THE INFLUENCE OF LEADERSHIP AND THE ROLE OF EMOTIONS ON THE EMPLOYEE'S ADOPTION OF A CONNECTED WORKER PROGRAM IN THE WORKPLACE

A multiple case-study within a global manufacturing company

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Abstract

This study explored how leadership and the role of emotions influenced the employee's adoption of a connected worker program in the workplace. Since a connected worker program is considered to be an Industry 4.0 innovation, this elaborated on the already existing knowledge of how leadership could help and boost the employee's adoption of Industry 4.0 innovations. A connected worker program is a bundle of digital software tools used in the workplace, to make the day-to-day operations easier and faster for employees, which has not been extensively studied in the context of Industry 4.0 adoption and leadership.

A multiple case study was conducted using the Retrospective Team Events and Affective Mapping (R-TEAM) approach. Four factories were sampled, across multiple continents, with different maturity regarding their connected worker program implementation. After that, the researcher had key informant meetings with four plant managers of the respective factories. Then, a questionnaire was designed and send out to all employees of the selected factories to get some additional information on how the implementation process had been perceived by them. These two data streams were used as input for the group interviews and validation sessions that were conducted a month later. Among the participants of the group interviews and validation sessions were different levels of management (level 6 and 7), to gain a comprehensive perspective on the implementation process. The group interviews and validation sessions were transcribed and coded inductively, translated into Gioia tables visualizing key trends, themes, and dimensions. The analysis showed the three different stages to be observed in the implementation process as aggregate dimensions: the pre-implementation, during implementation and current situation 'stage'. All these stages consisted of different concepts and themes, relating to the findings from the group interviews and validation sessions. The findings were discussed while comparing the findings with other studies in other contexts. The researcher create a conceptual model, that proposed that middle managers leadership styles, such as transformational and instrumental leadership, positively influence the perceived usefulness by employees of an Industry 4.0 innovation, moderated by the emotional intelligence of middle managers, through managerial empathy, managerial patience and emotional regulation. Moreover, technical flaws of an Industry 4.0 innovation are negatively influencing this perceived usefulness by employees of the Industry 4.0 innovation, but again, moderated by the emotional intelligence of middle managers. Lastly, structured network planning positively moderates the relationship between the perceived usefulness by employees of the Industry 4.0 innovation and the adoption by employees of the

Industry 4.0 innovation. Therefore, this multiple case study provides future researchers with insights how leadership and the role of emotions influence the employee's adoption of Industry 4.0 innovations over time.

This research has showed that it added to the already existing knowledge on how middle manager leadership styles and the role of emotions impact Industry 4.0 adoption by employees, through showing that middle managers using transformational or instrumental leadership styles, can boost this adoption. Besides that, it has highlighted the importance of emotional intelligent middle managers, when dealing with implementing a Industry 4.0 innovation. Lastly, this research has showed that managers could use the R-TEAM approach to reflect on implementation processes, to stimulate continuous improvement, as well as, the importance of accommodating their subordinates in the path-goal facilitation, to stimulate the employee's adoption of new technologies even further.

Keywords: Industry 4.0, leadership, role of emotions, connected worker program, employee's adoption

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1. Introduction

There is an emerging phenomenon in business research, which considers Industry 4.0. Industry 4.0 is gaining more and more attention in the last few years (Liao et al., 2017; Calabrese et al., 2022). Industry 4.0 is defined as general increasing intelligence through digitalization and digitization of products and services (Schneider, 2018; Culot et al., 2020), which is achieved by intra-company and cross-company integration (Frank et al., 2019) to eventually establish end-to-end integration throughout the whole supply chain of a company (Chiarini & Kumar, 2021). An example of an Industry 4.0 technology that is getting increasingly popular by the day is the connected worker program (Patel et al., 2022). It concerns the implementation of in-house developed mobile and web-based applications in the manufacturing and logistics environment. It aims to digitalize paper-based processes in the factories, to ultimately create a better working environment for workers in the workplace. However, the implementation of Industry 4.0 technologies is proven to be counteracted by resistance of workers in the workplace (Weinmann, 2017). Therefore, leadership could be a factor that relaxes this resistance. When higher-level managers use their leadership to comfort their subordinates to adopt a new technology, this resistance could be reduced.

The implementation of Industry 4.0 technologies does raise several challenges, which include the employee's adoption of the new innovations (Marcon et al., 2022), which is defined as "internal resistance to organizational change" (Da Silva et al., 2020, p. 336). These challenges have been well addressed in the last decade, but the possible factors that could enhance the adoption of employees of Industry 4.0 innovations are not completely known yet. Industry 4.0 is mostly focused on the technical and production areas but seldom look towards the impact on people (Feng, 2016; Hanafi et al., 2018). That is where the research gap arises that this longitudinal research aims to investigate.

There are many different leadership styles that occur in management (Rafferty & Griffin, 2004; Avolio & Gardner, 2005), which ranges from transformational leadership (Bass, 1990; Choi, 2011; Chen & Cuervo, 2022) and instrumental leadership (Bryman et al., 1996; Antonakis & House, 2014), all the way to transactional leadership (Elenkov, 2002; Birasnav, 2014; Abdelwahed et al., 2022). Transformational leadership puts the focus on motivating employees to reach organizational goals an interests and to make them perform beyond their individual expected levels of work performance (Aarum Andersen, 2009), where the leader and the follower assist each other to improve continuously (Burns, 1978). Instrumental leadership builds on the concept of transformational leadership (Allgood et al., 2022), but

includes “the application of leader expert knowledge on monitoring of the environment and of performance, and the implementation of strategic and tactical solutions (Antonakis & House, 2014, p. 749). On the other hand, transactional leadership considers a management system which includes rewards and punishments that must stimulate the compliance of the followers of the transactional leader (Elenkov, 2002; Odumeru & Ogbonna, 2013). Important to state is the transformational leadership and instrumental leadership augment transactional leadership (Odumeru & Ogbonna, 2013), as it results in better corporate performance (Howell & Avolio, 1993; Bass & Avolio, 1994; Lowe et al., 1996) when transformational or instrumental leaders are present. Therefore, it is likely that transformational and instrumental leadership will be dominant, but transactional leadership will also be considered whenever it occurs to influence the technology adoption process.

Another possible factor that could play its part in this relationship is the role of emotions (Kerr et al., 2006). Within the role of emotions, it could be that emotional intelligence plays a role in management to boost employee’s adoption of Industry 4.0 innovations (Kerr et al., 2006). Emotional intelligence is defined as: “a set of skills that are relevant to the accurate appraisal and expression of emotion in oneself and in others, the effective regulation of emotion in self and others, and the use of feeling to motivate, plan, and achieve in one’s life” (Salovey & Mayer, 1990, p. 185). Emotional intelligence from a leader could make his followers being more open to radical change (Cotet et al., 2020), which could be the case when Industry 4.0 technologies get introduced in the workplace. In this research, emotional intelligence together with leadership could prove to be the crucial factor in enhancing the employee’s adoption of a connected worker program (van Dun & Kumar, 2023).

This research aims to explain the relationship between leadership and the role of emotions that could possibly positively influence the employee’s adoption of Industry 4.0 technologies over time. As the focal Industry 4.0 technology of this research, a connected worker program will be included. Since connected worker programs are becoming more widely used in manufacturing firms and are proving to be complicated to install firm-widely (De Stefano & Wouters, 2022; Le, 2022), this will be interesting to see how the employee’s adoption of such a program could be enhanced. Therefore, the research question will be: “*How do leadership and the role of emotions impact the employee’s adoption over time of a connected worker program in the workplace?*”. This will be investigated through analyzing multiple factories where a connected worker program has been introduced. The analyzed company is a multinational manufacturing firm, with various factories around the globe that have been

going through a implementation process linked to this Industry 4.0 technology. To investigate this relationship, multiple qualitative methods of data collection will be used. These include: team surveys, key informant meetings, group interview sessions and validation sessions. This data will be analyzed through a case study protocol (Yin, 2015) and will be executed in line with the qualitative R-TEAM approach which uses mixed methods (van Dun et al., 2022), taking an inductive approach to investigate factors that influence the discussed relationships.

