising with data collection, access, and preparation, new teams could be created to structure the data, but also new jobs could emerge like a data supply-chain officer (Daugherty & Wilson, 2018; Dewhurst et al., 2014). Here, it might get important for leaders to highlight the opportunities of AI to automate several tasks, which could lead to job shifts and job creation (Ransbotham et al., 2017).

Job & Team Creation

Ransbotham et al. (2017) found out that many employees are not afraid of losing their jobs or that AI will replace many professions, in contrast to articles where just this fear is addressed (Dhanrajani, 2019; Fleming, 2020). They propose to decrease it by highlighting that humans and AI should work in coexisting symbioses complementing each other, a job for leaders which is addressed in detail in a later section (Dhanrajani, 2019; Verhezen, 2019). Fleming (2020) broke it down to the number of 2.5% of jobs being under risk because many corresponding tasks are fulfillable by machine learning algorithms. But often only a few tasks or steps can be

automated rather than full jobs (Brynjolfsson & McAfee, 2017). In contrast, 2.3 million jobs will be created by AI until 2020 (Hunt, 2020). Interestingly, some leadership roles can also be performed by AI like the delegation of tasks (Daugherty & Wilson, 2018).

However, Dhanrajani (2019) highlights the importance of building new teams related to the identification of AI use-cases. Furthermore, leaders should think about the creation of teams that focus on improving the employee's skill set, especially regarding social ones. A division of the Bank of America called "Academy and Advisor Development" can be named as an example. Beyond that, a workforce could be established to teach employees how to work with AI (Meister, 2019).

Regarding the creation of jobs, leaders in the HR segment always have to look forward to new jobs arising through the AI-driven shifts as well as refinements of job descriptions. For example the chief officers that are responsible for the alignment of AI to ethical and humane rules can be named (Meister, 2019).

Even more interesting is the observation that questions might also change due to the results of the algorithms as explained in an example by Bourton et al. (2018) where a generic CEO's question of increasing productivity leads to the question of how to work as a team. This transformation was found as the AI identified missing collaboration between two departments as a bottleneck. Based on this question new leadership decisions can be performed like creating cross-department teams (Bourton et al., 2018).

Mindset

The AI enabling mindset as a basis for all following concepts are of further importance. Leaders need to be able to be openminded to let go of some common and well-proven concepts of organizational development to be ready for the use of AI (Dewhurst et al., 2014). Additionally to the classical approach of only optimizing business processes, leaders have to rethink how to work and the business processes are done (Daugherty & Wilson, 2018). Beyond that, Fleming (2020) adds that leaders in the age of AI have to further distinguish where to invest to reach business goals. The use of AI for instance could increase employee productivity, which also accelerates innovation (Fleming, 2020; Plastino & Purdy, 2018). In detail, he carries out that rebalancing the business resources and employee trainings are of importance here.

Verhezen (2019) described the leader's mindset change by transforming towards wise leadership. The term depicts a leadership style focusing on being responsible, smart, and reasonable while concentrating on creating a sustainable organization with a focus on long-term

development. Thereby, the importance of a broad and an emotionally stable mind is highlighted since those are needed to inspire others. Here, AI can be used to materialize the corresponding vision, while the outcome is dependent on the named capabilities of the leader (Verhezen, 2019).

One key factor in applying AI algorithms into workplaces is to fairly introduce them to the employees by sensemaking. A corresponding main topic is the transparency of the use of those intelligent algorithms and their results (Birkner, 2020; Lee et al., 2015). This includes the privacy of e.g. the employees data as well (Pandey et al., 2018). Here, trust is one key element (Daugherty & Wilson, 2018; Verhezen, 2019) that should be initiated by leaders. Trust can be earned by defining AI's that behave in consideration of humane and ethical rules, where the corresponding chief officer comes into play (Daugherty & Wilson, 2018; Meister, 2019). A related problem is the handling of errors made by the AI-assisted leader since it directly affects trust (Daugherty & Wilson, 2018). One method to overcome this uncertainty in the black box alike AI is to provide some visual output including dashboards (Le Clair et al., 2016). Those systems could also be used by leaders to track the performance and conformity of the system.

Beyond that, the use of AI has to be flagged on a roadmap, while it should be seen as an enabler for business growth (Plastino & Purdy, 2018). To finalize the discussion about the leader's mindset change, Dhanrajani (2019) states that it should be AI-first in order to compete in the future (Dhanrajani, 2019).

The leader's mindset should also take into consideration that people are looking for meaningful work more often than ever before. Creating and maintaining meaning in the age of AI should be a major concern of future leaders (Meister, 2019).

Culture

An open AI culture needs to be adapted. This includes setting up a collaborative relationship between AI and human employees. Necessary attributes are openness, trust, and transparency. This shift is part of the responsibility of a leader: Explaining pains and gains of the integration of AI. Defining the corresponding culture will help to get the most out of the implementation, while AI could also be used to enhance a culture by detecting stress for example (Plastino & Purdy, 2018).

Besides, Daugherty and Wilson (2018) mentioned that a culture must be integrated which tolerates experimentation with AI. This should result in quick detections of possible use-cases for

the use of AI in business processes and where processes can or must be rescaled or rescoped (Daugherty & Wilson, 2018).

Coexistence of AI and HI

AI in general only aims to perform single tasks but not to substitute whole jobs and humans are still needed to monitor what the algorithms do (Verhezen, 2019). But their cooperative coexistence could also be an opportunity (Lichtenthaler, 2020). One prominent example is context-aware robots by Mercedes-Benz helping human workers, but still being guided by those. This highlights again that job descriptions can change by focusing on different, maybe new talents. On the other hand, the example above is a great one to illustrate the potential amenities concerning productivity by complementing humans and AI technology (Verhezen, 2019). Beyond that Meister (2019) and Plastino and Purdy (2018) made one interesting annotation calling AI's a team member.

AI Leadership

According to Walczak (2016), there are three use-cases for the implementation of AI in the area of leadership: First, as a source for expert knowledge to be used in decision-making processes to enhance the corresponding capabilities and productivity along with all organizational levels by meeting the requirements set by knowledge management. Second, AI might directly support decisions by evaluating business heuristics to use it on the managerial tasks left. The last option proposed is to use AI as a classification tool for leadership methods and types. Whereas those classifications may be in use to optimize current leadership styles (Walczak, 2016).

The first use-case could be helpful since managers and leaders being positioned lower in the hierarchy could get help from expert knowledge in their tasks. This enables a shift in the tasks of leaders since they can push decisions down in the hierarchy while still being sure that the outcome is of high quality. When the AI serves as some kind of organizational knowledge, the capability of organizational learning from errors could improve as well (Walczak, 2016).

Another interesting concept is introduced by Fonseca (2020): AI's in the leadership team as demonstrated by Tieto, a tech firm from Scandinavia, and Deep Knowledge Ventures from Hong Kong.

A Leader's Skill set

The shift in the skill set of leaders is again oriented on the findings of Daugherty and Wilson (2018) while only seven of the eight skills proposed could be adapted to transformations in

leadership by AI. The skill called "Holistic Melding" is dropped because it does not match the overall aim of the elaboration. Thus, the first seven capabilities below are based on their findings. Leaders might already have some of the skills mentioned, but when AI plays a bigger role, they could get crucial and may have to be expanded.

1. Bot-based Empowerment

   Leaders have to recognize the benefits of AI agents in extending the capabilities of the user and using them effectively. A related concept is the empowerment of AI to do easy daily tasks like scheduling (Daugherty & Wilson, 2018). Besides, many interviewees of a study hope that AI will also take on displeased and time-consuming tasks and thereby free up time for other tasks like creative ones (Bourton et al., 2018; Ransbotham et al., 2017; Walczak, 2016). This transformation could develop a new dynamic (Bourton et al., 2018).

2. Rehumanizing Time

   Business processes must be reimagined to enhance the redirection of time for distinctly human assignments like interactions between humans, creative tasks, and decision-making (Daugherty & Wilson, 2018). The best leaders likely succeed by being human since AI will be brilliant in the other topics. This includes tolerance for ambiguities, a focus on soft skills and human capabilities like going around (Dewhurst et al., 2014).

3. Responsible Normalizing

   Shaping the way people understand and think about the collaboration with intelligent machines. Normalization requires some further skills in fields like humanity, social issues, entrepreneurial mindsets, STEM-skills, and a basic understanding of how AI systems can assist (Daugherty & Wilson, 2018). "One effect of normalization is that CEOs must develop a clear thesis on the future of work" (Daugherty & Wilson, 2018, p. 139). This includes the shareholding of workers in the whole process if leaders want them to use AI tools provided (Daugherty & Wilson, 2018). Furthermore, those findings have implications for leadership since it is very important for leaders to consider the hopes and fears of their followers, but also enable learning new skills, which might require the leader to shift those workers to high value-creating tasks (Fleming, 2020; Plastino & Purdy, 2018; Ransbotham et al., 2017).

4. Judgment Integration

   This skill is about sensing when the abilities of an AI's reasoning comes to its limitations or anomalies occur and how, where, and when to intervene. One example would be the

knowledge on when AI should not be used in making contact with customers or the expertise required to detect errors in AI-generated production lines (Daugherty & Wilson, 2018). In automated error handling a leader's expertise is of importance to react appropriately (Dewhurst et al., 2014). Furthermore, this is the point where ethical considerations can be included (Daugherty & Wilson, 2018).

Regarding ability sensing, possible opportunities with a focus on expansion and career development as well as employee training should be under consideration (Hunt, 2020; Meister, 2019). The need for it grows since AI might complete a lot of tasks currently used by young workers to gain experience. Thus, the unexperienced ones are detained from gaining expertise (Meister, 2019).

5. Intelligent Interrogation

   Intelligent Interrogation is about knowing how to ask the right questions to receive the desired insights and to know about their impact (Daugherty & Wilson, 2018; Dewhurst et al., 2014; Walczak, 2016).

6. Reciprocal Apprenticing

   Both, AI´s and workers learn from each other when working together. Leaders can enhance the process by giving control to those employees and by providing proper training to them (Daugherty & Wilson, 2018). Leaders of companies using AI need to be champions in their use by spending time using it but also questioning the use to be able to provide such control and training (Plastino & Purdy, 2018).

7. Relentless Reimagining

   Relentless reimaging describes rebuilding processes from scratch instead of only automating existing processes. Reimagination is necessary since AI-assisted processes can differ a lot due to the improvements in how work can be performed. This process which can alter whole organizations might include various steps of experimentation (Daugherty & Wilson, 2018).

   As an example, the following fields could be reimagined by AI. It could help leaders in fields like employee training and mentoring, the designation of talent gaps, and identification of fields where employees need training and comparison if it is superior to hire an external workforce (Hunt, 2020; Walczak, 2016). But it could also be used to flag unusual behavior of employees to improve communication and productivity and give more insights

on how they work as indicated in a case-study (Skilton & Hovsepian, 2018). However, this field could be used to assist leaders by increasing the potential their employees reach and by aligning future visions and leadership methods closer along with the needs of the employees. Furthermore, those monitoring techniques could be used to increase the performance of leaders in their self and organizational learning (Meister, 2019; Walczak, 2016).

8. Consciousness

   Consciousness will also be a necessary skill of AI-assisted leaders, as changes will occur more frequently, and wise leaders have to be aware of new developments. Leaders in the age of AI will also transform to communicate their vision to corresponding stakeholders with power and clarity while still being focused on executive aspects (Dhanrajani, 2019).

9. Appreciation of Employees

   Another skill getting more important when AI is assisting is the capability to appreciate the work of employees. Since some jobs and even more tasks could be taken by AI in the future, leaders should evolve too (Meister, 2019). Knowledge about the limitations and capabilities of AI are essential here. Beyond asking questions, it is also required to get most of the collaboration instead of trying to copy the strength of the AI (Daugherty & Wilson, 2018). Furthermore, AI-assisted leaders have to leverage the predictive power of AI and combine it with areas where humans are superior like personal experience, soft skills and creativity (Verhezen, 2019). This combination of capabilities can be used to enhance for example the product life cycle and the carbon footprint or to motivate employees since it can also be used to help them to do their job better and faster (Brynjolfsson & McAfee, 2017; Verhezen, 2019).

   The appreciation of employees' skills must increase because the importance of human abilities such as emotional and social intelligence is becoming more important, as well as programming skills (Meister, 2019). Valuing those skills is important in the age of AI since they will probably make the key difference when AI takes on other fields.

   Regarding leadership, ethical, legal, and trust-related concerns of the use of AI must be managed. It is also important to consider the social consequences and changes in the processes. More detailed, it is important to ensure that employees are not afraid to be substituted by AI. Leaders have to communicate those objectives. Moreover, it is necessary to help workers get comfortable in the use of AI. Therefore, it is important that the leaders also know how to work with the AI and how to show workers the benefits and limitations to prevent frustrations in advance. Reaching goals by using AI and providing brief

explanations for AI decisions are the further catalyst for the use of AI by employees which should be concerned (Daugherty & Wilson, 2018).

10. Responsible Management of AI

    Regarding data, people, and algorithms, companies should create governances as guidelines to enhance the decision-making process of all three (World Economic Forum, n.D.). Here, a new skill of executives is brought in: Calibrating of the AI (Verhezen, 2019) and setting its parameters. Without proper configuration, the executive might lead the company towards a disaster since it can have enormous impacts (Dewhurst et al., 2014). This can be of further interest when AI algorithms are for example used to motivate employees like it is done by Uber and Lyft (Lee et al., 2015). Beyond leading and motivating human employees, future tasks of leadership are going to include responsible management of AI as well (Plastino & Purdy, 2018). Furthermore, leaders have to manage, verify, and monitor the input and the output of the algorithms to ensure good functionality (Verhezen, 2019). The necessary guidelines and boundaries for AI must be defined in advance to simplify control over the outcome for leaders. These mechanisms help to enhance confidence in AI (Daugherty & Wilson, 2018).

AI as a Challenge

One emerging challenge is that ignoring the trend of AI could lead to even higher damage (World Economic Forum, n.D.). Thus, it is the task of a leader to evaluate it's use properly. A related risk is the one of managers being overwhelmed by the vast amount of data accessible. Nonetheless, only hoarding information could eventually slow down the organizations instead of getting the full advantage, which should be considered in how leadership is performed (Dewhurst et al., 2014). Another risk is created when leaders do not fully understand how certain results of AI are materialized and which impacts arise when blindly following those (Dewhurst et al., 2014). A specific risk of AI is that it currently treats all employees equally, which is in fact also a benefit, but could get problematic when single employees need specific services due to respected incidents like a pregnancy or long-term illnesses (Lee et al., 2015). AI should never be in a position to make final decisions (Fonseca, 2020; Meister, 2019). Instead, fair human judgment is needed which cannot be performed by AI (Verhezen, 2019).

Another important aspect is the concept of responsibility: Who is accountable for decisions made by or based on AI-driven ones? Guidelines and policies have to be created to counteract those problems (Fonseca, 2020).

4 Interviews

For this elaboration, experts are searched from the leadership field in medium-sized and large companies who are active leaders. For example, personnel managers, personnel directors, and heads of departments. Despite that, everyone who fulfills the definition of leadership proposed in chapter 3.1 is of interest as an interviewee.