This report continues with a theoretical background section, that describes the individual concepts within the research question. This will consider an elaboration of the definitions of the theoretical concepts of Industry 4.0 and the connected worker program, the human and socio-technical factors that influence the employees adoption of Industry 4.0 technologies, both transformational and instrumental leadership as the main focus and the relationship between leadership and the role of emotions. Then, the methodology of this research will be further explained, which includes the research design, data sampling, data collection and data analysis. After that, the results are presented, with a discussion and a new, conceptual model with propositions, contributing to the already existing theory in literature. Finally, the theoretical, practical implications and limitations are provided, accompanied by some suggestions for future research.

2. Theoretical background

2.1 The concept of Industry 4.0 and the connected worker program

The Fourth Industrial Revolution, commonly referred to as Industry 4.0, is the incorporation of cutting-edge digital technologies and data analytics into the production process (Lee et al., 2014; Gadre & Deoskar, 2020). The rise of cyber-physical systems, the Internet of Things, and cloud computing are characteristics of this idea. It strives to replace conventional manufacturing processes with ones that are smarter and more effective, enabling quicker and more adaptable production of specialized goods and services (Agostini & Filippini, 2019).

The concept of Industry 4.0 was initially promoted by the German government in the early 2010s, which is when it may be said to have its origins (Gadre & Deoskar, 2020). The phrase "Industry 4.0" was created to describe the fourth industrial revolution, which would involve the integration of cutting-edge digital technologies and data analytics to transform

conventional production processes into intelligent and effective ones (Lee et al., 2014). The idea attracted a lot of interest and has since been accepted by organizations including universities, businesses, and governments all across the world (Lu, 2017). The adoption of Industry 4.0 technology is considered to be one of the primary forces behind economic growth and worldwide market competitiveness (Sony & Naik, 2020b).

There are various subdimensions that make up Industry 4.0 (Hermann et al., 2015), including:

- Cyber-Physical Systems: These are systems that have sensors and communication devices built into them so they can gather information and interact with other systems.
- "Internet of Things": This describes a network of machines, automobiles, and other objects that are equipped with connections, electronics, software, sensors, and other components that allow them to connect and share information.
- Smart Factory: This is defined as: “a factory that context-aware assists people and machines in execution of their tasks” (Hermann et al., 2015, p. 10). This factory is consisting of smart machines, which are based on smart systems that are constructed through input from the physical and virtual world (Kagermann et al., 2013).
- Internet of Services: This enables vendors to sell their services through digital environments. It consists of the infrastructure for the services and business models, the participants and the services themselves.

These subdimensions work together to create a complex network of interconnected technologies that make it possible to build intelligent supply chains and smart factories. Industry 4.0 technology adoption has the ability to transform the production process and result in considerable enhancements in productivity, quality, and personalization. There are additional concepts that are often linked to Industry 4.0, such as: big data analytics, cloud computing, machine-to-machine learning and smart products, but for this research we focus us on the four main subdimensions (Hermann et al., 2015).

The connected worker program is the Industry 4.0 technology where this study will focus on. This is related to the ‘Smart Factory’-subdimension of Industry 4.0, as the connected worker system is defined as “a central hub for extracting contextual information from disturbed networks […] for better workflow organization, asset management and predictive maintenance” (Patel et al., 2022, p. 1). Additionally, there are multiple different types of Industry 4.0 technologies described, where base technologies enable front-end technologies that ultimately combine into the Industry 4.0 concept (Frank et al., 2019). A connected worker

program is a combination of multiple base technologies, such as big data, analytics, cloud storage and linked to the internet of things, that ultimately can be regarded as a smart supply chain enabler (which is a front-end technology) (Frank et al., 2019). A connected worker program is a database where users can upload their actions to the system, which then automatically generates usage data in various business units. Besides this, connected worker systems identify safety risks relatively quick, compared to other safety management systems (Patel et al., 2022). The program drives the implementation of in-house developed mobile and web-based applications in the manufacturing and logistics environment. Hence, the connected worker program is a program that consists of multiple applications (that vary from data logging to uploading maintenance observations), which are complementing the employee's primary work process. It aims to digitalize paper-based processes in the factories, to ultimately create a better working environment for workers in the workplace. Even though it aims to help the workers in a workplace, it is not always adopted by the workers. That will be discussed in the next section.

2.2 Socio-technical factors that influence the adoption of Industry 4.0 technologies

Industry 4.0 technologies have proven to be a positive influence on productivity and quality in business operations (Agostini & Filippini, 2019). Besides that, the connected worker program specifically aims to positively influence the working environment in operating factories (Patel et al., 2022). Therefore, it seems to be logically for employees to adopt these technologies, but this is not always the case. The effective adoption of Industry 4.0 technologies often has major implications for the organization itself (van Dun & Kumar, 2023).

Firstly, Industry 4.0 could cause anxiety amongst employees, due to fear of using the new technology. Negative emotions tend to arise, when employees are not able to work with the new technology, which makes the technology 'technology-induced' (Kummer et al., 2017). In particular, connected worker programs are often linked to 'technostress' (Oh & Park, 2016), which is a modern disease that occurs when the workers are unable to cope with the new technology (Kummer et al., 2017). To counteract this anxiety, it is important to focus on management practices within organizations, such as designing a transparent corporate structure, a clear HR-strategy and pursuing a leadership style that fits the working environment (Shamim et al., 2016). In this way, managers can increase the innovativeness of employees and boost their learning processes (Tan et al., 2021).

Looking at specific behavioral factors, it can be noted that motivation, trust, employee cooperation/communication and perceived usefulness are crucial to implementing Industry 4.0 technologies successfully. Behavioral factors focus on how human or organizations perceive approaches due to the specific situation or their own characteristics (Giroux et al., 2022). Motivation is important to be stimulated by top management to stimulate Industry 4.0 technology adoption by employees (Taqi et al., 2023). Besides motivation, trust is essential, as the employees should always feel that their top management has belief in them to successfully interact with the Industry 4.0 technology (Neumann et al., 2021; Taqi et al., 2023). In addition to this, the employees' cooperation and communication to one another and towards management should be respectful and focused on problem-solving to successfully implement Industry 4.0 technologies (Cárcel-Carrasco & Gómez-Gómez, 2021; Taqi et al., 2023). Lastly, the perceived usefulness from employees towards a new technology related to Industry 4.0 should always be there, at a satisfactory level for the employees to be convinced that it well create an overall better working experience (Nguyen & Luu, 2020; Khin & Kee, 2022). Otherwise, this could result in employee's resistance (Weinmann, 2017; van Dun & Kumar, 2023), which would cause complications for the organization when trying to implement the new technology.

There are many other behavioral factors that could stimulate the implementation of Industry 4.0 technologies, such as the connected worker program. To provide an overview of all potential factors that participate in this relationship between employee's adoption towards Industry 4.0, the research of Taqi et al. (2023) has been studied intensively. They constructed a table, where there are in total 16 factors included, which all differ on the aspect of how they influence the employee's adoption and how they could be used to effectively stimulate this adoption from a managerial perspective within a manufacturing organization (Taqi et al., 2023). These are: "perceived usefulness, employee cooperation, social responsibility, organizational openness, communication, skills and aptitude, motivation, intrinsic drive of employees, organizational culture, Industry 4.0 training, leadership, emotional intelligence, trust, performance evaluation and reward system, effective change management and stakeholders' awareness of Industry 4.0 technologies" (Taqi et al., 2023, p. 4).

For this research, the main focus will be on factor 11 and 12: leadership and emotional intelligence, as those two concepts are interrelated (van Dun & Kumar, 2023). These two factors are directly enacted by managers when trying to stimulate the employee's adoption of the newly introduced technology linked to Industry 4.0 (Kim & Kim, 2017; Hanafi et al.,

2018). This means that managers use their emotional intelligence and being effective leaders in order to enhance the employee's adoption of an Industry 4.0 technology (Kim & Kim, 2017). Moreover, the ability to recognize and regulate the emotions of subordinates (Zeidner et al., 2004) is proven to be of critical importance when leaders want to enhance employee's adoption of a Industry 4.0 technology (van Dun & Kumar, 2023). Adding to that, leaders often acknowledge the benefits of implementing Industry 4.0 technologies into primary job processes and could then convince their subordinates to adopt these innovations, when they are emotionally intelligent and showing effective leadership (Hanafi et al., 2018; van Dun & Kumar, 2023).

Leadership and emotional intelligence are factors that could stimulate the adoption of a connected worker program, as they could make the workers embrace the change (Rampasso et al., 2020; Reshma & Sripirabaa, 2020). In the next section, the focus will be on leadership and its subdimensions.

2.3 The influence of leadership on Industry 4.0 technology adoption and the role of emotions

Leadership, as mentioned before, could be a possible stimulating factor with regards to employee's adoption of Industry 4.0 technologies. Back in the day, leadership was seen as a trait that certain individuals possessed, and the focus was on identifying these traits. This approach was known as the trait theory of leadership (Carson Jr & Schultz, 1964; Colbert et al., 2012). However, as research progressed, it became clear that leadership was a complex phenomenon that could not be explained by traits alone (Bass, 1990).

The next wave of research focused on the behaviors of leaders, known as the behavioral theory of leadership. This theory proposed that effective leadership was about specific behaviors rather than traits (Annese, 1971). This theory led to the identification of two subdimensions of leadership: task-oriented and people-oriented leadership (Akhtar & Butt, 2002; Engelbert & Wallgren, 2016; Galli, 2017).

From there onwards, a new theory emerged, known as the contingency theory of leadership. This theory proposed that there was no one-size-fits-all approach to leadership and that the most effective leadership style depended on the situation (Kriger & Seng, 2005; Waters, 2013). This theory led to, for example, the identification of situational leadership as a subdimension of leadership (Quinn, 1996).

Nowadays, research has identified various styles of leadership (Amanchukwu et al., 2015). A leadership style that follows a personalized way of leading subordinates is called 'transformational leadership' (Burns, 1978). This idea was further elaborated a few years later (Bass, 1990; Bass & Avolio, 1994). Transformational leadership is a leadership style that inspires and motivates followers to achieve their full potential (Howell & Avolio, 1993; Rafferty & Griffin, 2004; Birasnav, 2014). It is based on longer-term relationships between a manager and the subordinates (Nam & Park, 2019). This style of leadership has four subdimensions (Bass, 1990), which consist of:

- Idealized influence, which is about being a role model as a leader for your subordinates;
- Inspirational motivation, which is about communicating expectations and purposes clearly to subordinates;
- Intellectual stimulation, which is about promoting intelligence and rationality of subordinates;
- Individualized consideration, which is about providing personal attention to subordinates.

Besides these four subdimensions of transformational leadership (Bass, 1990), there is an addition to this including key aspects of transformational leadership (Rafferty & Griffin, 2004; Vashdi et al., 2019). These aspects are:

- Personal recognition: distribution of rewards, such as acknowledgement of effort when certain goals have been achieved by subordinates;
- Supportive leadership: supporting subordinates by expressing concern for them;
- Intellectual stimulation: stimulate the problem-solving mindset of subordinates and their innovative way of thinking;
- Inspirational communication: being able to encourage subordinates through providing positive, encouraging messages/feedback;
- Vision: a clear goal for the future, somewhat idealized for the overall organization.

Linking these two models to each other, there are many similarities. The aspect of 'inspirational communication' is linked to the subdimension of 'inspirational motivation. 'Intellectual stimulation' is literally present in both models. 'Personal recognition' and 'supportive leadership' could be linked to the subdimension of 'individualized consideration'. The 'vision' aspect is an overall addition compared to the four subdimensions. Concluding

from this, there is overlap in both definitions of subcategories of transformational leadership, which then validates this definition (Vashdi et al., 2019).

Building on the concept of transformational leadership, an extension was introduced that is called ‘instrumental leadership’ (Bryman et al., 1996; Antonakis & House, 2014; Allgood et al., 2022). It emphasizes a more goal-oriented, task-driven approach to leadership (Rowold, 2014) and recognizes the importance of providing clear direction and expectations to followers (Antonakis & House, 2014). Instrumental leaders often set clear goals and objectives for their followers, which helps to create a sense of purpose and direction within the organization. “They continuously scan the external environment for resources and opportunities, bringing together a more comprehensive set of leader functions that encompass functional and strategic behaviors” (Allgood et al., 2022, p. 7). It is constructed of four subdimensions, which is based on an extensive literature review by Rowold (2014), focused on Antonakis and House (2004):

- Environmental monitoring: scanning the environment for opportunities regarding growth and development;
- Strategy formulation and implementation: establish an overall vision and a strategy to achieve an end-goal that is in line with the vision;
- Path-goal facilitation: removing obstacles along the way for the subordinates and providing them with sufficient resources;
- Outcome monitoring: provide feedback to subordinates which is instrumental for reaching the goals.

Another way in which instrumental leadership builds on transformational leadership is by emphasizing the importance of using rewards and incentives to motivate followers (Antonakis & House, 2004; Antonakis & House, 2014). While transformational leaders may rely more on intrinsic motivation and personal fulfillment to inspire their followers, instrumental leaders recognize that tangible rewards such as bonuses or promotions can be effective in driving performance (Rowold, 2014). By building on the concept of transformational leadership and emphasizing the importance of clear direction and rewards, instrumental leadership offers a valuable approach to driving performance and achieving results in the workplace, which could be essential when implementing Industry 4.0 technologies in organizations (Allgood et al., 2022).

Looking at what leadership types are most likely to have a positive influence on employee's adoption of Industry 4.0 technologies, transformational and instrumental leadership are favorable (Le, 2020; Siangchokyoo et al., 2020; Chen & Cuervo, 2022; van Dun & Kumar, 2023). Moreover, those two leadership styles are most effective when managing radical change, which relates to Industry 4.0 (Bednall et al., 2018; Chiu et al., 2021). Therefore, this thesis will focus on those two subdimensions of leadership. Both leadership styles have been found to have a significant impact on organizational outcomes and especially, implementing new technologies successfully (Antonakis & House, 2014). Also, transformational and instrumental leaders require to be empathic and able to put themselves into the perspective of their subordinates (Vashdi et al., 2019; Le, 2020). This relates to emotional intelligence, which will be further discussed in the next section.

Looking at leadership in particular, the role of emotions also plays a part, for example with emotional intelligence. The concept of emotional intelligence was first introduced in the early 1990s by psychologists Peter Salovey and John Mayer. Emotional intelligence is defined as "the ability to recognize and regulate one's own and other's emotions" (Salovey & Mayer, 1990; Wong & Law, 2002; Zeidner et al., 2004; van Dun & Kumar, 2023, p. 28). It involves the capacity to perceive, express, and regulate emotions in a way that facilitates effective communication, decision-making, and interpersonal relationships (Salovey & Mayer, 1997; Wong & Law, 2002; Kerr et al., 2006). Salovey and Mayer (1990) proposed that emotional intelligence involves four interrelated abilities:

- Perceiving emotions: the ability to perceive and accurately interpret emotions of other people;
- Using emotions: the ability to use emotions to eventually initiate decision-making and critical thinking;
- Understanding emotions: the ability to understand relationships between emotions and understanding complex emotions themselves;
- Managing emotions: the ability to regulate and manage your own emotions, as well as those of others.

Since then, numerous researchers and practitioners have expanded on this concept and developed various models and frameworks to describe the different facets of emotional intelligence (Goleman, 1996; Kerr et al., 2006; Birol et al., 2009; Hanafi et al., 2018; Harlan,

2020). Goleman (1996) designed a model where he described five subdimensions of emotional intelligence:

- Self-awareness: being able to recognize to understand emotions;
- Self-regulation: being able to manage and control your own emotions;
- Motivation: being able to motivate others and yourself to overcome obstacles in whatever context;
- Empathy: being able to understand and how to respond to emotions of others;
- Social skills: being able to effectively interact with other people and build long-term relationships.