The definition of the European Commission (2003/361/EC) is used for classification purposes (Table 3). According to their definition, medium-sized companies have more than 50, but less than 250 employees and earn between 10 million and 50 million euros or the annual balance sheet in total is higher than 10 million euros while being lower than 43 million euros. Companies with more than 250 employees and an annual turnover of more than 50 million euros or an annual balance sheet total of more than 43 million euros are called big companies. Mainly medium-sized and big companies are taken into consideration because the literature analysis emphasized that those are using AI in leadership more often. The companies are contacted via e-mail or their contact forms. The interviews are conducted in German between 01.08.2020 and 24.09.2020. The execution of the interviews was obstructed during this period as the worldwide COVID-19 pandemic made it impossible to perform interviews in person. Thus, only telephone and video interviews are used. The current economic impact is currently described as extreme (Statistisches Bundesamt [Destatis], 2020).

Company classes	Employees	Annual turnover (in millions of euros)	Annual balance sheet total (in millions of euros)
micro	< 10	< 2	< 10
small	< 50	< 10	< 10
medium-sized	< 250	< 50	< 43
big	> 250	> 50	> 43

Table 3 Definition of Enterprise Classes according to 2003/361/EC of the European Commission. Own Illustration.

There are two possible paths for the interviews depending on whether AI is used or not. If AI is used, the focus is placed on the reasons and usage to identify advantages and disadvantages. If AI is not used, it is aimed to determine corresponding reasons. The introductory questions as well as demographic ones and questions about prospects are asked similar in both scenarios.

As described by Strübing (2014) and Charmaz (2006) the interviews are coded to draw insights from them which are then analyzed in the Discussion

Discussionsection. Each code is assigned to specific content. Those are used as the basis for theory development. This is the first step of the qualitative analysis and will be done based on the rules created before as described in P. Mayring (2010) for each code element. The codes are created as explained in chapter 2.2 before coding and defined in Table 8. These codes are revised and expanded with new codes in iterative processes. The exact procedure is explained in chapter 2.2. Each interview is coded by two scientists to minimize subjective influences. Therefore the coding rules are created and used in collaboration (Charmaz, 2006; P. Mayring, 2010; Strübing, 2014). A code is a text segment that has been summarized to one or a few words. In the end, the codes are analyzed according to their frequency distribution. Thus, it combines qualitative and quantitative analysis (P. Mayring, 2010).

4.1 Questionnaire Creation

The structure of the questionnaire was developed based on the RO developed in chapter 1.3. The survey aims to answer the RQ. Therefore, the questionnaire uses the same structure. When selecting the questions, the following guidelines of Sreejesh et al. (2014) are considered. The questions have to contribute significantly to the RQ, while not affecting the results of other questions asked. In the next step, all questions are checked to identify ones that have to be split up to gather the desired answer more easily. The questions must be formulated in a way that the interviewees understand them. Therefore, the researchers try to make them short and precise. The vocabulary used is easy to understand for the interviewees and all words have a clearly defined frame of reference. Since the research topic is still relatively unexplored, open-ended questions are asked. These do not contain any answer options and therefore do not limit the answers of the respondents to the knowledge of the researchers. They also prevent bias, as there are no specifications.

Further information that has been used for the formulation can be found in Table 7 in the Appendix. In the beginning, questions in the form of lead-in questions are asked to get started. These questions should be simple, and it should be possible to answer them with yes or no. Next, questions are asked to answer the RQ. Qualifying questions have been deliberately avoided, as the interview partners are carefully selected (Sreejesh et al., 2014). As recommended by Leech (2002) and Sreejesh et al. (2014), the demographic data is asked at the end. Thus, the respondent does not get the impression that the focus of the interviews is the organization or people questioned. The topic itself is set in the foreground (Leech, 2002; Sreejesh et al., 2014).

For the interviews, in addition to the formulation, the order is also relevant after Helfferich (2019). Interviews are conducted in the form of a question-answer scheme. After asking the question there is always an answer from the respondent. The respondent may answer questions before the actual question. In this case, the question will be asked directly if it has not been answered completely. It is important that the structure with lead-in and specific questions remains the same. The structure of the questionnaire consists of different levels. On the first level, questions are asked more openly, which enables the interviewee to answer without being influenced or restricted by the question. The next level contains more precise questions relevant to answer the RQ and is not as open as the first level (Helfferich, 2019).

4.1.1 Basic Questionnaire Structure

The questions are asked in German to increase the potential number of interviews. According to the guidelines of Sreejesh et al. (2014), the interviews should start with some lead-in questions.

Lead-in questions

1. *Do you think that artificial intelligence will have a rising influence on your company?*
2. *Does your company currently uses artificial intelligence?*
   2.1. In which business areas does your company use artificial intelligence?
3. *Do you use artificial intelligence also in the field of leadership? For us, leadership means the "[...] leadership of individual employees and teams up to the visionary thinking and acting of managers for the entire company. Leaders motivate and inspire employees and lead them to top performance by recognizing their individual wishes and needs and by providing special incentive packages." (Bruch et al., 2006, p. 4).*

The lead-in questions form the introduction into the interviews and help to answer RQ1 - *How is the usage status of AI in the leadership area?*. Those first three questions are to be answered with *yes* or *no* and should only make up a short amount of time. The 1st question is based on the finding that 63% of the companies questioned in a previous study revealed that AI is expected to have a huge influence on them (Ransbotham et al., 2017). Next, the interviewees are asked whether they actively use AI in their company regardless of the department where it is implemented. Here it is also of interest to ask about those fields of application in question 2.1 to find out how familiar the company is with AI in general. Those two questions are followed by an explanation of what we understand under the term leadership to create a common basis. Afterwards, the participant should be able to state if they use AI in the leadership area as well.

Current Usage

The next question group is focusing on applications of AI in leadership. They are different depending on whether the company uses AI in leadership or not. According to the answer to question 3, it is decided if the questionnaire blocks described in chapter 4.1.2 or 4.1.3 are used in the interview.

Prospects

Afterwards, a few questions about the future use of AI in leadership is asked. They are different for both scenarios as well.

Demographics questions

9. What is the size of the company in which you work?

9.1. How many employees does the company you work for has?

9.2. What is the annual turnover of the company in which you work?

9.3. What is the annual balance sheet total of the enterprise in which you work?

10. In which of the following industrial sectors would the company fit?

Industry, manufacturing industry	☐
Wholesale and retail	☐
Building	☐
Handicrafts	☐
Hospitality, tourism	☐
Services	☐
Energy	☐
Agriculture, forestry and fisheries	☐
Transport and traffic	☐

11. What is your position in the company?

11.1. How big is the team you lead?

12. Do you know any other company using artificial intelligence in leadership?

The demographic data does not address any research question. They are important for the analysis in order to be able to classify the respondents and companies and thus possibly enable generalization. Furthermore, this anonymous data could be used in future research to determine possible target groups. The table for answering question 10 was adopted from Destatis (2019). Afterwards, the position and team size of the respondents asked for further classification of the results and if other companies are known to evaluate previous findings.

4.1.2 Questionnaire AI-Use

The questionnaire version in German can be found in Appendix 7.6. The following questionnaire is asked when the company uses AI in the leadership area. Otherwise, the questionnaire explained in chapter 4.1.3 is used.

Current Usage

The following questions specifically address the leadership area.

4. *For which activities is artificial intelligence used in the field of leadership?*
   - 4.1. *Does the artificial intelligence executes decisions independently or does it support decision making?*
5. *For what reasons did you use artificial intelligence in the leadership area?*
   - 5.1. *What are the advantages of this use for you?*
   - 5.2. *What are the disadvantages of this use for you?*
6. *Are changes through the use of artificial intelligence in leadership recognizable?*
   - 6.1. *What roles do leadership and artificial intelligence play in this transformation process? Would you rather say that artificial intelligence changes leadership or that the transformation process in leadership is supported using artificial intelligence?*

The questions in this section and the prospects deal explicitly with the leadership area. The 4th question and sub-question 4.1 are taken over by Borgert and Helfritz (2019) from the basic approach and adapted for the leadership area. This was used in a survey of the Gesellschaft für Personalführung e.V., TU Kaiserslautern, and Algorithm Accountability Lab for the use of AI in HR (Borgert & Helfritz, 2019). They should support answering RQ2 - *If AI is used, in which leadership areas is it used? This question refers to areas of work such as further training, career planning and personnel recruitment*. Beyond that it might already provide a hint on answering RQ8 - *In how far does Leadership change in general and how does AI support this?* Questionnaire block 5 is intended to provide support in answering RQ 3, 5, and 6. In the following the corresponding RQ are mentioned again: RQ3 - *What are the reasons for the use of AI in* leadership?, RQ5 - *What are the benefits of using AI in the leadership field?* and RQ6 - *What are the disadvantages of using AI in the leadership field?*. Questionnaire block 6 was taken from Borgert and Helfritz (2019) and should be supportive in answering RQ7 - *How does the use of AI change the way leaders lead?* and RQ8 - *In how far does Leadership change in general and how does AI support this?*.

Prospects

7. *Will you continue to use artificial intelligence for leadership?*

8. *Does the current situation (COVID-19) has a positive or negative effect on the use and dissemination of artificial intelligence in leadership?*

Questions 7 and 8 reflect the future course of use and answer RQ1 with the future trend while considering the current situation of COVID-19.

4.1.3 Questionnaire No-AI-Use

The German questionnaire version can be found in appendix 7.7.

Current Usage

4. *What are the reasons against the use of artificial intelligence in the field of leadership?*
5. *Are you familiar with examples of the use of artificial intelligence in leadership?*
   - *5.1. What are known advantages of artificial intelligence in leadership?*
   - *5.2. What are known disadvantages of artificial intelligence in the leadership area?*
6. *Do you think artificial intelligence can have an influence on leadership?*

The 4th question is intended to answer research question 4 - *What are the reasons for not using AI in leadership?*. Questionnaire block 5 should generate information to answer RQ1 - *How is the usage status of AI in the leadership area?*, while the questions 5.1 and 5.2 focus on supporting to answer RQ5 - *What are the benefits of using AI in the leadership field?* and RQ6 - *What are the disadvantages of using AI in the leadership field?*. The last question on the current use aims to provide insights regarding potential transformations in leadership when using AI concerning *RQ7 - How does the use of AI change the way leaders lead?* and RQ8 - *In how far does Leadership change in general and how does AI support this?*. Nonetheless, the information provided can only give a glimpse since their origin is not a real use-case.

Prospects

7. *Will you take a closer look at artificial intelligence in leadership in the future?*
   - *7.1. Will you use artificial intelligence in leadership in the future?*
   - *7.2. What would be prerequisites for a closer look at the technology?*
8. *Does the current situation (COVID-19) has a positive or negative effect on the use and dissemination of artificial intelligence in leadership?*

Questions 7, 7.1, and 8 are intended to answer RQ1 - *How is the usage status of AI in the leadership area?*, as they reflect the future decisions of the company about the current situation. A time frame of roughly two years should be considered. Question 7.2 goes into more detail regarding the reasons for not using AI in leadership formulated in RQ4 - *What are the reasons for not using AI in leadership?*.

4.2 Coding Results

The complete coding results including the coding rules can be found in the Appendix in chapter 7.8 “Coding Guideline”. A total of eighteen interviews were conducted and coded. 232 companies were contacted for these interviews, 43 of them replied after the first request. When no response was received after fourteen days the companies are contacted again. This resulted in another 59 responses, which led to eighteen interviews. The companies were searched for via various search engines with different queries, whereby the aim was to address the largest companies possible. Inquiries, confirmations, and rejections were recorded in a Microsoft Excel file, which must not be attached due to data protection regulations. In the case of several contact possibilities, these are noted, and a different type was chosen for the second request. Contact forms were preferred, as feedback was provided more often if that case.

Seventeen different companies could be interviewed within the eighteen interviews. One company was interviewed twice since the interview partners provided could not be interviewed parallel. These interviews were both conducted completely but only the additional results were coded. This means that from the lead-in questions only the applications of AI and from the demographic question only the team size and position were coded. The other questions were conducted as usual. In the following the results are listed in the order of their appearance in the questionnaire besides demographic data which is presented first: Demographic data, distribution of the AI, AI usage in leadership, no AI usage in leadership, and future prospects of AI in leadership.

4.2.1 Demographic Data

Figure 4, Figure 5, and Figure 6 show the demographic data of the respondents regarding the size of the company. According to the classification from chapter 0 one micro enterprise, one small enterprise, and fifteen large enterprises were interviewed.

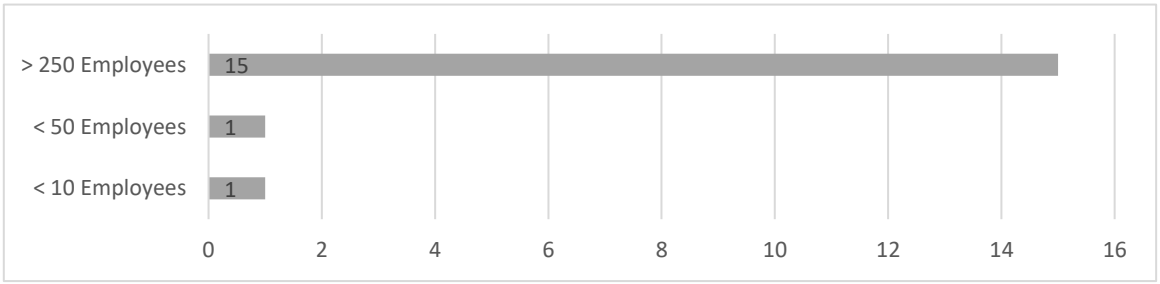

Figure 4 Number of Employees in the Company. Own Illustration.

The diagram in Figure 5 only contains sixteen companies because the turnover value was not available for one company.

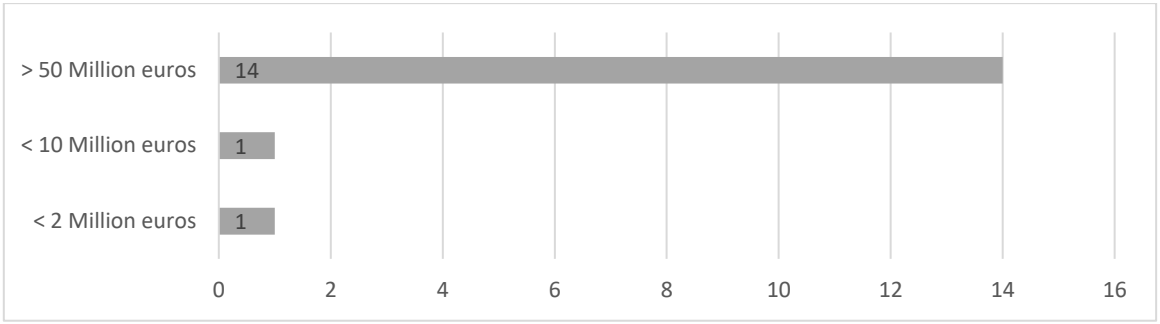

Figure 5 Turnover of the Company. Own Illustration.

Additionally, to the data regarding the turnover, the annual balance sheet was also asked.

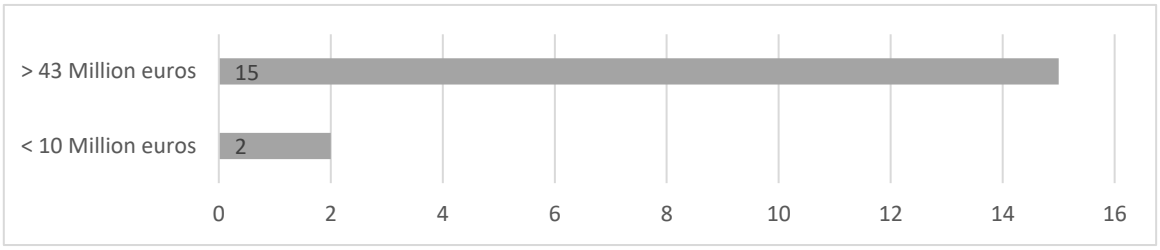

Figure 6 Annual Balance Sheet Total of the Company. Own Illustration.

The majority of the surveyed companies are active in the service sector (64.7%). 23.5% of the respondents work in the industry and manufacturing sector and the remaining 11.8% are active in the energy sector. These classifications were suggested to the respondents based on the categories and they were able to classify themselves into these categories. The distribution by company is shown in Figure 7.

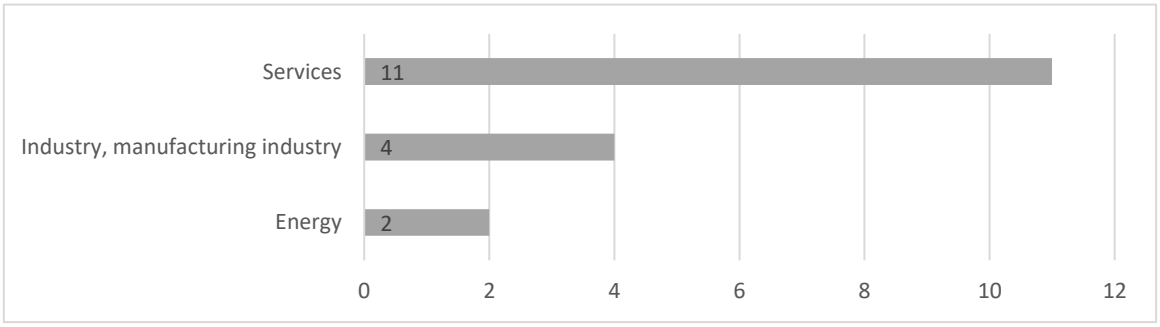

Figure 7 Industry Sector of the Surveyed Companies. Own Illustration.

The positions of the interviewees are extraordinarily diverse and unique. Thus, they are clustered into departments to ensure anonymity. Figure 8 shows the corresponding distribution. There are twenty appearances because there had been two interview partners in one interview twice and one company was questioned twice. Six participants are from the area of HR, five from the executive board, four from the field of information technology, and three are from

departments that handle future technologies. Beyond that, there are two participants from communication departments.

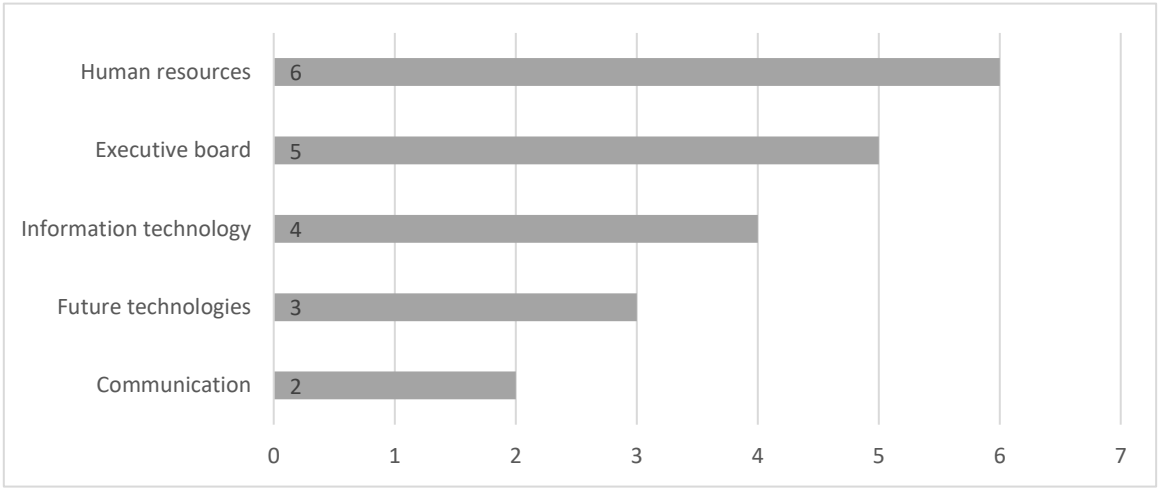

Figure 8 Distribution of Positions of the Interviewees according to their Departments. Own Illustration.

The distribution of the team sizes is classified in Figure 9. The team size varies between zero and over 41 employees per team. The majority has a team of ten to twenty employees (Seven appearances), while five lead a team of six to ten members. Four participants have a team of fewer than six employees. Furthermore, there are two participants in a team of 21 to 30 members and one interview participant each leading a team of 31 to 40 or even more than 40 employees. Those findings are shown in Figure 9.

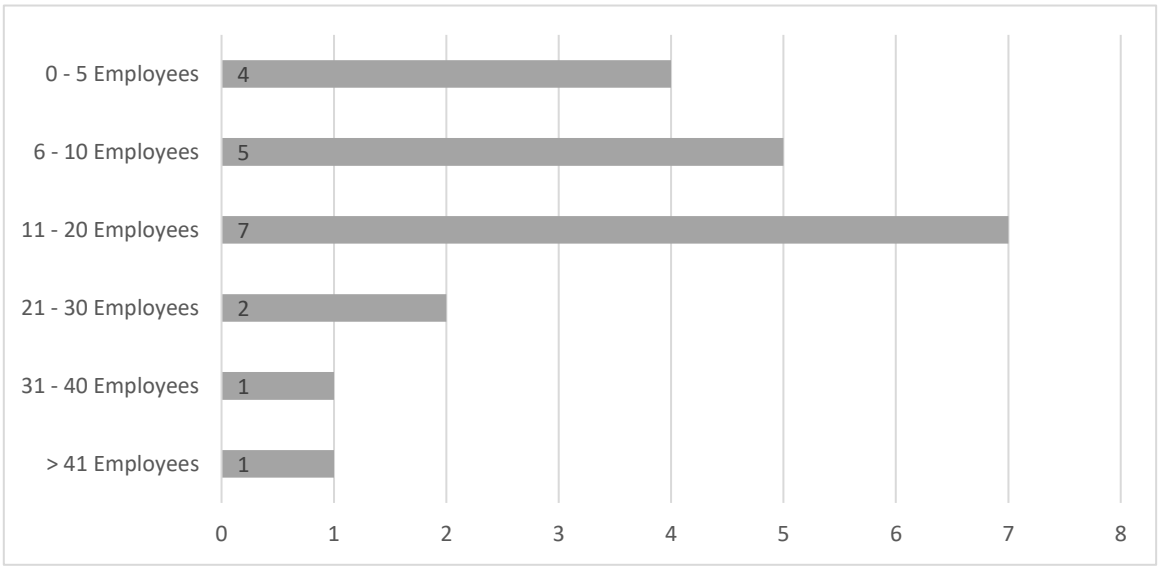

Figure 9 Size of the Respondent's Teams. Own Illustration.

4.2.2 Distribution of the AI

All of those surveyed said that AI currently influences their own company. Besides, nearly 90% of respondents are currently using AI in their own organizations as shown in Figure 10.

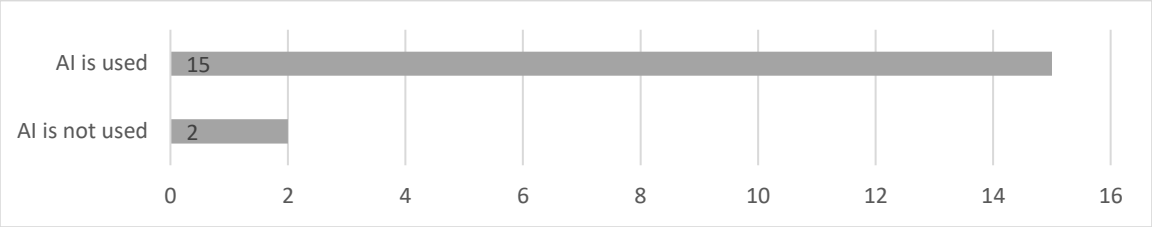

Figure 10 AI Use vs. no use of AI. Own Illustration.

Most applications are chatbots, data analytics (Four mentions each), employee planning, image recognition (Three mentions each), everywhere, future planning, application processing, and automation (Two mentions each). In addition, there are others that have only been mentioned once. Those are: Marketing & Sales, speech recognition, text recognition, dynamic pricing, logistics: goods tracking, all supporting functions, selection processes, maintenance, system monitoring, consulting, personnel consultancy, translating languages, training measures, and product development. All in all, it can be stated that the majority of the respondents are already using AI in their companies and therefore the technology is not unknown or will be rejected fundamentally.

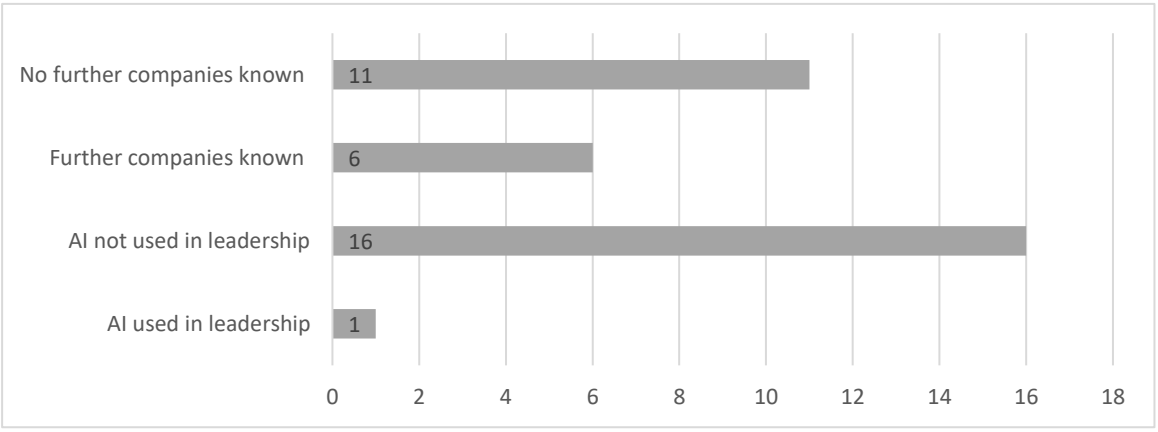

Figure 11 AI Use in Leadership vs. no Use of AI in Leadership. Own Illustration.

94.1% of those surveyed currently do not use AI in leadership. Only one of the questioned companies uses the technology in the border area of leadership. Out of these respondents, eleven or 64.7% said that they do not know any company that uses AI in this area. The remaining said that they know other companies, but these were mostly large companies like Microsoft, IBM, Netflix, and Salesforce. Only three out of these six people knew a company using AI in the leadership area personally. Unfortunately, the interviewees could not get in touch with another

interviewee who uses AI for leadership purposes. All in all, these results indicate that AI in the leadership area is not yet widespread among the companies interviewed and is currently hardly used in the majority of companies. These results are visualized in Figure 11.

4.2.3 AI Usage in Leadership

In this section, only the results of the company using AI in leadership are listed. The application areas in which AI is used in leadership are employee planning, career management, and recruiting fields close to the area of HR. In employee planning, for example, employees enter their available working hours and vacation times via an app and the AI can create shift plans independently. In addition, in the event of an unplanned outage, a replacement can also be automatically sought. This is also used for career management and recruiting since the AI can decide based on the existing database which person is qualified best for which task. Beyond that, the AI provides information to the leader if employees are suitable for leadership tasks or not. In these areas, the AI constantly makes decisions, which do not have to be rechecked by a human being. However, if there are conflicts or questionable decisions, a human can still intervene. The interviewee mentioned that the automation of processes through the integration of AI helped to save time and costs. The following three disadvantages were added: Too much trust is placed in the AI, the acceptance is often low since employees assume that workplaces will be lost and human interactions are decreased (similar to the codes of the non-use of the AI). If too much trust is placed in the AI, it is assumed that the AI also makes wrong decisions, which are not detected by leaders. No differentiated result to “RO4 - Identify how leadership has changed through the use of AI” could be determined since only one person uses AI. The person surveyed said that Leadership is changed by using AI because lazy people will use AI to work even less and people who take their job seriously will take advantage of it.

4.2.4 No-AI-Use in Leadership

The results in this chapter are obtained through seventeen different interviews. Therefore, the maximum number of possible codes is seventeen. Figure 12 shows the related findings. 58.8% of the interview partners mentioned that there are no known areas of application for AI in leadership. This shows that the awareness of such solutions and possible use-cases is relatively low, while it is reinforced by the fact that more than a third of the interviewees (35.3%) don’t see any need for such use since the current processes function satisfactorily or AI cannot create any benefit at the moment. A technical and legal problem which is named by 29.4% is that a human being is not completely digitally detectable and therefore it is not possible to provide a comprehensive database for the AI. This might lead the AI to make wrong decisions due to missing

information. 29.4% of the interviewees said as a reason for no usage of AI that human interactions can be reduced, which is problematic since it forms the key for leading. One possible implication from this finding is that leaders will have to develop further skills to manage the changing conditions. A further matter are ethical concerns, which are already raised by the two items before. It develops beyond in critical system where the AI's decisions might risk or even costs lives like in healthcare.

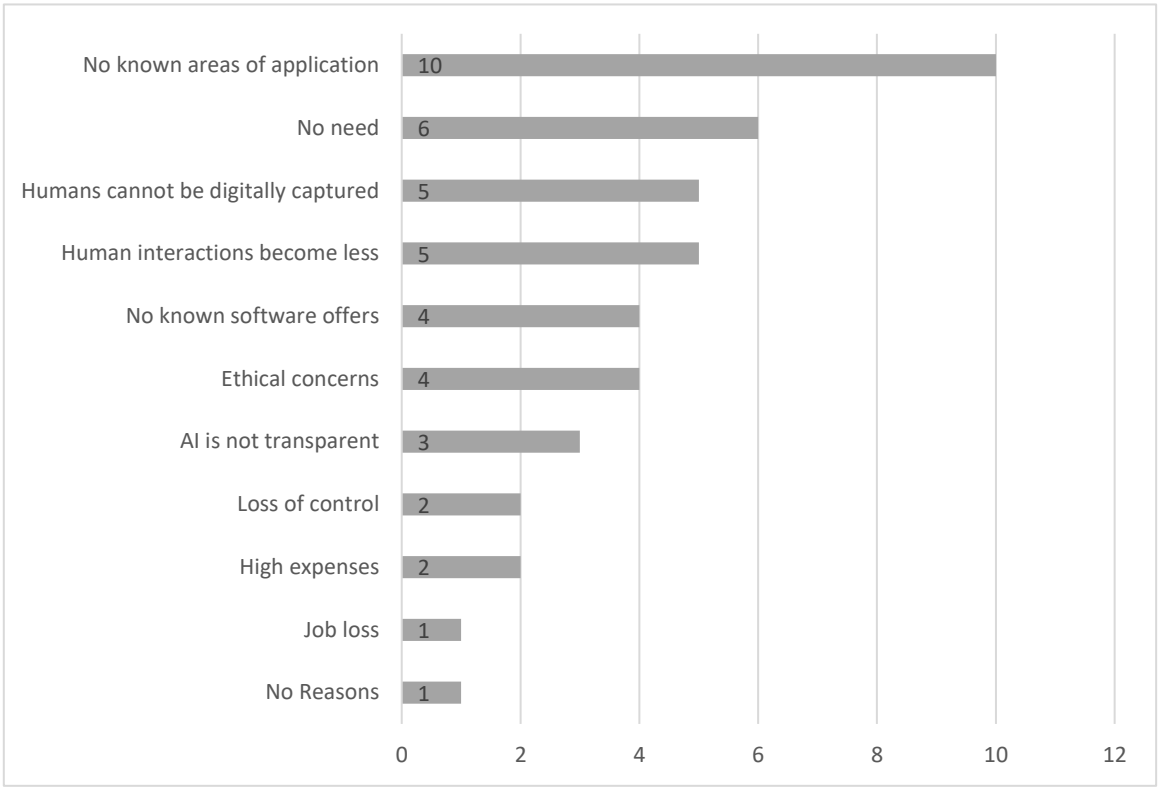

Figure 12 Reasons for not using AI in Leadership. Own Illustration.