As both of these models (Salovey & Mayer, 1990; Goleman, 1996) have been extensively researched and have been found out to be extremely useful in understanding emotional intelligence, this validates the definition of the concept. Moreover, it has been often linked to improved leadership effectiveness, as it has been applied in business research on several occasions (Kerr et al., 2006; Hanafi et al., 2018; Harlan, 2020; Reshma & Sripirabaa, 2020). Research has shown that leaders who are emotionally intelligent are more effective when trying to understand and manage their own emotions, as well as the emotions of their team members, resulting in higher levels of engagement, motivation, and corporate performance (Joseph & Newman, 2010; Sadri, 2012; Kim & Kim, 2017). Besides that, one of the main aspects of transformational leadership is that a leader should always supported their subordinates and being able to intellectually stimulate them (Rafferty & Griffin, 2004; Vashdi et al., 2019). This goes hand in hand with emotional intelligence, which enhances the effectiveness of a transformational or instrumental leader. Concluding from that, this indicates the link between the concepts and clarifies the scope of this research, where these two could be the facilitators of effective employee's adoption of Industry 4.0 technologies.

3. Methodology

3.1 Research design

This research has an embedded multiple case design (Bresman, 2013; Langley et al., 2013), which focusses on a single large, multinational manufacturing company; Company X. It examines the implementation process of a Industry 4.0 technology, which is the connected

worker program in four factories of company X, by focusing especially on how emotional intelligence and leadership have influenced this process. The locations of these factories are: Western-Europe, North America, North America and Eastern-Europe. In that way, a representative sample is made of all the factories of company X, from multiple continents. This research contributes further to the research gap with regards to the employee's adoption of Industry 4.0 technologies. Since this is most often applied within a manufacturing company (Schneider & Sting, 2020), this validates the choice for a company within this industry.

First of all, there was a kickoff meeting with senior management of company X, including the vice president for Industry 4.0 technology adoption, to determine what factories will be included in the research. Moreover, some information of the company is provided that will help to further understand the corporate structure. This kickoff call outline can be found in Appendix A.

In addition, a site visit has been conducted by the researcher at the nearest factory involved in the research. This could provide interesting insights, as the researcher is then able to see how the connected worker program has been implemented in practice. Due to time and geographical constraints, this has not been done at every factory involved in this research, so only in the factory in Western-Europe.

As the embedded multiple case design needs to be respected, multiple qualitative methods are combined in this research, according to the R-TEAM method (van Dun et al., 2022). Firstly, there were key informant meetings to "gather information about a focal team, describe the goals and data collection procedures and get access to team members" (van Dun et al., 2022, p. 3). In this research, the level of analysis will be at factory-level, which is an adjustment to the original R-TEAM approach. This is further explained in Appendix B.

Besides that, multiple qualitative individual questionnaires have been created and sent out to all team members of the respective factories. This has provided data on the team events over time, about the business context regarding the connected worker program and demographic data about the individual members (van Dun et al., 2022). The idea behind this questionnaire was that it will provide insights into the experiences of the employees with the connected worker program and its implementation, as well as the key events that happened during the 1-year or more of the connected worker program implementation process. This questionnaire is provided in the four native languages of the nations where the factories are present in, so that

the respondents can read and answer the questionnaire to the most extensive way possible. The guide for this is listed in Appendix C.

Moreover, group interviews have been conducted with factory representatives that have resulted in a "visual map of past events during the selected time period" (van Dun et al., 2022, p. 3), linked to the emotional intelligence, leadership and employee's adoption over time of the connected worker program. Again, this has been investigated at factory-level, which is an adjustment to the original R-TEAM approach (van Dun & Kumar, 2023). These has been eventually revised, during a validation session, where the visual maps have been shown to a different group of people out of different levels of management to make sure all the key events are included regarding the implementation of the connected worker program (van Dun et al., 2022).

By using multiple qualitative methods, synergistic and complete data utilization is ensured (Fetters et al., 2013). Through using multiple methods, the overall research is relatively more representative, than when only a single method has been used (Grzywacz et al., 2002; Yin, 2015). This also positively influences the construct validity (Lucas, 2003), which indicates to what extent this research gives a valid answer to the research question and to what extent it still aligns to the research goal (Hamdani et al., 2014). Besides that, also the external validity grows through using multiple methods, as the generalizability of the answer to the research question increases (Beletsky et al., 2019). Next to that, including four factories, distributing questionnaires amongst different management levels, including the lowest level which consists of the working staff, and conducting validation sessions with different employees than in the group interviews, increases the likelihood of creating a saturated, data collection (Goulding, 2005; Saunders et al., 2018). This also adds to the research validity (Francis et al., 2010). Moreover, ethical approval was handed out by the Ethics Committee of the University of Twente. Lastly, a visualization of the research procedure for each factory is shown in Figure 1.

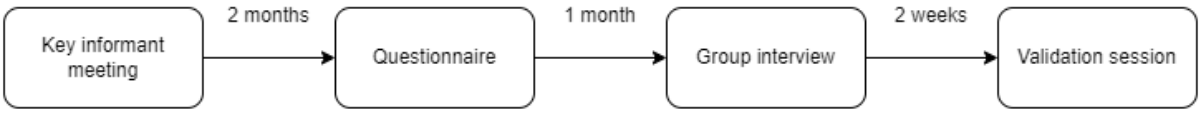

Figure 1: Visualization of research procedure for each factory, including an indication of allocated time in between each step.

3.2 Data sampling & sampling approach

Following from the case selection procedure, four factories have been selected from company X, who are producing fast-moving consumer goods, where they must meet the following criteria:

- Must be open to participation in this research and consent with the analysis of the provided data (e.g. audio recordings of the key informant meetings, group interviews and the corporate validation session + the handling of the team survey data)
- Have introduced the connected worker program into their factory at least a year ago, which means that the time between the introduction and now is long enough to get a representative reflection on the implementation process
- Must consist of at least 5 factory employees that are willing to participate, so that there are a satisfactory amount of participants during the group interviews and for the questionnaire, which creates a representative outcome for all the analyzed cases. These employees are part of level 7 of management for the group interviews, and level 6 for the validation sessions, which is clarified in Figure 2 and Appendix D.
- Must have a leader or manager that has worked at that specific factory at least a year before the connected worker program was implemented, so that they can reflect on the change and how it impacted the team
- The level of connected worker program adoption should vary amongst the factories, which adds a new dimension to the research, as factories could learn from one another on how to implement the program successfully.

Based on this procedure, four factories have been selected, which is shown in Table 1 below. The level of CWP adoption was established through examining usage reports of company X related to the CWP, discussions with senior management, as well as progress-monitoring documents related to the CWP.

Factory	Location	Level of CWP adoption	Number of employees	Number of employees in higher management positions (leaders)	Number of CWP apps implemented	Average age of employees	Start of implementation CWP (year)
A	Western-Europe	High	250-500	50-75	4	20-25	2019
B	North America	Medium	250-500	50-75	3	40-45	2020
C	North America	Medium	500-750	75-100	3	35-40	2020
D	Eastern-Europe	Low	750-1000	100-125	3	40-45	2021

Table 1: Factory selection, accompanied by demographic information.

Following this factory selection, this was discussed with company X during a kick-off call (with the director of the Industry 4.0 department and the head of digital transformation), in which they made clear to change the factory selection on one selection. The factory in the North America was changed by them to another one of their North American factories, as the initially selected factory was not able to participate in the research. The initial selected factory was running multiple projects at this moment in time and did not have enough people available to support the research. The other factory in North America did still fulfill the factory selection procedure, as the level of CWP adoption was the same, so it was fine to select that factory in this research.

For this research, there are four data collection methods that require a sample. Starting with the key informant meetings, it is important that all the team leaders of the respective factories that were analyzed, were available. That is in line with the R-TEAM method, as suggested by van Dun et al. (2022), where top/senior managers are defined as key informants. In this research, these are the plant managers of the four respective factories, which is the equivalent of management level 5 within company X, which is shown in Figure 1. This is an example of purposive sampling (Hermawan et al., 2021), since it is the most representative example in line with the construct of key informant, which links to the sampling approach of this research.

The questionnaires have been distributed along all management levels present in the selected factories, which means level 5, 6, 7 and 8 (which considers the front-line staff). As mentioned before, below level 6 the employees are not always fluent in English (unless it is their native language), so the questionnaire has been translated into the native language of the employees. This has been done by contacts of the researcher, who have fluent proficiency in the respective language. A high response rate has been ensured, as the plant managers have championed the questionnaire amongst all factory employees, so that as many responses as possible have been acquired. The plant managers received the questionnaire via email and have then distributed it amongst all of their subordinates.