Furthermore, 23.5% of the respondents are not aware of any software offerings that integrate artificial AI in the area of leadership. Since most of the interviewed companies buy software from manufacturers and only in rare cases program it themselves, this is also a decisive problem for the distribution. 17.6% said that the decisions of the AI are not transparent which is contrary to the current leadership style, because decisions are currently justified to the employees. This would usually not be possible with AI since it only provides the reasons for decisions in the case of an explainable AI, which is currently not widely used. With two mentions and 11.8%, it is declared that the executives lose control by implementing the use of AI and that the introduction would lead to considerable financial and workforce expenditures. Those cannot be taken by some companies in uncertain times like the current one regarding the COVID-19 outbreak, especially for technologies with the named issues. The data protection laws and that they

highly impact the use of AI negatively were mentioned by one participant. That no reason speaks against a use was named once.

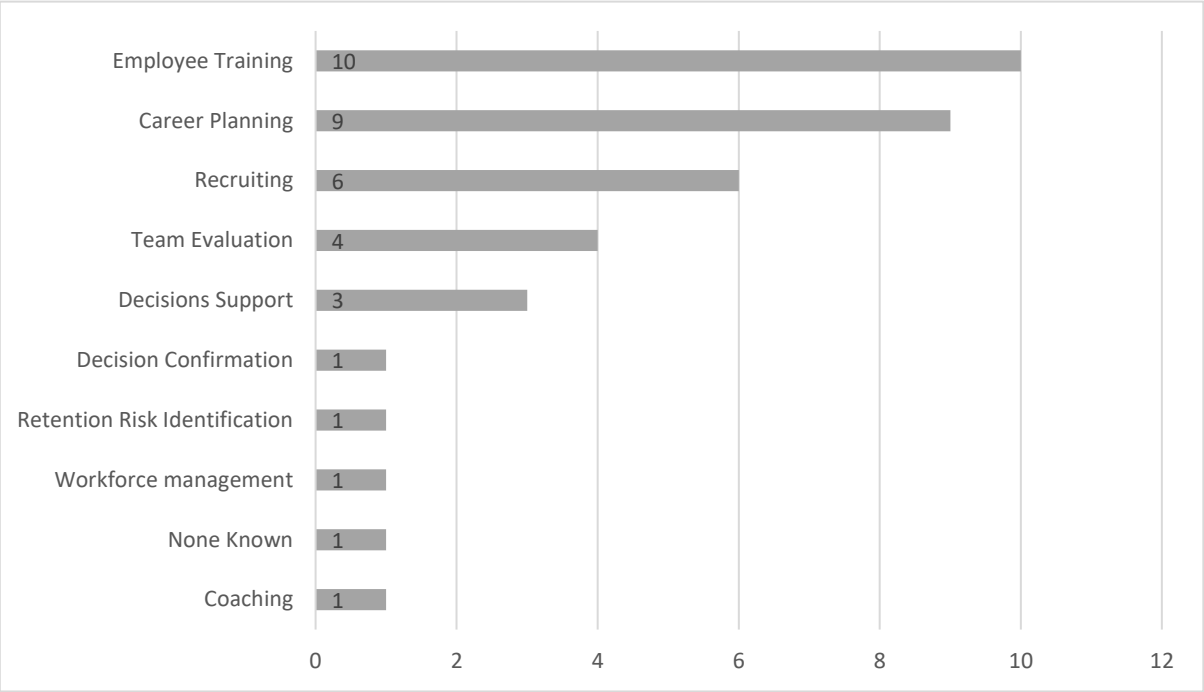

Figure 13 Known Application Examples. Own Illustration.

In the following, well-known application examples are listed. Partly, these have also more than seven denominations (Ten of seventeen do not know areas of application) since some interviewees developed possible areas of applications during the interviews. Nevertheless, the code *No Known Areas of Application* was not changed or removed because it can be assumed that the ideas were generated solely by the interview and the raised awareness of such possibilities. The most frequently mentioned application examples, such as employee training (mentioned ten times), career planning (mentioned nine times), recruiting (mentioned six times), and team evaluation (mentioned four times) are only partly found in the leadership area. These mainly fit in the area of HR management, which is only a part of leadership. The following application were only mentioned ones: Coaching, none known, workforce management, retention risk identification, decision confirmation. A chart with the frequency distributions of the application areas mentioned only once can be found in Figure 13.

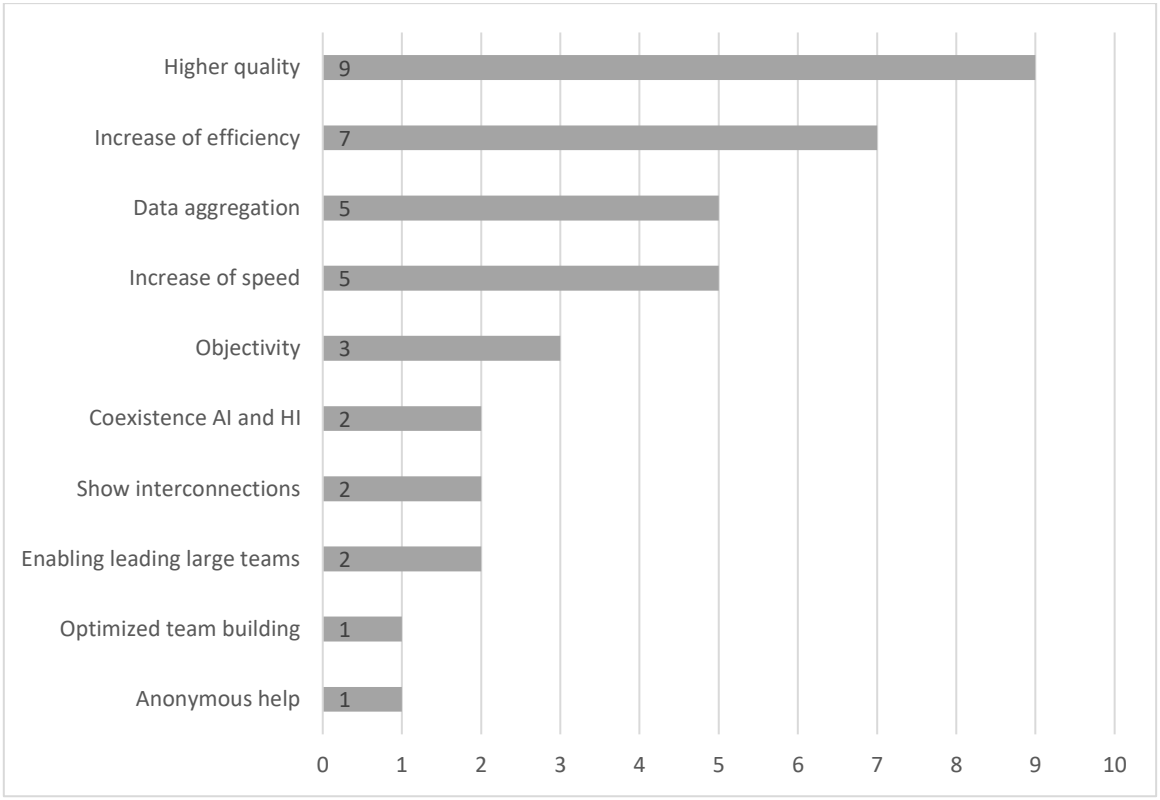

Figure 14 Known Advantages of AI use in Leadership. Own Illustration.

Fourteen of the seventeen interviewees who do not use AI for leadership purposes currently were still able to name advantages for the use of AI in leadership. These advantages are depicted in Figure 14. 71,4% of the respondents who are aware of possible advantages, named that the quality is higher when using AI. Thus, it is assumed that the AI can make better decisions than a human or that human decision-making can be improved by AI assembled data. In addition, an increase in efficiency was mentioned by 50% of the participants since AI processes faster than a human (with five mentions) and can also aggregate data from multiple sources with ease (also five mentions). A further advantage mentioned three times is that AI can perform more objective decisions. With two mentions each, the coexistence of AI and HI, the possibility to show interconnections, and the chance to lead large teams is named. The advantage of a more optimized team creation is noted, and that AI is able to help anonymously are named once each.

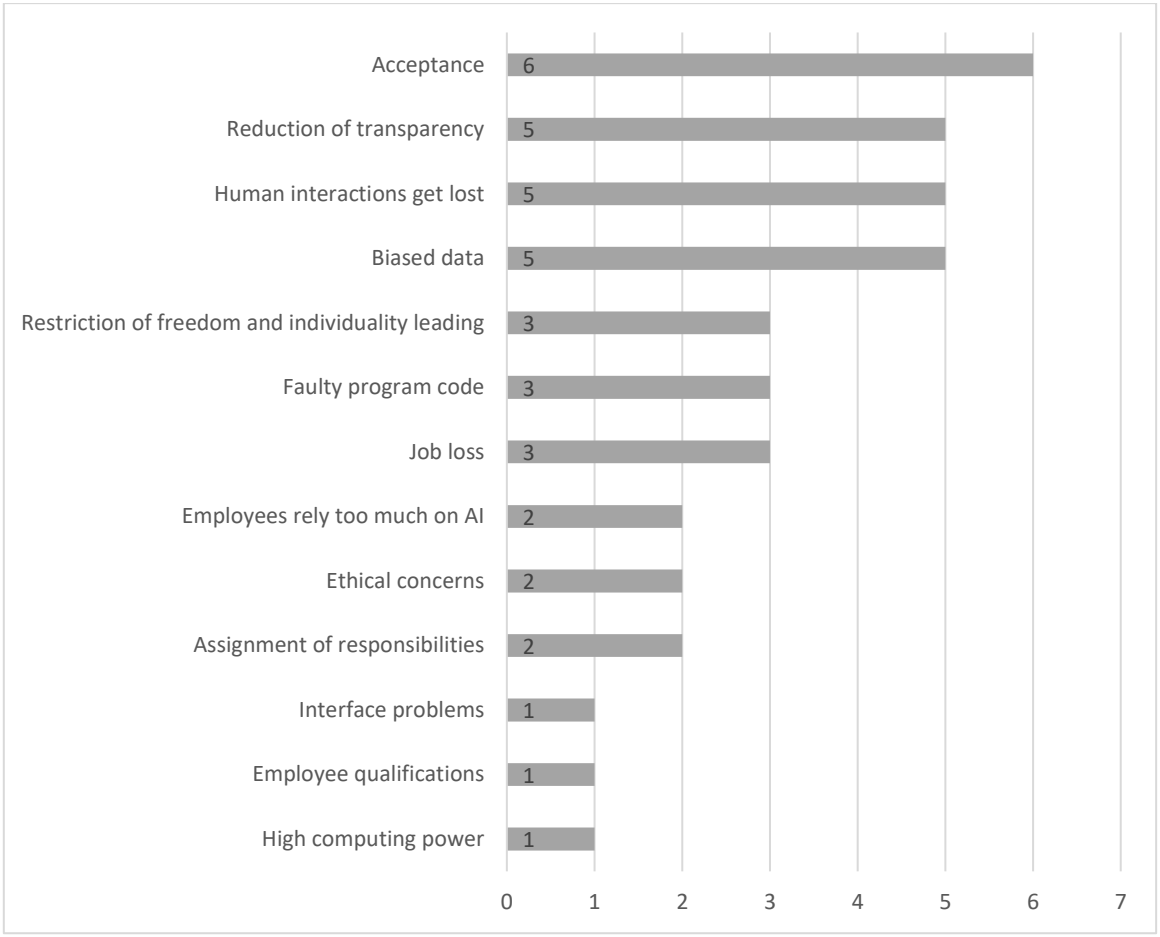

Figure 15 Known Disadvantages of AI use in Leadership. Own Illustration.

Out of seventeen companies not using AI in leadership, fourteen added some disadvantages of using it. They are listed in Figure 15. The acceptance of AI in the leadership area is too low as mentioned by six participants, while it includes employees and leaders. This is often grounded in a reduced transparency of decisions (Five mentions) but also in the fear of job losses (Three mentions). Another problem that was named is that human interactions are decreasing, which is a problem in the leadership area (Five mentions). Furthermore, it is also a problem for leaders if they are restricted in their leadership behavior as mentioned by three participants. One example is when guidelines of the AI have to be followed exactly. Another problem is that the AI can also make wrong decisions, for example, if the program code contains faults (Three nominations) or the database on which the AI is trained is biased (Five nominations). The assignment of responsibilities is also a problem with two denominations since it is not legally clear who is liable in such a case. In addition, that one interviewee mentioned that there must be a framework of rules in the company for such decisions that regulate these problems. Ethical concerns (Two mentions) were also seen as a disadvantage by some companies who did not use the technology. Other disadvantages with two or fewer mentions were that employees rely too much on the AI,

that high computing power is needed and that there are no employees who can operate such an AI or who can prepare a sufficient unbiased database.

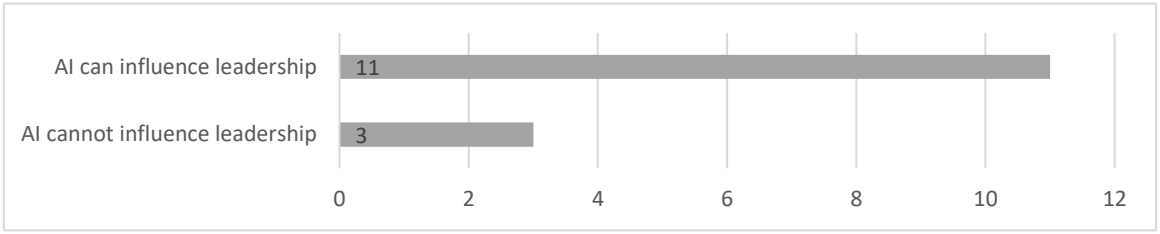

Figure 16 Influence vs. no Influence of AI no Leadership. Own Illustration.

Despite the small number of current uses, the majority with 61.1% say that AI can have an impact on leadership. In contrast, only 16.7% said it could not have an impact and 22.2% could not answer this question (Figure 16).

4.2.5 Future prospects of AI in leadership

Out of the companies surveyed, 52.9% will deal with AI in management over the next few years, but do not yet know whether they will use it or not. 29.4% of the companies know that AI in leadership will not be used in the near future. Only 11.8% will use AI for leadership in the coming years. The company that is currently using AI in leadership will continue its operation. Those findings can be found in the chart in Figure 17.

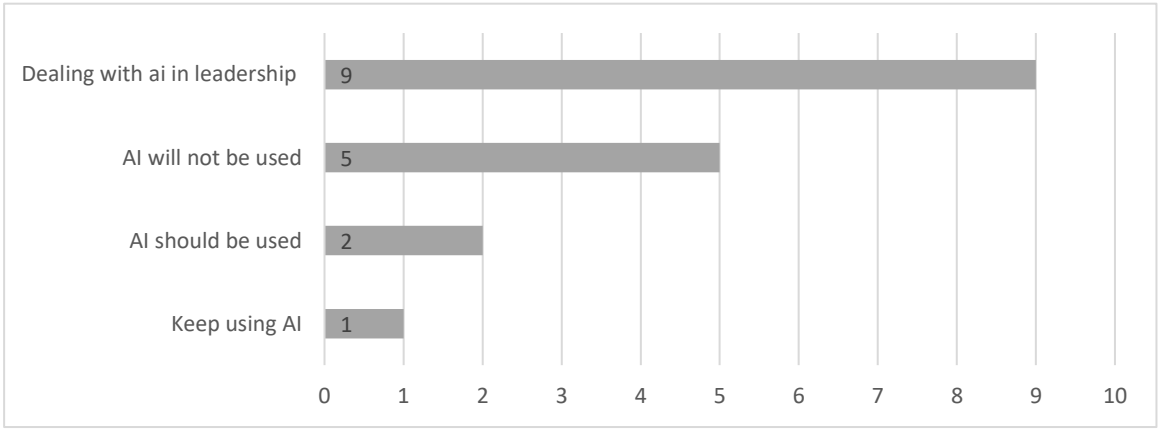

Figure 17 Future Prospects of AI use in Leadership. Own Illustration.

The following points were highlighted as prerequisites for a closer dissemination: The presence of basic knowledge about AI (mentioned eight times), increased transparency of decision-making processes of AI, a high degree of digitization, sufficient database (each mentioned six times), the existence of positive use-cases of well-known companies (mentioned five times), awareness of solutions (mentioned four times), the necessity of the introduction, user acceptance, the development of ethical guidelines, legal framework conditions are present (each

mentioned three times), sufficient financial resources are available, the implementation of AI in leadership must be performed as transparent as possible (each mentioned two times), sufficient technical capabilities are present and AI is more human (each mentioned one time).

That COVID-19 has a positive impact on the spread of AI in leadership is said by 61.1% of the respondents, representing eleven companies. Figure 18 shows the distribution in form of a chart. This mostly refers to the great progress of digitalization projects, the fact that the increased digitalization provides a sufficient database, or that the acceptance of digitalization projects is increased. Only two companies said that it has negative effects. This is justified by the fact that the enterprises could have liquidity problems or should prefer other digitalization projects first. The remaining 27.8% said that this will not have an impact on the distribution. Reasons for this were that the level of digitization of the company was already high before COVID-19 and therefore there is no difference or that progresses regarding the digitization does not have a guaranteed influence on the spread of AI.

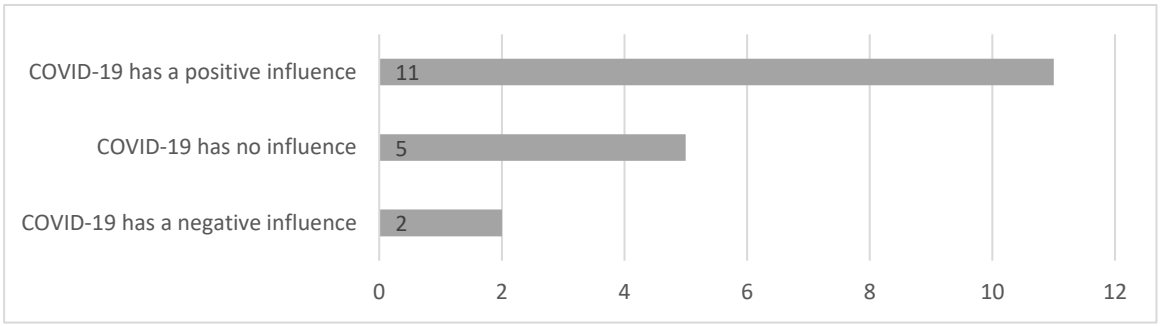

Figure 18 Future Prospects of AI in Leadership regarding COVID-19. Own Illustration.

5 Discussion

In this chapter, a detailed discussion is conducted to answer the previously set RO while considering items from the literature analysis, especially the concept matrix from chapter 3.3. The RO are considered in numerical order.

Research Objective 1 ***(****Identify the current usage status of AI in leadership****)***

The results show a clear picture regarding the first RO. To answer RQ1 (*How is the usage status of AI in the leadership area?*), the usage status is currently very limited. Just 5.9% of all companies questioned currently use AI in leadership. This matches the expectations based on Borgert and Helfritz (2019). To answer RQ2 (*If AI is used, in which leadership areas is it used? This question refers to areas of work such as further training, career planning and personnel recruitment.*), it can be noted that AI is used in the following fields: Employee planning, career management and recruiting. However, this information cannot be used for generalization due to the small number of participants using it. Nonetheless, 100% of the participants declared that AI influences their companies, an increase of 37% compared to the findings of a study of Ransbotham et al. (2017) three years ago. Thus, their expectations are even outperformed.

Additional to the current status of use, the participants have also been asked to provide some insights on the use in the close future. Five companies indicated that they do not plan to use AI in leadership at all. In contrast, one company using it will continue the use and two enterprises plan to use it. Whereas nine out of seventeen companies indicated keeping an eye on the market and possible use-cases. Thus, it is not expected that there will be a huge shift in the usage status shortly.

However, several items are identified that are important to consider a use for the companies which are not using it yet. Thus they also answer RQ4 (*What are the reasons for not using AI in leadership?*). Half of the companies not using AI suggested increases in the overall and basic knowledge people have regarding AI. When more workers know what AI can do and what cannot be done by it (currently), a deployment of the technology will get much easier and even the search for use-cases could get easier. The restriction is closely connected to the talent gap named earlier (Pandey et al., 2018). Even if Daugherty and Wilson (2018) included that leaders have to gain certain expertise to use AI properly, the concept is not stretched to a larger community yet. Another prerequisite that has to be fulfilled is that one can trace the decisions made by AI (Six mentions), a thought that is discussed in further detail later. Beyond that, about 35% of the companies stated that some companies might need to digitalize further to be able to

handle AI in leadership, while the circumstances of COVID-19 seem to have a positive impact on the distribution of digitalization as it is stated by nearly all participants. Another technical condition is related to digitalization: The availability of data sufficient to use for an AI regarding the amount, but also the diversity of data to train and test the AI appropriately. A finding that is also stated in literature for example are verification chains (Pandey et al., 2018).

The next point is also discussed later: Five mentions are allotted to the need of knowing positive use-cases of using AI in leadership and four interviewees named that there must be awareness for possible ready-to-use solutions. Unfortunately, there are, even in the literature analyzed, no out-of-the-box use-cases. Thus, the overall opinion that use-cases and areas of applications are missing is confirmed. Beyond that, some researchers even emphasize allocating employees to the identification of use-cases (Dhanrajani, 2019).

Then there are four conditions noted three times each. First, the companies are not going to use AI in leadership when there is no benefit or necessity in using it. Another point, called in the section focusing on RO3 as well, is the acceptance by the users and the existence of ethical guidelines for the use – a requirement often set by the work council as named by two interviewees. Some researchers even go that far to announce the need for a corresponding chief officer to ensure compliance with set guidelines (Meister, 2019). Thoughts like that are not mentioned in the interviews at all. Reasons for this circumstance might be that most of the interviewees are not actively using AI in leadership and in some cases, the work council for example might oversee such tasks. A further restriction is the legislator, especially when focusing on data security as also stated by Pandey et al. (2018).

Furthermore, financial resources can be a burden as well. As stated by two participants this factor might even get more complicated since some companies got into serious financing problems because of COVID-19. Thus, future technologies like AI in leadership are shifted to a later point in time especially when there is no area of application, no known software available, and no benefit in using it at that time according to some interviewees. Apart from that, the need for technical capabilities are named by one interviewee.

In addition, two participants declared that a transparent implementation is of particular importance concerning the user acceptance and the work council. Those thoughts match with the findings of Plastino and Purdy (2018) stated under the term *culture* in the concept matrix. The last aspect is that AI has to be more human-alike to be used in companies, even though this was

only named once. It refers to the circumstance that human interaction decreases as soon as AI implementations proceed.

Research Objective 2 ***(****Identify the reasons for use and non-use of AI in leadership****)***

In the next step, the reasons for using AI in leadership are summed up as part of RQ3 (*What are the reasons for the use of AI in leadership?*). Since only one company uses AI in leadership, the findings are not diverse. The interviewee replied that they use AI in leadership because it helps to automate processes and thereby leads to reductions regarding time and financial costs. These findings correlate with the ones for automation (Brynjolfsson & McAfee, 2017; Ransbotham et al., 2017), possible time savings (Bourton et al., 2018; Pandey et al., 2018; Ransbotham et al., 2017; Walczak, 2016) and decreases in costs (Verhezen, 2019) from the previous literature.

In contrast, the findings regarding RQ4 (*What are the reasons for not using AI in leadership?*) are scattered. Nonetheless, there are some similarities between the opinions of the respondents. First, nearly 60% of the companies noted that they do not know any areas of application of AI in leadership, while four mentioned that they simply do not know any software offers. Whereas this might be grounded in the fact that many companies do not see fields of application. This is supported by the fact that eleven enterprises mentioned to not know any company that is using AI in leadership. Beyond that, another 35% of the companies added that there is no necessity to use it in this field. Besides, five participants replied that a huge burden is that a human being consists of multiple dimensions. Only a few of them can be captured and stored in a database, while ethical concerns play a huge role in this consideration (Four mentions). While various sources highlighted the importance of data quality (e.g. Daugherty & Wilson, 2018; Verhezen, 2019), none of them stated that it is hard to gather all relevant data related to a human being digitally. However, the thoughts on ethical concerns confirm the findings of the literature analysis and thereby emphasize the use of a corresponding chief officer (Daugherty & Wilson, 2018; Meister, 2019). Furthermore, 14% of the interview partners added as a reason for not using AI in leadership that decisions made by an AI are not transparent, which plays an important role since leaders are responsible to explain their decisions to employees and supervisors (Birkner, 2020; Lee et al., 2015). One related concept is the fear of losing control when AI is used in leadership and high expanses regarding operation and implementation (Two mentions each). Those are also based on the combination of for example missing areas of application and insufficient transparency which lead to uncertainties of amortization times and chances as stated by one interviewee. In addition, one participant answered that possible job losses are another

burden. While some sources confirm this fear (Dhanrajani, 2019; Fleming, 2020), a trend towards the contrary opinion of job creations and shifts outweighing job losses created through AI is identified (Hunt, 2020; Meister, 2019; Verhezen, 2019).

Interestingly, one company is not seeing any issues, AI is just not implemented in its leadership areas yet, whereas those findings are contrary to the ones stated above.

Research Objective 3 ***(****Investigate the advantages and disadvantages of AI in leadership****)***

The investigation of advantages and disadvantages of the use of AI is splitting into two RQ: RQ5 (*What are the benefits of using AI in the leadership field?*) and RQ6 (*What are the disadvantages of using AI in the leadership field?*). Those two RQ are answered in two steps. First, the answers from the participants not using AI in leadership are evaluated. Wherever possible, the answers to the interviewee using AI in leadership are compared with the findings of the first group. This step is important since the first group only considers their expectations and knowledge from other business fields and not a real use-case in leadership.

The group not using AI in leadership noted that the following benefits could arise when using AI in leadership: The most important item is that the overall quality can rise due to a better information basis used for decision-making, while this assessment is shared by various researchers (Brynjolfsson & McAfee, 2017; Verhezen, 2019).

The item is closely connected to a higher efficiency stated by seven participants and an increase of speed since decisions can be made faster (Five mentions). The aspect of increased speed is also part of the literature analyzed prior to the interviews (Brynjolfsson & McAfee, 2017; Verhezen, 2019). Another reason is the chance to use multiple data sources as an origin for AI decisions (Five mentions) which in fact happens faster than humans scanning the same amount of data. Regarding those findings, time savings can be confirmed as an advantage by the interviewee using AI in leadership and through their importance in scientific sources as stated above. Beyond that, the respondent mentioned cost savings which indirectly verify considerations on quality and efficiency increases named before.

Three participants named the advantage of AI being objective. In literature, this term was described with the notion that AI treats all employees equally (Lee et al., 2015).

Two mentions are given to the following advantages each: Showing hidden interconnections between data that are not detected by humans, enabling leading of large teams, and that the full benefit arises from the coexistence of AI and HI. Whereas, the advantage of combining both is stated in the concept matrix by Verhezen (2019) and Lichtenthaler (2020). The notion of

enabling the management of huge teams is also evinced in scientific resources (Lee et al., 2015). In contrast to that, it must be noted that one interviewee mentioned to lead a team larger than 41 members which is perceived as a large team and his company is not using AI in leadership. Thus, it might be a useful assistance depending on the AI's design, but is not a necessity.

In addition, two possible advantages are named once. On one hand, the use of AI in leadership can lead to the building of optimized teams by analyzing teams and possible candidates to create the best mix of characteristics and expertise possible. Here, notes on data security and technical capabilities on digitalizing employee data are important as stated for the second RO. On the other hand, one advantage of AI might be that employees can receive help in an anonymous manner which might be of advantage for them. However, it might also make leading harder for leaders since those social interactions are essential in it as stated by one participant, which is already indicated by the definition of leadership used for this paper.

Next, the disadvantages are examined with the same approach to answer RQ6. The set of answers is very diverse. Six mentions are allotted to the acceptance of AI in leadership, which could be a huge burden – a concept examined in detail in multiple studies, whereas they partly highlighted the connection to trust in such technologies as well (e.g. Dietvorst et al., 2018; Verhezen, 2019). This correlation is not drawn in the interviews. Besides, the following three items are named three times. First, the chance of falsification of results through biased data. Problems with biased data are well-researched phenomena (Dhanrajani, 2019; Pandey et al., 2018), especially focused on hard to detect hidden biases (Brynjolfsson & McAfee, 2017). The notion on hidden biases is also made in the interviews. Two participants for example stated the difficulty to balance data regarding genders in the recruitment processes. Second, the use of AI in leadership can lead to a decrease in human interactions, a key activity in leadership. In contrast to this perception, Daugherty and Wilson (2018) declared in this context that the integration of AI itself creates a need for social interactions and skills when reacting and considering the social consequences of the use. Beyond that, it is noted multiple times that social skills will get increasingly important when AI takes upon various tasks (Dhanrajani, 2019; Meister, 2019) and that the time getting freed by using AI can be used to be social and human (Daugherty & Wilson, 2018). However, both views are not contradictory: Even when human interaction is reduced, its importance can still rise. Nonetheless, the difference can be explained in the design of the study. Since no clear AI scenario in leadership is proposed by the scientists and most interviewees do not know areas of application, the basis of knowledge was very diverse and led to different scenarios, which imply different impacts of AI. And third, the transparency of the

decision-making process is reduced a lot due to missing the comprehensibility of AI's results. Interestingly, some research proposed an increase in the transparency of decision-making processes due to the use of AI (Lee et al., 2015). Here, the wish for an explainable AI was named a few times. In the literature, this aspect was only mentioned once, when stating that AI can be made more comprehensible by including dashboards for example (Le Clair et al., 2016).

Another disadvantage named three times is the fact that jobs will get lost by applying AI in leadership. A differentiated discussion on that point is performed regarding RO2. Three mentions are allocated to the disadvantage of wrong results being created by AI grounded in faulty software code which highlights the importance of internal expertise in the field of AI and of an explainable AI to make it easier to verify AI results. While three interviewees also mentioned that they are afraid to be restricted in their individual and free leading when AI is used and may even force specific activities. An important notion here is that this freedom is often a motivation for employees to apply for leading activities as noted by one participant.

On top of that, multiple items are named twice. The assignment of responsibilities is not clear if errors happen related to the AI as stated by one interviewee and by Fonseca (2020): *Is the software vendor accountable or the leader relying on the results of the AI?* Whereas relying on the decisions of the AI too much is another disadvantage mentioned two times – another finding not appearing in the literature. Equally important are ethical concerns which are discussed prior.