Purposive sampling has been used in the formation of groups for the group interview sessions, so that the groups will be representative for their factory. This has been done in line with Appendix D, which describes the step of participant selection of the R-TEAM method (van Dun et al., 2022). Doing it in this way, this has increased the possibility of complete and coherent validation to include multi-layered levels of management in these sessions (van Dun et al., 2022). Additionally, the group interviews and validation session have been done with

respectively level 7 and level 6 of management. In that way, the initial presented findings in the group interview have been validated by higher management in the validation session, to avoid curbing bias. For more information, please see Appendix D, E and F for the participant selection, the group interview guide and the validation session guide. Moreover, a company policy clarified that these people in these management levels are fluent in English. Level 8 are only fluent in their own native language, which made it not convenient to include them in this section of the methodology. For extra clarification on the organizational structure of company X, the organizational chart is provided in Figure 2, which showcases what people are present in what management levels in company X.

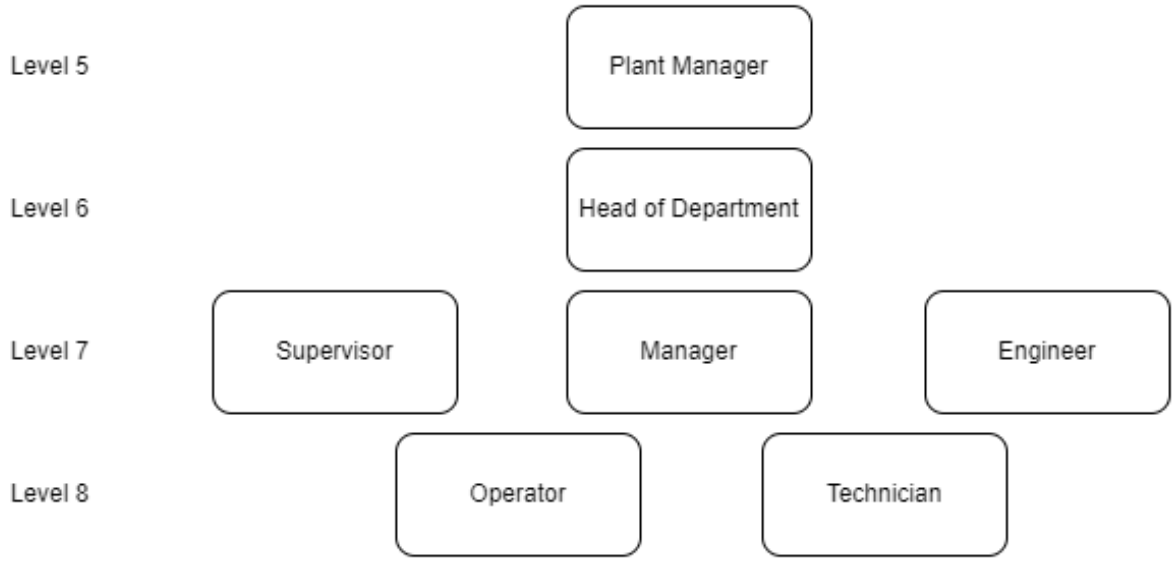

Figure 2: Organizational chart of company X including all the management levels present in a single factory.

In this research, the main focus was on the behavior of middle managers, linked to the concept of leadership. As level 6 and 7 of management are the linking pins between the plant managers and the operators/technicians, these levels were therefore key to include in the group interview and validation sessions. To gain a comprehensive understanding of the whole implementation process of the connected worker program, the questionnaire was filled out by all levels of management, so that every level was represented in this research.

As for the chosen company, a global, manufacturing company has been selected, as this research aims to contribute further to the research gap with regards to the employee's adoption of Industry 4.0 technologies. Since this is most often applied within a manufacturing company (Schneider & Sting, 2020), this validates the choice for a company within this industry.

3.3 Data collection

The data in this research has been collected through multiple different ways. Firstly, the key informant meetings were held via Microsoft Teams, recorded and transcribed afterwards. Secondly, the questionnaire was set up in Qualtrics and the data was then exported to Microsoft Excel, so that the researcher could analyze the responses and use them as input in the group interview and validation sessions. Thirdly, the group interviews and validation sessions were held via Microsoft Teams, recorded and transcribed afterwards. Besides that, the team maps were organized and color-coded and then exported as images to support the results section. All data was then gathered and used in the data analysis.

3.4 Data analysis

The analysis of this research is threefold:

1. A short description of every factory regarding the implementation process of the CWP (within-case approach), accompanied by a visual, digital map (poster) with the team-wide validated events, including a line that will visualize the adoption of the connected worker program apps over time;
2. A thematic analysis of all the findings regarding the outcomes of the key informant meetings, questionnaire, group interviews and validation sessions, where multiple Gioia tables, with key themes and quotes, will be designed for all the different, identified stages regarding the implementation process;
3. A cross-case comparison of all the four individual cases (cross-case approach), to see what were the main trends in the CWP implementation process, where also the evolution of the individual stages is being discussed, accompanied by the influence of one stage on the other.

Through this within-case and cross-case analysis approach, the answer to the research question will has increased in terms of validity, since key trends are observed that occur in multiple individual cases (Ridder, 2017). The within-case approach creates an in-depth case narrative for every single factory observed regarding their implementation of the connected worker program and how their employees have adopted it. Additionally, in the cross-case analysis the cases are compared to each other, to eventually create a constructive analysis on the identified stages and the key trends that were observed.

The data analysis has been done in an inductive way, since the available theory about the influence of emotional intelligence and leadership on Industry 4.0 technology adoption will be extended (Bamberger, 2018), by taking a fresh look on concepts that have been discussed in the four methods of data collection. So, new patterns have been identified, which could lead to interesting new insights. The events that are included that are key during the implementation process of the connected worker program are noted down on the posters. These will then be analyzed (van Dun et al., 2022), inspired on the subdimensions of the role of emotions and leadership, which are mentioned in section 2.3. The visual maps have multiple lines, which represents the team's adoption of the connected worker program apps, to see how this process has evolved over time. The events mentioned by the employees in the group interviews are linked to how they influenced the adoption of the connected worker program. This is a technique to verify and extend the already existing theory-based patterns in the literature about this subject (Barratt et al., 2011; Gehman et al., 2018). Next to during the group interviews, also quotes from those sessions are included in the visual maps, which is done by explaining them more in-depth in a case narrative. This depends on how popular a certain perspective/event was during the research and is subject to change.

During the group interviews, the researcher did occasionally bring up certain events (gathered this information through the questionnaire or the key informant meeting) and observed how the group responds to that information, whenever the discussion tones down. If there is consent on a certain insight (Yin, 2015), it was then noted down. The same goes for the validation sessions, where some events were subject to change or to be added/removed, which is in line with the R-TEAM method (van Dun et al., 2022). However, in practice, in the validation session the outcomes were mainly validated and only additional events were mentioned. No events were actually perceived completely different by the participants in the validation session than the participants of the group interview did.

4. Results

Various similarities and differences were found between the factories regarding the implementation process of the connected worker program. First of all, individual case descriptions will be provided from each individual factory and the created team map. After that, there will be a cross-case comparison, where the key trends and identified stages will be observed, accompanied by data structures as a visualization.

4.1 Case descriptions

Below are the case descriptions from each of the four individual factories regarding their context and progress with regards to the implementation process of the CWP. They are accompanied by the team maps designed in the group interview and validation session. In the team maps, there are multiple lines to be observed regarding the employee's adoption of the CWP apps, which are categorized in multiple, anonymized categories, which are: safety, operations and data logging. The footnotes below the team maps state what lines resemble what apps. The sticky notes on the team maps will be either **blue** (when they are linked to *leadership* type factors that relate to the adoption of the CWP), **purple** (when they are linked to the *role of emotions* that relate to the adoption of the CWP), or **yellow** (whenever they are *other* factors that play a role in the adoption of the CWP).

4.1.1 Factory A (Western-Europe)

Factory A has a relatively high maturity regarding the implementation of the CWP in their operations, looking at Table 1. In the beginning, the CWP was perceived to be of high importance, due to key performance indicators being easier to monitor and that "*the CWP was advertised to enable fast data flow in comparison to the flow of data back in the day […]*", mentioned by empl_2. Moreover, the overall workload that was going to be reduced due to the smart innovation of the CWP was perceived as "*promoting the innovativeness of the company*", mentioned by empl_7. When going through the implementation process, there were several challenges that they faced, such as employee's resistance and employees on the shopfloor losing track of all the information that they got overloaded with. Empl_2 mentioned: "*In the beginning of the implementation process of the CWP, the staff got overloaded with information […] on how to use the apps […], which could be seen as a stimulator of employee's resistance towards the program*". In the current situation, the feedback loops for end-users to pass through to the developers that have not been established have created some struggles. Besides that, the age gap between employees on the shopfloor was hard to manage. Empl_4 mentioned: "*Amongst the older employees, it is quite a challenge to get them on board, […], since they are not that familiar with new digital technologies like the CWP".* Moreover, the patience that is necessary to have for middle managers to let such a new innovation pay off was a key factor in this stage, as said by empl_8: "*When dealing with a new innovation like the CWP, it is important that managers and employees have a certain amount of patience in order to achieve success […]*". However,

leader’s behavior did change positively through the implementation of the CWP, as middle managers now made sure that they were more in touch with their subordinates. Empl_10 mentioned: “*Managers showed operators what is in it for them and stayed in close contact with them to make sure they were convinced of how the CWP would help them in their day-to-day routines*”.

In Figure 3, the team map for Factory A can be observed. It can be observed that the adoption of the apps is limited, as the higher the 'score’ related to the y-axis, the more complete or comprehensive the adoption of that particular application was within Factory A. The flow of the adoption lines are different than those in factory B, C and D, even though the scores do not differ significantly. As the perceived maturity regarding the CWP was seen as high, the scores of the adoption are perceived to be lower in practice.

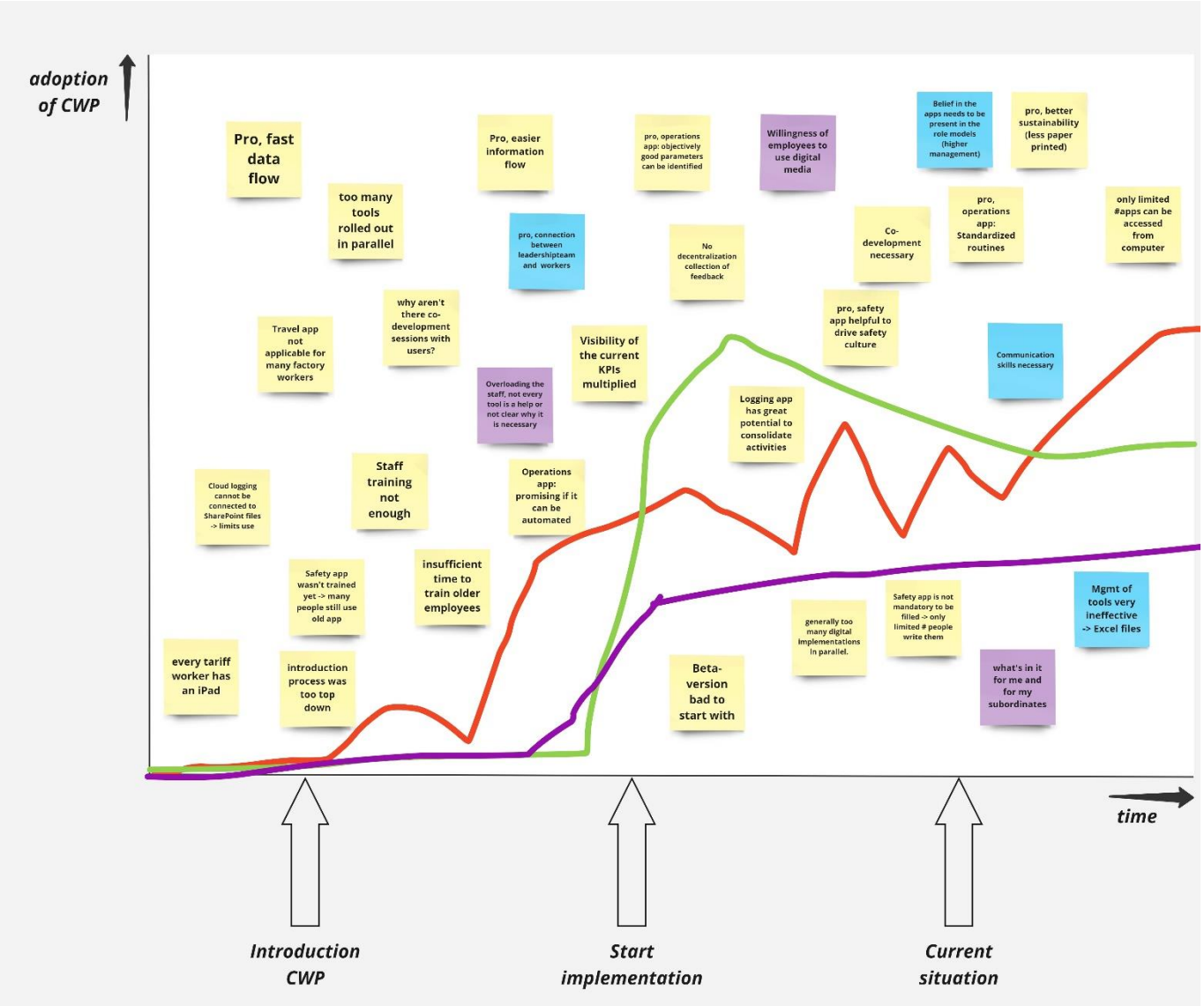

Figure 3: Team Map Factory A. The red line resembles the safety-type app, the green line resembles the operations-type app and the purple line resembles the data logging-type app.

4.1.2 Factory B (North-America)

Factory B has a moderate/medium maturity regarding the implementation of the CWP in their operations, looking at Table 1. In the beginning, the employees in factory B were really looking forward to the new technologies in their operations, as it would be making their work easier and reducing the workload. Empl_9 mentioned: "*The CWP had the initial focus on process improvement, […], which created positive thoughts amongst me and my colleagues to start with this new project*". When going through the implementation process, there were several challenges that they faced, such as it being hard to implement several apps due to the complexity of the plant and the irregularity of their shift patterns. Empl_3 mentioned: "*Because the pattern of shifts in our factory is really different every week, which is not the case in all other factories in other countries, we were initially a bit worried that it would not work out for us […]*". Empl_7 mentioned something similar: "*In the beginning, there were some questions being raised about the practicality of some apps for our factory, since our factory is not like the others, […], but we made sure to show our people how it would help them in their position*". In the current situation, it is going well with regards to the staff training, as they use a personal development type of training, but the onboarding program could still be improved with for example an app manual. Empl_2 mentioned: "*Right now, we have seen challenges regarding the CWP and the application of it, […], it differs from age to age how effectively people can use it, so therefore we need to get training sessions made specifically for every individual's needs*", which shows the personalized training scheme. Empl_1 mentioned that: "*Whenever we want to see how to use a certain app, we have some short Sharepoint files, but an app manual would be way better, […]*", which was also confirmed by the rest of the participants of the group interview and validation session. Leader's behavior did change positively regarding middle managers as empl_7 mentioned: "*Even though there is not a lot of on-site technical know-how and resources, we can reach out to the CWP team and then stay in close contact with the operators on the shopfloor, […], to eventually make sure that the employees are convinced of the potential and success of the program*".

In Figure 4, the team map for Factory B can be observed. It can be observed that the adoption of the apps is limited, as the higher the 'score' related to the y-axis, the more complete or comprehensive the adoption of that particular application was within Factory B. Also, relatively to Factory A, the lines are at similar adoption scores compared to Factory B. As the

perceived maturity regarding the CWP was seen as medium, the scores of the adoption are perceived to be lower in practice.