In addition to those items, the following problems are named once. Using AI requires a certain amount of computing power which is perceived as high for some companies (Pandey et al., 2018). As already mentioned before, the necessity of employee qualification might be a burden as well, a finding that is not identified in prior research. Above that one interviewee mentioned that interface problems with current systems are also important to consider, even if they are not mentioned in the literature yet.

Out of those thirteen items, the following three were mentioned by the company using AI as well. Thus, they are confirmed on a small scale since they were noticed by the company using it in that field: The reduction of human interactions, the circumstance that people tend to trust AI too much, and that workplaces could get lost by implementing AI in leadership.

Research Objective 4 ***(****Identify how leadership has changed through the use of AI****)***

The last research objective is dedicated to changes in leadership through AI usage. However, only one interviewee could be questioned to identify specific changes in leadership. This interviewee answered that changes in leadership are recognizable, but that he could not give a

complete answer due to a too short time of use. The tendency was that through automation many processes can be controlled and the human being only confirms important decisions in the end. Furthermore, the respondent said that lazy people are more prone to laziness and that motivated people can do their job better because they have more time and possibly a better information basis for decisions. This information answers RQ7 partly (*How does the use of AI change the way leaders lead?*). Though, it must be considered that the findings are only based on one interview and thus, cannot be generalized. Due to the small number of companies using AI in leadership, no answer can be made for RQ8 (*In how far does Leadership change in general and how does AI support this?*). However, it can be stated that AI changes the way how leaders lead. In the company, AI is allowed to make decisions independently. Nonetheless, AI is limited since humans have the final decision-making power and change or correct the judgments of the AI. This picture is shared by eleven companies expecting AI to influence leadership, while only three interviewees said that AI cannot impact leadership.

Concept Matrix Assessment

Even if only a few answers are made focusing on transformations in leadership, the other results also indicate changes. Those are displayed in Table 4. The overall visuals are reduced to a cross when a notion is made. When no consideration of a concept is taking place, the field is left blank. The matrix can be understood as a summary of the results from above. Concepts listed in the prior version that are not confirmed, are circled orange. No new concepts are identified.

Transformation Concept	Productivity Enhancements							
	Decision-Making							
Article	Data	Job & Team Creation	Mindset	Culture	Coexistence of AI & HI	AI Leadership	A Leader's Skill set	AI as a Challenges
Assessment on Transformation	X	X		X	X		X	X

Table 4 Concept Matrix Assessment. Own Illustration.

Overall, many hints are found that there are many transformations expectable regarding productivity. The main focuses here are placed regarding time and cost savings, whereas one notion is

also made to a changed team-building behavior based on AI to increase overall team results and quality. There, one possible transformation regarding decision making is also displayed.

Regarding the data, the importance of high quality and balanced data sources is highlighted several times. Here, a close connection to productivity enhancements and decision-making can be placed since leadership might change to an extent that multiple data sources can be used aggregated more easily when AI is involved. Another notion is placed on data security.

Interestingly, none of the interviewees addressed the leader's mindset or the culture being necessary for success. Related thoughts are about the acceptance of AI by the users, which is commonly are mostly related to a company-wide culture. Thus, it is taken up by this new field.

The next concept of the matrix is about the coexistence of AI and HI. Since the point is also mentioned in the interviews as an advantage, it is expected that leadership will transform in this direction. However, no detailed prognosis can be given in this field because of the limited data provided in this direction.

In addition, no notions are made regarding AI leadership. Thus, this transformation concept is discarded as well. In contrast, several items are added regarding the leader's skills indirectly. First, leaders have to be able to act more human than ever before, since AI in leadership might decrease humanlike actions. Second, participants stated that jobs will get lost. Thus, even if new jobs are created, leaders will still face several layoffs that could transform current leadership, especially focusing on the need for social skills. Furthermore, the role proposed in the literature of the leader promoting the use of AI in leadership is also considered on the edge. Since AI is called objective and good assistance in some interviews, leaders should consider the benefits, but also the limitations of AI in this position and when combining AI and HI. Those findings emphasize but do not clearly state the importance of the following skills introduced in chapter 3.3: Bot-based empowerment, rehumanizing time, responsible normalizing, and appreciation of employees. In contrast, those skills are not even named on the edge: Judgment integration, intelligent interrogation, reciprocal apprenticing, relentless reimagining, consciousness, and responsible management of AI.

The last concept introduced in the concept matrix is AI as a challenge. None of the introduced items is mentioned. However, some new items can be added in accordance with the interviews. First, data itself, especially focused on the collection of all items needed for the well-functioning of AI and data security introduce multiple challenges transforming leadership. Related are ethical issues. Here, compliance with guidelines set by for example the council of work is

essential. Beyond that, user acceptance is named multiple times. It can be a challenge as well. One reason could be the fear of losing jobs due to the implementation of AI named multiple times. On top of that, the creation of the AI itself may also be a huge issue due to named data-related challenges and further financial, technical, and human limitations – if companies see any benefit at all in using AI in this field, being very much characterized by human interaction.

As a final remark, the limited meaningfulness of the concept matrixes above is stated. This is reasoned in the fact that less than 6% of the companies are using AI in leadership and an additional 12% are about to implement it in the near future. Thus, the results used here are mainly about expectations and not about actual use-cases.

5.1 Implications

The results discussed above form several implications, both for scientists and companies. Nonetheless, multiple limitations restrict the expressiveness of the findings. They are considered in the next chapter.

The first implication is that even if all companies are influenced by AI in general, use cases of AI in leadership are quite rare and mainly located in HR. Thus, it is implicated for scientists to further focus on the identification of areas of application. While this also applies to companies, we do not advise to go beyond due to the lack of fields of applications and software solutions known and proven. Furthermore, the results indicate that a use is not guaranteed to be beneficial in the field of leadership which is highly characterized by human interactions. It cannot be answered yet if AI fits in this area to a sufficient extent. Here, the expected advantage of AI to be an objective source of information might be interesting as assistance. However, AI might be a good choice to improve decision-making since more data can be viewed in a shorter time and therefore cheaper. Furthermore, it could be used to automate some processes like verification chains and task distributions to a certain degree. Thus, AI might also be useful, when leading huge teams, whereas this item could not be fully confirmed.

Beyond that companies expect that the use of AI in leadership rises the quality by making better decisions more efficiently by considering more data sources for example. This can already be seen as a kind of coexistence of AI and HI, which is described as highly beneficial. Thus, time is freed up that could be used to be human and social and thereby counteract the fact that the use of AI in leadership reduces human interactions in leadership.

Besides, companies have to consider that disadvantages arise from the use as well. As already stated, human interactions are going to be less. It has to be evaluated individually if this is

bearable while it is also dependent on the specific use case of AI in leadership. Beyond that, it has to be considered that leaders might trust the assessments of the AI too much and that workplaces are going to be lost or at least shifted. This has several implications for leaders as well. Those will be considered later. Furthermore, several expectations are named. However, it must be considered that employees accept the use of AI. A field, that is also of interest to scientists. Beyond that transparency might be reduced by using AI in leadership – an issue that should be especially addressed when using AI in leadership. It can help to raise acceptance and useability when leaders have to evaluate possible decisions. Another implication is that companies must be aware of the importance of the data provided: It must be free of bias and a huge amount of data is necessary to train and test an AI sufficient, while it might be a huge issue to actually collect adequate data of human beings. Reasons for that are technical limitations of how data of dimensions of humans can be captured and legal and ethical guidelines that have to be considered. Those should be prioritized high when companies contemplate a use.

In addition to those items, companies must also be aware that certain technical (e.g. computing power and connectivity with current interfaces), but also human capabilities must be present to make the use of AI a success. Since some interviewees mentioned that it can be hard to find skilled employees, companies should either start early to attract qualified people or should rather focus on finding buyable solutions. Nonetheless, it is advised to keep looking for possible applications since AI can be a huge competitive advantage (Lee et al., 2015).

Beyond that, some small insights on possible transformations could be gathered. Those should be considered by enterprises and scientists. As already stated, the use and prioritization of data might change a lot. In addition, teams and jobs could shift as well as the culture to enable AI in leadership. Some inspections are also made regarding the skillset a leader must have to emphasize and use AI in leadership. However, using AI in leadership might also be a huge challenge as stated by the several disadvantages and issues related to the use.

In addition, two aspects are of interest to scientists primarily. First, changes regarding the leader's mindset are identified based on the literature analysis. Since those findings do not occur in the interview results, it is implicated for scientists, that the influence is rather small. The same applies to AI leadership, which is also not addressed by the participants.

5.2 Limitations

The findings are limited by certain aspects. One key limitation is that only one company could be found that uses AI in leadership. The findings regarding advantages and disadvantages

especially arise from the findings of one company and the expectations of the other companies. Thus, they cannot be generalized to any extend.

Additionally, if more companies would have used AI in leadership, it would also be interesting to know how their teams are structured or which methods they use (e.g. SCRUM) and how AI affects those techniques. Another aspect related to the questionnaire is, that every participant had a unique understanding of AI, and only two asked how it is delimited. Thus, it is advised to define AI in future interviews to create a uniform basis. Furthermore, since many participants do not know any actual use cases and that the possibilities of using AI differed a lot, a very diverse field of answers was created. Those might also differ based on the background of the participants (e.g. HR or information technology field) Thus, it is hard to compare the findings since the basis is very different in some cases, which also explains the diverse field of answers regarding advantages and disadvantages. In addition, some contradictions occurred in the findings that might be explained by the fact, that even if leadership was defined, still a lot of use cases in the field of HR are considered.

One limitation regarding the overall structure of the paper is that the literature analysis is highly focused on the identification of transformations in leadership by using AI. Since only one company was questioned using it in that field. No profound insights could be generated. This highly affects the expressiveness of the findings and of the concept matrix, especially of the modified one (Table 4). Thus, verification of the matrix is advised for future research. Beyond that, the category system to sort the companies according to their size or industry sector might be too stiff. Some more detailed categorization with a focus on tech companies for example might be more suitable since some participants indicated that they know or expect huge tech companies to have a leading role in the use of AI in leadership. As no such companies could be questioned, no further conclusions could be drawn.

Apart from that, the open questions limited the number of questions in the questionnaire. Answering those questions takes longer than replying to closed questions and the time of the respondents is limited. It is also possible that the answers are misinterpreted, even if they are coded by two different coders (Sreejesh et al., 2014).

Concerning the methodology of the paper, it must be noted that the theory extraction can be influenced by the subjective opinions of the researchers. Despite all efforts to minimize those effects, they can never be fully prevented (Strübing, 2014). Since the coding guide is formulated by both authors, some of the subjective effects on the creation are already negligible, but there

are still some. Future work should focus on validating the coding guide to find out if there are still some subjective aspects. Besides, it is not possible to find deep structures in the transcripts with the used method (P. Mayring, 2010). Another limitation of the qualitative approach according to P. Mayring (2010) is that one cannot find out why the results are like they are.

The content analysis according to Mayring and Philipp (2004) offers advantages such as transparency, comprehensibility, and an easy transfer to new RQ due to the fixed coding rules. But it should be considered that these fixed structures also have disadvantages for open RQ because they partly restrict the content. This is reduced by the revision of the coding rules and the repetition of the coding by a second researcher but should be noted. An open procedure such as grounded theory is superior in these points but is less supportive in the above-mentioned advantages. For this reason, a conscious decision was made to use the qualitative content analysis according to Mayring (Mayring & Philipp, 2004).

5.3 Future Research

A lot of possible future research fields are identified due to the differences between the findings of the literature analysis and the results of the coding process. Based on the limited generalization of the findings, future research could focus on the validation of our findings.

One aspect that has arisen is the notion of basic education regarding AI. Many companies called it a prerequisite to be fulfilled before using AI in leadership. Thus, a field of future research is to evaluate, for example as part of a survey, if workers have different expectations and fears regarding the use of AI at their workplace depending on their knowledge of the technology. A related aspect is the one of a talent gap regarding human capabilities to be able to implement an AI – with a focus on software developers and leaders, especially important when considering that small programming errors can have a huge impact on such technologies integrated in fields like leadership. Thus, it could be investigated if companies evaluate their capabilities as sufficient to implement AI or if they are only interested in demanding ready to use solutions. One item that could be added regarding capabilities is technical aspects like computing power and the integration in preexisting systems with a focus on interfaces.

Another huge point of the results is the acceptance of AI by the users. Here, a survey could be used to evaluate specific fears and factors affecting acceptance, like the use of ethical guidelines and the use of a chief officer to ensure compliance with it. While the idea of integrating a corresponding chief officer is only mentioned in the literature. Thus, the necessity of having one could be investigated further. Beyond that, trust was named as a crucial aspect in this field in

the literature. Since it is not called again during the interviews, its influence has to be investigated further.

One of the most important points mentioned in the interviews is that more than half of the companies do not know any fields of application or specific software offers. Besides the one company using AI in leadership, no such systems or fields could be identified in the literature analysis. Thus, it is of further scientific and practical interest to identify possible use cases that have a practical relevance – if there are any. A question that has to be answered as well because some interviewees mentioned that they do not see any benefit in using AI in leadership due to its nature. One concept introduced in the literature and by one interviewee is that AI could be used to lead huge teams easier. As stated before, this field has to be investigated in more detail.

One additional aspect being of interest for scientists and companies is the factor data in the people-oriented field of leadership. On one hand, the availability of data is important to consider with a focus on laws and ethical rules. On the other hand, practical capabilities to even capture human data are of interest.

One field of future research could also be the objective nature of AI in leadership as stated by about 18% of the companies. In how far an AI is acting objectively concerning the available data sources and do companies want to use objective expressions in a field characterized by subjective assessments and human traits.

One important item handled very differently in the literature and the interviews is the one about the transparency of decisions made by AI. The significance is very high in the field of leadership, where leaders probably have to justify their decisions which gets hard when they use AI and it only displays a result. Since those findings reject the assessments of current literature, that AI can help to make decisions more transparent, future research should focus on the confirming either direction. Two related concepts identified during the interviews are the problems arising in the assignment of responsibilities if AI decisions are faulty and what happens if leaders rely too much on the estimations of the AI. Since AI takes on many problem-solving tasks, we wondered if employees but also leaders might lose their ability to solve those problems in the future (Daugherty & Wilson, 2018). Those items should be addressed in future research.

In the questionnaire, a short proposition was asked regarding the future use of AI in leadership and the influence of the pandemic. Future research might be interested in verifying those results. Beyond that, it would be of interest to examine if the estimations regarding the COVID-19 situation change over time. For example, will the companies still work a lot in their home office

or not? Because those items are important factors in the deployment of AI since they form the underlying data structures. In addition, most of the enterprises noted that they see a connection between COVID-19 and the amount of digitization. This circumstance can be investigated further as well.

Even though the topic of this elaboration is the field of leadership, a lot of use cases of AI in other fields like HR are noted. Thus, the use of AI in other fields seem to be developed further than in leadership and thus might result in interesting results.

Another topic only introduced shortly are the effects of the use of AI on the well-being of employees and leaders at their workplaces. Future research could thus focus on the vision of employees towards the use of AI as mentioned by Citrix (Bulpin, 2020) to handle distractions and undone work for example to minimize health-related issues like stress. In this area, the combination of AI and employees in collaboration tools could also be of interest. While the collaboration of AI and people as a cultural shift is highlighted (World Economic Forum, n.D.). Related to this area in a wider sense is which jobs are replaced through AI-use. A study shows that out of five middle-class job tasks, only one will shift to a higher vague job and four to a lower one, which has several implications for the workforce (Fleming, 2020). As the fear of job losses is also shared by multiple participants future research should investigate this circumstance in more detail.