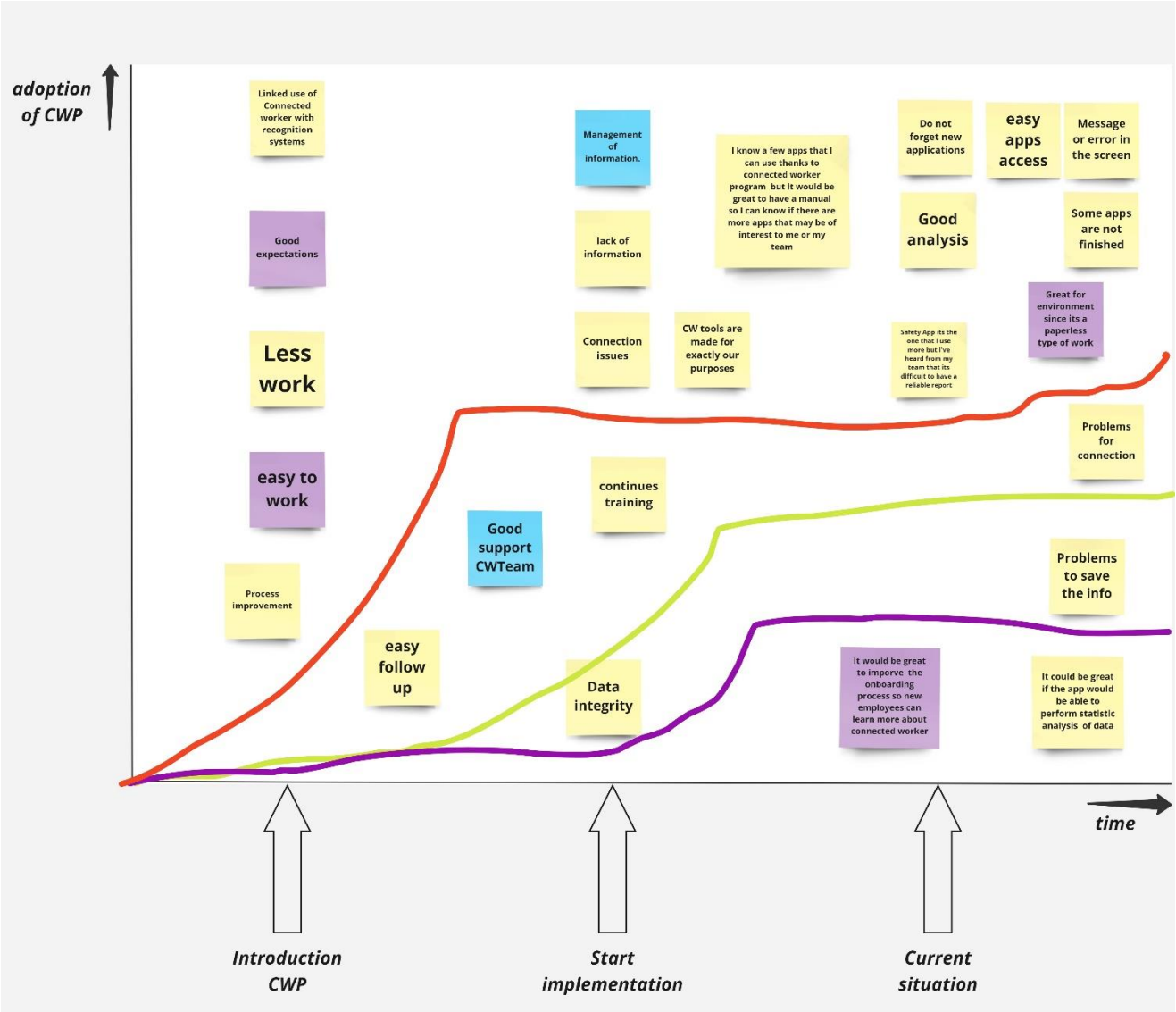

Figure 4: Team Map Factory B. The red line resembles the safety-type app, the green line resembles the operations-type app and the purple line resembles the data logging-type app.

4.1.3 Factory C (North-America)

Factory C has a moderate/medium maturity regarding the implementation of the CWP in their operations, looking at Table 1. In the beginning, the employees in factory C were optimistic about new digitization projects being launched for their operations, which would make it easy for them to convince their subordinates to start using it. Empl_1 mentioned: *"The CWP has the potential to decrease the workload of employees in the whole plant, when effectively used […]".* When going through the implementation process, there were several challenges that they faced, such as the little on-site knowledge about the CWP to tackle issues whenever they arose in the process. Empl_3 mentioned: *"We need a digital engineer, or digital team, that […] are fully focused on the CWP and have full responsibility for it […]. In this way, we make sure that it does not increase the workload of other employees […], to tackle issues regarding the CWP for example […], but will improve the effectiveness of the whole chain of activities that is related to the implementation of the CWP".* In the current situation, it is good that the data is easier accessible in the operational side of the factory, but the apps still experience bugs from time to time and that the internal alignment of the apps is sometimes lacking. Empl_2 and empl_7 said respectively: "*The procedure of how to report safety issues regarding production processes sometimes does not work due to spontaneous freezing of the program […]"* and *"Bugs occur in the form of apps freezing, […]".* Leader's behavior did change in a positive way, as the middle managers started to communicate more and more with their subordinates. Empl_3 mentioned: "*There is good communication necessary in this situation, because operators want to stay involved in the overall improvement of the program […]. Therefore, higher management gets in touch with the global team of the CWP and then makes sure employees on the shopfloor get an update as soon as possible on the matter".*

In Figure 5, the team map for Factory C can be observed. It can be observed that the adoption of the apps is limited, as the higher the 'score' related to the y-axis, the more complete or comprehensive the adoption of that particular application was within Factory C. Also, relatively to Factory A and B, the lines are at similar adoption scores compared to Factory C. As the perceived maturity regarding the CWP was seen as medium, the scores of the adoption are perceived to be lower in practice.