In addition, there are some hints about AI being a risk (Ransbotham et al., 2017). Facets of the use like that have not been analyzed and addressed within our research. Those are very important for practitioners since they are central in considerations of the use of AI in leadership and beyond that.

6 Conclusion

As a conclusion of the findings stated above, it can be stated, that it seems that there is no meaningful involvement of AI in leadership at the moment. This can be gathered from the fact that currently only one of the questioned companies uses AI in leadership and only two more actively plan to integrate it in the closer future. These findings answer RO1 (*Identify the current usage status of AI in leadership*) and thereby also RQ1 (*How is the usage status of AI in the leadership area?*). The one company using AI in leadership stated the following three areas of application, whereas they have a close connection to the field of HR: Employee planning, career management, and recruiting (*RQ2 If AI is used, in which leadership areas is it used? This question refers to areas of work such as further training, career planning and personnel recruitment.*).

Concerning RO2 (*Identify the reasons for use and non-use of AI in leadership*), the following items declaring why using AI in leadership is advised: Cost and time savings and the possibility to automate processes (*RQ3 What are the reasons for the use of AI in leadership?*). In contrast, the following main items (minimum of 30% of participants mentioned them) speak against the use of AI in leadership to answer RQ4 (*What are the reasons for not using AI in leadership?*): No areas of application are known, no necessity exists to use AI in leadership, human interaction as a key aspect of leadership is becoming less frequent and for a successful use a lot of human-related data is needed which cannot be captured because of legal, technical and ethical restrictions. Besides, the participants are asked to think about prerequisites to be fulfilled to consider AI in leadership. Those results also reflect reasons for not using AI: Basic knowledge on AI is spread far enough, transparency of AI decisions is not high enough, digitization must sufficiently advance, and related, databases must be adequate for the use.

Regarding RO3 *Investigate the advantages and disadvantages of AI in leadership* various further constraints are named under disadvantages of a use (*RQ6 What are the disadvantages of using AI in the leadership field?*), whereas only the first three items are from the real use-case; the others are again only the main items arising from the expectations from the other participants: Human interactions are reduced (named by both), some leaders trust AI too much, some workplaces are lost, the acceptance of the users is critical, biased data is a huge issue and transparency is reduced by using AI in leadership. In contrast, the following expected What are the benefits of using AI in the leadership field?[OBJ]*What are the benefits of using AI in the leadership field?*[OBJ]). The ones from the user of AI correspond with the reasons for the use. A higher quality

regarding decision-making is expected, as well as an increase in efficiency and speed and better possibilities to aggregate data are a further advantage.

RO4 (*Identify how leadership has changed through the use of AI*) could not be answered adequately. The company using AI stated that there are changes in leadership through the use of AI, but no differentiated results can be stated for RQ7 (*How does the use of AI change the way leaders lead?*) and RQ8 (*In how far does Leadership change in general and how does AI support this?*) due to the limited number of participants using AI.

7 Appendix

7.1 Overview of the Image of Man

Image of Man	Economic Man	Social Man	Self-Actualizing Man	Complex Man	Brain-Directed Man
Year of origin	1900	1930	1950	1960	2000
Basic human type	Machinelike being	Social being	Developmental being	Multifaceted being	Black box-triggered/ brain-controlled being
Sequence of action and decision-making processes	Controlled and cognitive processes determine the action and decision-making processes				Emotions and affects overlay cognitive processes
Important source of motivation	Financial inducements	Social "acceptance"	Unsatisfied needs in the hierarchy of needs	Complex, situation-dependent needs structure	Complex, neuronally structured motivational structure
Consequence for the work process	Optimize work process	Improve social conditions	Granting room for maneuvers and autonomy	Consider complex motivation structure	Fulfilment of basic neuroscientific needs; activation of an individually tailored reward system

Table 5 Overview of the Image of Man. Own Illustration based on Peters and Ghadiri (2013).

7.2 Selection of Different Concepts of Leadership

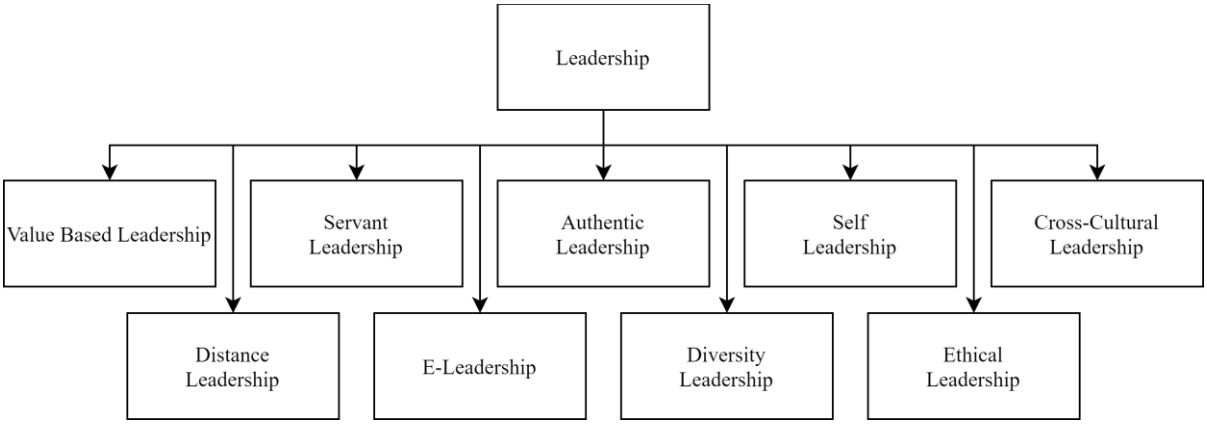

Figure 19 Leadership Concepts Overview. Own Illustration based on Peters (2015).

7.3 Maslow's Hierarchy of Needs

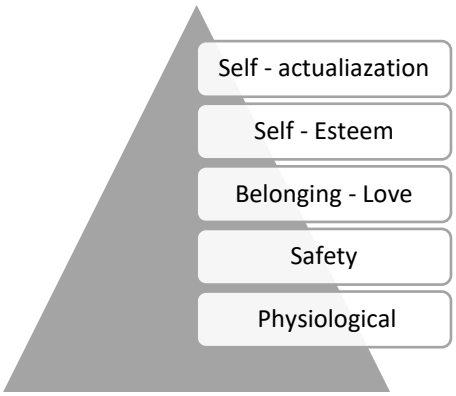

Figure 20 Maslow's Hierarchy of Needs. Own Illustration based on Peters (2015) and McLeod and Saul (2007).

7.4 Leadership vs. Management

Management focus	Leadership focus
Goals and objectives	Vision
Telling how and when	Selling what and why
Shorter range	Longer range
Organization and structure	People
Autocracy	Democracy
Restraining	Enabling
Maintaining	Developing
Conforming	Challenging
Imitating	Originating
Administrating	Innovating
Directing and controlling	Inspiring trust
Procedures	Policy
Consistency	Flexibility
Risk avoidance	Risk opportunity
Bottomline	Topline

Table 6 Leadership vs. Management. Own Illustration based on McManus (2006, p. 13).

7.5 Examples of Common Problems in the Formulation of Questions

Common Problems	Examples
Avoid objectionable and sensitive questions	Objectionable: How often do you travel in a bus without a ticket? Unobjectionable: How often do you forget to take a ticket while travelling by bus? (Disguised)
Avoid biased questions	Biased: Do you think that TV has a negative effect on children? Unbiased: What are your views about the effects of TV on children?
Avoid vague questions	Vague: How satisfied are you with Celebrity Resorts? Better: How would you describe the hospitality in Celebrity Resorts in your own words?
Avoid unwarranted Presumptions	Presumptive: How satisfied are you with the speed of response for on-site technical support? (assumes that customers are satisfied) Better: How satisfied or dissatisfied are you with the speed of response for on-site technical support?
Avoid the use of leading questions that prompt the respondent to a particular answer	Leading: Would you prefer a supermarket nearer your home? Better: How often would you shop from a supermarket based on its distance from your house?
Avoid asking negative Questions	Negative: Salespersons should not be allowed to make visits in the evening. Agree/Disagree Positive: Salespersons should be allowed to make visits at any time. Agree/Disagree
Ensure that the wording is completely unambiguous	Ambiguous: How seldom, occasionally and frequently do you purchase stock? Unambiguous: How often do you purchase stock? a) Seldom b) Occasionally c) Frequently
Avoid double-barreled questions	Double-barreled: Do you drive or take the bus every day to office? Yes/No Better: How do you go to your office every day? Drive or take a bus?
Have as narrow a reference range as possible	Too broad time period: How many times have sales promotions influenced you to switch brands over the last year? Better: How many times in the last month have sales promotions influenced you to switch brands?

Table 7 Examples of Common Problems in the Formulation of Questions. Own Illustration based on Sreejesh et al. (2014, pp. 152–153).

7.6 Questionnaire AI-Use in German

Einleitungsfragen

1. Denken Sie, dass künstliche Intelligenz immer mehr Einfluss auf Ihr Unternehmen nimmt?
   1.1. Ja: ☐
   1.2. Nein: ☐
2. Findet die künstliche Intelligenz aktuell Verwendung in Ihrem Unternehmen?
   2.1. Ja: ☐
      2.1.1. In welchen Unternehmensbereichen nutzt Ihr Unternehmen die künstliche Intelligenz?
   2.2. Nein: ☐
3. Verwenden sie die künstliche Intelligenz auch im Leadership-Bereich? Leadership bedeutet für uns die "[…] Führung einzelner Mitarbeiter und Teams bis hin zum visionären Denken und Handeln von Führungskräften für das gesamte Unternehmen. Leader motivieren und inspirieren Mitarbeiter und führen diese über das Erkennen ihrer individuellen Wünsche und Bedürfnisse sowie einer speziellen Bereitstellung von Anreizpaketen zu Spitzenleistungen." (Bruch et al., 2006, pp. 4–5).
   3.1. Ja: ☐
   3.2. Nein: ☐

Themenspezifische Fragen

Aktuelle Nutzung

Die folgenden Fragen gehen gezielt auf den Leadership Bereich ein.

4. Für welche Tätigkeiten wird die künstliche Intelligenz im Leadership Bereich genutzt?
   4.1. Führt die künstliche Intelligenz eigenständig Entscheidungen aus oder unterstützt sie Ihre Entscheidungsfindung?
5. Aus welchen Gründen habe sie die künstliche Intelligenz im Leadership Bereich eingesetzt?
   5.1. Was sind für sie die Vorteile dieser Nutzung?
   5.2. Was sind für sie die Nachteile dieser Nutzung?
6. Sind Veränderungen durch den Einsatz von einer künstlichen Intelligenz im Leadership erkennbar?
   6.1. Welche Rolle nehmen Leadership und die künstliche Intelligenz in diesem Transformationsprozess ein? Würden sie eher sagen, dass die künstliche Intelligenz Leadership verändert oder dass der Transformationsprozess im Leadership Bereich durch den Einsatz von einer künstlichen Intelligenz unterstützt wird?

Zukunftsaussichten

7. Werden sie künstliche Intelligenz auch weiterhin im Leadership Bereich nutzen?
8. Hat die aktuelle Lage (COVID-19) positive oder negative Auswirkungen auf die Nutzung und Verbreitung der künstlichen Intelligenz im Leadership?

Demografische Fragen

9. Wie ist die Unternehmensgröße des Unternehmens in welchem Sie tätig sind?
   9.1. Wie viele Mitarbeiter beschäftigt das Unternehmen in welchem Sie tätig sind?

< 10	☒
< 50	☐
< 250	☐
> 250	☐

   9.2. Wie ist der Jahresumsatz des Unternehmens in welchem Sie tätig sind?

< 2	☐
< 10	☐
< 50	☐
> 50	☐

   9.3. Wie ist der Jahresbilanzsumme des Unternehmens in welchem Sie tätig sind?

< 10	☐
< 10	☐
< 43	☐
> 43	☐

10. In welchem Industriesektor würden sie sich einordnen?

Industrie, Verarbeitendes Gewerbe	☐
Groß- und Einzelhandel	☐
Bauen	☐
Handwerk	☐
Gastgewerbe, Tourismus	☐
Dienstleistungen	☐
Energie	☐
Land- und Forstwirtschaft, Fischerei	☐
Transport und Verkehr	☐

11. Welche Position haben Sie im Unternehmen?
    11.1. Wie groß ist das Team, dass sie leiten?
12. Kennen Sie weitere Firmen, welche die künstliche Intelligenz im Leadership einsetzen?

7.7 Questionnaire No-AI-Use in German

Einleitungsfragen

1. Denken Sie, dass künstliche Intelligenz immer mehr Einfluss auf Ihr Unternehmen nimmt?

   1.1. Ja: ☐

   1.2. Nein: ☐

2. Findet die künstliche Intelligenz aktuell Verwendung in Ihrem Unternehmen?

   2.1. Ja: ☐

      2.1.1. In welchen Unternehmensbereichen nutzt Ihr Unternehmen die künstliche Intelligenz?

   2.2. Nein: ☐

3. Verwenden sie die künstliche Intelligenz auch im Leadership-Bereich? Leadership bedeutet für uns die "[…] Führung einzelner Mitarbeiter und Teams bis hin zum visionären Denken und Handeln von Führungskräften für das gesamte Unternehmen. Leader motivieren und inspirieren Mitarbeiter und führen diese über das Erkennen ihrer individuellen Wünsche und Bedürfnisse sowie einer speziellen Bereitstellung von Anreizpaketen zu Spitzenleistungen." (Bruch et al., 2006, pp. 4–5).

   3.1. Ja: ☐

   3.2. Nein: ☐

Themenspezifische Fragen

Aktuelle Nutzung

4. Welche Gründe sprechen gegen eine Nutzung von künstlicher Intelligenz im Leadership Bereich?
5. Sind Ihnen Anwendungsbeispiele von der künstlichen Intelligenz im Leadership bekannt?
   5.1. Was sind für sie bekannte Vorteile von künstlicher Intelligenz im Leadership Bereich?
   5.2. Was sind für sie bekannte Nachteile von künstlicher Intelligenz im Leadership Bereich?
6. Denken Sie künstliche Intelligenz kann einen Einfluss auf Leadership haben?

Zukunftsaussichten

7. Werden Sie sich in Zukunft näher mit künstlicher Intelligenz im Leadership Bereich auseinandersetzen?

7.1. Werden sie in Zukunft künstliche Intelligenz im Leadership Bereich nutzen?

7.2. Was wären Voraussetzungen für eine nähere Auseinandersetzung mit der Technologie?

8. Hat die aktuelle Lage (COVID-19) positive oder negative Auswirkungen auf die Nutzung und Verbreitung der künstlichen Intelligenz im Leadership?

Demografische Fragen

9. Wie ist die Unternehmensgröße des Unternehmens in welchem Sie tätig sind?

9.1. Wie viele Mitarbeiter beschäftigt das Unternehmen in welchem Sie tätig sind?

< 10	☐
< 50	☐
< 250	☐
> 250	☐

9.2. Wie ist der Jahresumsatz des Unternehmens in welchem Sie tätig sind?

< 2	☐
< 10	☐
< 50	☐
> 50	☐

9.3. Wie ist der Jahresbilanzsumme des Unternehmens in welchem Sie tätig sind?

< 10	☐
< 10	☐
< 43	☐
> 43	☐

10. In welchem Industriesektor würden sie sich einordnen?

Industrie, Verarbeitendes Gewerbe	☐
Groß- und Einzelhandel	☐
Bauen	☐
Handwerk	☐
Gastgewerbe, Tourismus	☐
Dienstleistungen	☐
Energie	☐
Land- und Forstwirtschaft, Fischerei	☐
Transport und Verkehr	☐

11. Welche Position haben Sie im Unternehmen?

11.1. Wie groß ist das Team, dass sie leiten?

12. Kennen Sie weitere Firmen, welche die künstliche Intelligenz im Leadership einsetzen?

7.8 Coding Guideline

Category	Description	#
Distribution of the AI	This code was not used because it was created exclusively for category building.	0
AI influences the company	When the interviewee answered yes to the first interview question ("Do you think that artificial intelligence will have a rising influence on your company?").	17
AI is not used	When the respondent replied no to the second interview question ("Does your company currently uses artificial intelligence?").	2
AI is used	When the respondent answered yes to the second interview question ("Does your company currently uses artificial intelligence?").	15
Chatbots	When the respondent answered yes to the second interview question and said that AI is used for Chatbots in the company.	4
Data analytics	When the respondent answered yes to the second interview question and said that AI is used for data analytics in the company.	4
Employee planning	When the respondent answered yes to the second interview question and said that AI is used for employee planning in the company.	3
Image recognition	When the respondent answered yes to the second interview question and said that AI is used for image recognition in the company.	3
Everywhere	When the respondent answered yes to the second interview question and said that AI is used in every department of the company.	2
Future planning	When the respondent answered yes to the second interview question and said that AI is used in the company for future planning.	2
Application processing	When the respondent answered yes to the second interview question and said that AI will be used in the company for processing applications.	2
Automation	When the respondent answered yes to the second interview question and said that AI is used in the company to automate processes.	2
Marketing & sales	When the respondent answered yes to the second interview question and said that AI is used in the marketing and sales department.	1
Speech recognition	When the interviewee answered yes to the second interview question and said that AI will be used for speech recognition in the company departments.	1
Text recognition	When the interviewee answered yes to the second interview question and said that AI will be used for text recognition in the company departments.	1
Dynamic pricing	When the interviewee answered yes to the second interview question and said that AI is used for dynamic pricing in the company departments.	1

Category			Description	#
		Logistics: Goods tracking	When the interviewee answered yes to the second interview question and said that AI is used in the company's logistics department to track goods.	1
		All supporting functions	When the interviewee answered yes to the second interview question and said that AI will be used in all supporting divisions.	1
		Selection processes	When the respondent answered yes to the second interview question and said that the AI is used for selection processes.	1
		Maintenance	When the interviewee answered yes to the second interview question and said that AI is used for maintenance processes in the company departments.	1
		System monitoring	When the interviewee answered yes to the second interview question and said that AI is used for system monitoring processes in the company departments.	1
		Consulting	When the interviewee answered yes to the second interview question and said that AI is used in the corporate divisions of the management consultancy.	1
		Personnel Consultancy	When the interviewee answered yes to the second interview question and said that AI is used in the field of personal consultancy.	1
		Translating languages	When the respondent answered yes to the second interview question and said that AI is used in the company for language translation.	1
		Training measures	When the respondent answered yes to the second interview question and said that AI is used in the company for training measures.	1
		Product development	When the respondent answered yes to the second interview question and said that AI is used in the company for product development.	1
	AI is used in leadership		When the respondent answered yes to the third interview question („Do you use artificial intelligence also in the field of leadership? For us, leadership means the "[...] leadership of individual employees and teams up to the visionary thinking and acting of managers for the entire company. Leaders motivate and inspire employees and lead them to top performance by recognizing their individual wishes and needs and by providing special incentive packages." (Bruch et al*., 2006, p. 4)*. “).	1
	AI is not used in leadership		When the interviewee answered no to the third interview question or says that he does not use AI for leadership purposes.	16
	Further companies known		When the interviewee says that other companies are known which use AI in leadership.	6
	No further companies known		When the interviewee says that no other companies are known which use AI in leadership.	11

Category	Description	#
AI usage in leadership	This code was not used because it was created exclusively for category building.	0
Fields of application	This code was not used because it was created exclusively for category building.	0
Employee planning	If the AI is used in the leadership area for employee planning, employee administration or similar purposes.	1
Career management	If the AI is used in the leadership area for training courses planning such as planning or finding the best place to work.	1
Recruiting	If the AI is used for recruiting in the leadership area.	1
AI makes independent decisions	When using AI in leadership, the AI makes independent decisions.	1
Humans have decision-making power	When a human has the decision-making authority when using AI in leadership.	1
Reasons of use and advantages	This code was not used because it was created exclusively for category building.	0
Automation	If automation is mentioned as one reason for using AI in leadership.	1
Time saving	If time saving is mentioned as one reason for using AI in leadership.	1
Cost reduction	If cost reduction is mentioned as one reason for using AI in leadership.	1
Disadvantages of usage	This code was not used because it was created exclusively for category building.	0
Human interaction reduced	If as a disadvantage of AI in leadership is a reduction in relationships with other employees.	1
Too much trust in ai	If as a disadvantage of the AI in leadership is mentioned that it is not good to trust the AI alone.	1
Workplaces get lost	If as a disadvantage of the AI in leadership is mentioned that workplaces get lost.	1
Changes in leadership discernible	When using AI in leadership, it is said that changes in leadership are recognizable through its use.	1
AI changes leadership	If the code "Changes in leadership discernible" was used and said that the AI changes leadership.	1
No AI usage in leadership	This code was not used because it was created exclusively for category building.	0

Category	Description	#
Reasons for non-use	This code was not used because it was created exclusively for category building.	0
No known areas of application	If the code "AI is not used in leadership" was used and one of the reasons was the fact that there are no known areas of application or examples where AI can support Leadership.	10
No need	If the code "AI is not used in leadership" was used and there is currently no need or benefit in using it.	6
Human interactions become less	If the code "AI is not used in leadership" was used and a reason for not using it is that human interactions are lost or become less.	5
Humans cannot be digitally captured	If the code "AI is not used in leadership" was used and one of the reasons was that the factor human is not completely digitally recordable from a technical or legal point of view.	5
Ethical concerns	If the code "AI is not used in leadership" was used and one of the reasons was that ethical concerns were expressed directly or indirectly.	4
No known software offers	If the code "AI is not used in leadership" was used and one of the reasons was that was that no software manufacturer is known to offer such a program or tool.	4
AI is not transparent	If the code "AI is not used in leadership" was used and one of the reasons was that an AI must be traceable in leadership.	3
High expenses	If the code "AI is not used in leadership" was used and it was mentioned as one of the reasons that the resulting expenses, such as personnel and costs, are too high during implementation and operation.	2
Loss of control	If the code "AI is not used in leadership" was used and one reason for not using it is that control is lost because decisions are no longer made by the leader.	2
No reasons	If the code "AI is not used in leadership" was used and it was stated that there were no reasons against its use.	1
Job loss	If the code "AI is not used in leadership" was used and one reason for not using it is that jobs are lost because employees become superfluous due to the AI. This is because the AI can take over the tasks of the employees.	1
Known application examples	This code was not used because it was created exclusively for category building.	0
Employee training	If the code "AI is not used in leadership" was used and employee training was mentioned as a known application example.	10

Category	Description	#
Career planning	If the code "AI is not used in leadership" was used and was mentioned as a known application example that it can be used for career planning, such as finding the right place of employment and continuing education.	9
Recruiting	If the code "AI is not used in leadership" was used and the analysis of applicant data was mentioned as a known application example.	6
Team evaluation	If the code "AI is not used in leadership" was used and the evaluation of teams was mentioned as a known application example.	4
Decisions support	If the code "AI is not used in leadership" was used and as a known example of use it was mentioned that it can be used as support for decision making.	3
Coaching	If the code "AI is not used in leadership" was used and coaching was mentioned as an application example.	1
None known	If the code "AI is not used in leadership" was used and no application areas are known.	1
Workforce management	If the code "AI is not used in leadership" was used and workforce management was mentioned as a known application example.	1
Retention risk identification	If the code "AI is not used in leadership" was used and the identification of employees willing to leave was mentioned as a known application example.	1
Decision confirmation	If the code "AI is not used in leadership" was used and it was mentioned as a known application example that it can be used for decision confirmation.	1
Known advantages	This code was not used because it was created exclusively for category building.	0
Higher quality	If the code "AI is not used in leadership" was used and as a known advantage it was mentioned that better decisions can be made by using AI in leadership.	10
Increase of efficiency	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that efficiency can be increased by using the AI.	7
Increase of speed	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that AI in leadership can make faster decisions than a human.	5
Data aggregation	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that AI in leadership can bring together data from several sources better and faster than a human.	5
Objectivity	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that AI in leadership is acting objectively.	3

Category	Description	#
Enabling leading large teams	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that larger teams can be led by using the AI in leadership.	2
Show interconnections	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that an AI in leadership can show connections between data.	2
Coexistence AI and HI	If the code "AI is not used in leadership" was used and the coexistence of AI and HI was mentioned as a known advantage.	2
Anonymous help	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that an AI in leadership can help a worker anonymously.	1
Optimized team building	If the code "AI is not used in leadership" was used and it was mentioned as a known advantage that by using the AI in leadership, the composition of teams can be improved.	1
Known disadvantages	This code was not used because it was created exclusively for category building.	0
Acceptance	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that not all people trust or accept the decisions of the AI	6
Biased data	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that the results can be falsified when data is for example inaccurate or missing.	5
Human interactions get lost	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that human interactions get lost.	5
Reduction of transparency	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that the transparency of decisions made by the AI is reduced.	5
Job loss	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that jobs are lost.	3
Faulty program code	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that the result of the use depends on the programming of the AI and also faulty outputs could occur.	3
Restriction of freedom and individual leading	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that the freedom and individuality of the leader is restricted.	3
Assignment of responsibilities	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that the assignment of responsibilities is a problem.	2

Category	Description	#
Ethical concerns	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that ethical conflicts can occur.	2
Employees rely too much on AI	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that employees relied too much on the results of the AI.	2
High computing power	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage that the available computing power capacity can be a bottleneck with rising usage.	1
Employee qualifications	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that employees with the appropriate qualifications must be available.	1
Interface problems	If the code "AI is not used in leadership" was used and it was mentioned as a disadvantage of the use that the AI must be connected to the interfaces of the existing systems and data.	1
AI can influence leadership	If the code "AI is not used in leadership" was used and it is assumed that the AI can have an influence on leadership.	11
AI cannot influence leadership	If the code "AI is not used in leadership" was used and it is assumed that the AI will have no influence on Leadership.	3
Future prospects of AI in leadership	This code was not used because it was created exclusively for category building.	0
Dealing with AI in leadership	If the code "AI is not used in leadership" has been used, but a discussion about the use of AI in leadership will take place in the coming years.	9
Keep using AI	If the code "AI is Used in Leadership" has been used and is still being used.	1
AI should be used	If the code "AI is not used in leadership" was used but AI is to be used in leadership in the future.	2
AI will not be used	If the code "AI is not used in leadership" has been used and its use is not planned for the next 3 years.	5
Requirements for a dispute	This code was not used because it was created exclusively for category building.	0
Basic knowledge	If as a prerequisite for a closer examination was mentioned that a basic knowledge of AI should be present in all people.	8
Transparency	If it was mentioned as a prerequisite for a closer examination that the result proposed by an AI becomes comprehensible.	6
High degree of digitization	If as a prerequisite for a closer examination was mentioned that the companies are ideally digitized to a high degree.	6

Category	Description	#
Sufficient database	If it was mentioned as a prerequisite for a closer examination that the company must have a sufficient data base before AI can be used in leadership.	6
Awareness of solutions	If it was mentioned as a prerequisite for a closer examination that solutions must be made public.	4
Need	If it was mentioned as a prerequisite for a closer examination that first of all the need for a deployment would have to exist.	3
Positive use-cases of well-known companies	If it was mentioned as a prerequisite for a closer examination that positive use-cases of (named) companies must exist.	5
User acceptance	If it was mentioned as a prerequisite for a closer examination that a certain user acceptance is created in advance.	3
Ethics	If it was mentioned as a prerequisite for a closer examination that ethical boundaries must be observed when using AI.	3
Legal framework conditions	If it was mentioned as a prerequisite for a closer examination that legal basic conditions must be present.	3
Sufficient financial resources	If it was mentioned as a condition for a closer examination that sufficient financial means must be available.	2
Transparent implementation	If it was mentioned as a prerequisite for a closer examination that the introduction process of AI in leadership is transparent.	2
Technical capabilities	If it was mentioned as a prerequisite for a closer examination that the technical capacities must be available to a sufficient degree.	1
More human	If as a prerequisite for a closer examination was mentioned that the AI must become more human.	1
COVID-19 has a positive influence	If it was said that COVID-19 has a positive influence on the dissemination and use of AI in leadership.	11
COVID-19 has no influence	If it has been said that COVID-19 has no influence (neither positive nor negative) on the dissemination and use of AI in leadership.	5
COVID-19 has a negative influence	If it was said that COVID-19 has a negative impact on the dissemination and use of AI in leadership.	2
Demographic data	This code was not used because it was created exclusively for category building.	0
Number of employees in the company	This code was not used because it was created exclusively for category building.	0

Category	Description	#
< 10	If less than 10 employees work for the surveyed company.	1
< 50	If more than 10 but less than 50 employees work for the surveyed company.	1
> 250	When more than 250 employees work for the surveyed company.	15
Turnover of the company	This code was not used because it was created exclusively for category building.	0
< 2 million euros	If the surveyed company has a turnover of less than 2 million Euro per year.	1
< 10 million euros	If the surveyed company has a turnover of less than 10 million Euro, but more than 2 million Euro per year	1
> 50 million euros	If the surveyed company has a turnover of more than 50 million euros per year	14
Annual balance sheet total of the company	This code was not used because it was created exclusively for category building.	0
< 10 million euros	If the annual balance sheet total of the interviewed company was less than 10 million euros.	2
> 43 million euros	If the annual balance sheet total of the company surveyed was greater than 43 million euros.	15
Industrial sector of the company	This code was not used because it was created exclusively for category building.	0
Industry, manufacturing industry	If the interviewee answered the question "In which of the following industrial sectors would the company fit?", they would classify themselves in the category industry, manufacturing industry.	4
Services	If the interviewee answered the question "In which of the following industrial sectors would the company fit?", they would classify themselves in the category services.	11
Energy	If the interviewee answered the question "In which of the following industrial sectors would the company fit?", they would classify themselves in the category energy.	2
Departments of the respondent	This code was not used because it was created exclusively for category building.	0
Human resources	This code is used when the position named in the interviews is located in human resources.	6
Executive board	This code is used when the position named in the interviews is located in the executive board.	5
Information technology	This code is used when the position named in the interviews is located in information technology.	4

Category			Description	#
		Future technologies	This code is used when the position named in the interviews is located in future technologies.	3
		Communication	This code is used when the position named in the interviews is located in communication.	2
	Team size		This code was not used because it was created exclusively for category building.	0
		0 - 5 employees	If the employee has a leadership position and leads less than 5 employees.	4
		6 - 10 employees	If the employee has a leadership position and leads 6 or more employees but less than 11.	5
		11 - 20 employees	If the employee has a leadership position and leads 11 or more employees but less than 21.	7
		21 - 30 employees	If the employee has a leadership position and leads 21 or more employees but less than 31.	2
		31 - 40 employees	If the employee has a leadership position and leads 31 or more employees but less than 41.	1
		> 41 employees	If the employee has a leadership position and leads more than 41 employees.	1

Table 8 Coding Guideline. Own Illustration.

8 References

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