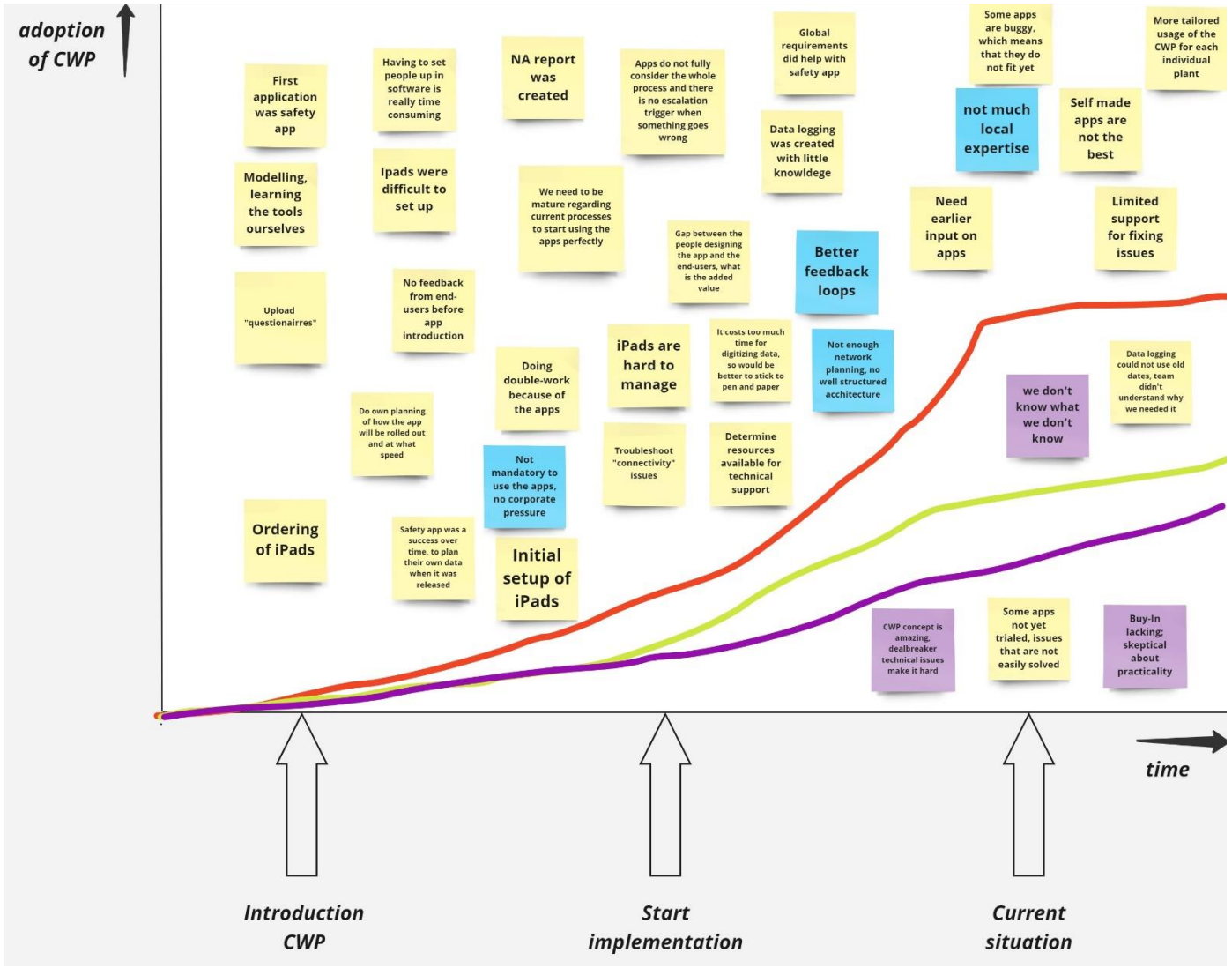

Figure 5: Team Map Factory C. The red line resembles the safety-type app, the green line resembles the operations-type app and the purple line resembles the data logging-type app.

4.1.4 Factory D (Eastern-Europe)

Factory D has a low maturity regarding the implementation of the CWP in their operations, looking at Table 1. In the beginning, the employees in factory D were positive about the newly launched project, but there was no well-structured transition period introduced to make sure the implementation was well planned. According to empl_3: "*The apps were introduced and then we should directly implement them, […], there was not really a well-structured transition period for us*". When going through the implementation process, there were several challenges that they faced, such as the possibility for a lot of apps to just collect data, but not to generate insightful reports on the basis of that data. Empl_6 mentioned that: "*I think that some apps are not really user-friendly, as they do not show the possibility to get the most out of our own data […]*". In addition to that, the parallel roll-out of the individual apps was perceived as not ideal. Empl_8 said: "*We need to make sure that in the future we roll out apps one after another, instead of multiple at the same time […], otherwise we will end up in trouble and then we have not learnt from our mistakes […]*". In the current situation, the interlinkage between the apps is not working as it should, which creates double administration from time to time. For example, as mentioned in the group interview by empl_3: "*The interlinkage between the apps is not optimal, which creates a double administration […], which is difficult for employees to keep believing in the overall CWP […]*". This was also mentioned in the validation session by empl_9: "*Some colleagues on the shopfloor feel that they are doing double work sometimes, which is not ideal […]*". Besides that, the complexity and size of this factory, makes it difficult to implement all the apps properly, since this is one of the largest and most complex plant of the case company. Lastly, the people in factory D feel that a network planning for future updates/upgrades is missing. "*We want to be involved in seeing what upgrades or updates will be on the horizon for the CWP, so that we can prepare for new innovations and know what will be there for us […]*", according to empl_3. Leader's behavior did change during the implementation process, as middle managers acted as linking pins to make sure employees on the shopfloor stayed well informed about for example problem-solving. "*We want to be the linking pin […], whenever problems happen we are there for our colleagues and make sure they get updated frequently on the issue […], in that way we stay in good contact and people don't lose their motivation […]*", according to empl_3.

In Figure 6, the team map for factory D can be observed. It can be observed that the adoption of the apps is limited, as the higher the 'score' related to the y-axis, the more complete or

comprehensive the adoption of that particular application was within factory B. Also, relatively to factory A, B and C, the lines are at similar adoption scores compared to factory D. The lines in the team map for factory D also follow a same flow as they do in factory B and C. As the perceived maturity regarding the CWP was seen as low, the scores of the adoption are perceived to corresponding rightfully in practice.

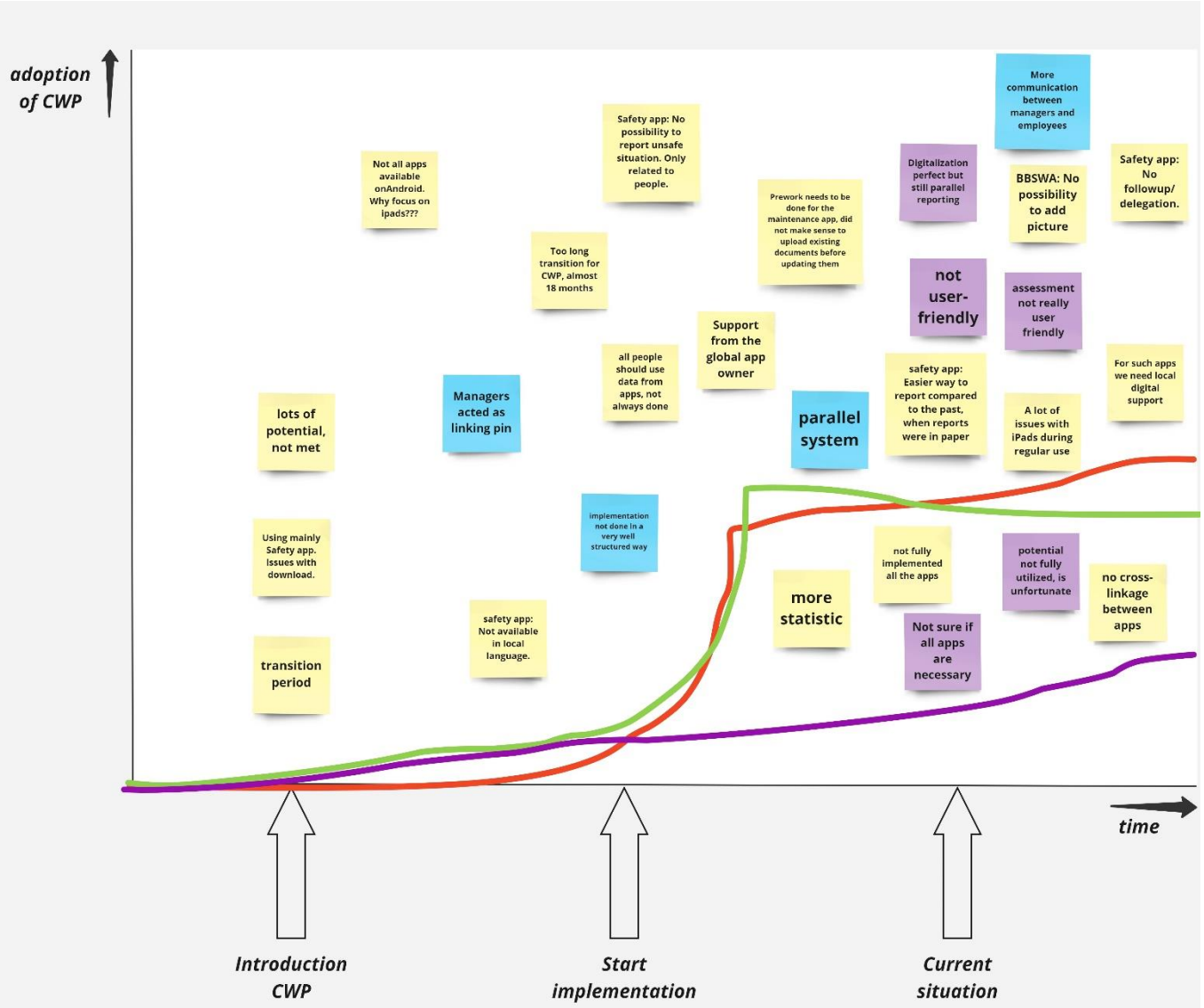

Figure 6: Team Map Factory D. The red line resembles the safety-type app, the green line resembles the operations-type app and the purple line resembles the data logging-type app.

4.2 Cross-case comparison

A cross-case comparison will be presented amongst the individual cases, where the key trends will be visualized in a team-map, from each individual stage. Besides that, the overall adoption of the connected worker program will be analyzed.

Below is Table 2, where all the main trends amongst the individual cases are listed in the left column. In the columns on the right, all the individual factories are listed. The cells reflect to what extent a certain trend was present in the individual case regarding the implementation process of the CWP. A cell is either marked with "++", "+", or left blank. In case of a cell being marked as "++", means that there was a lot of emphasis being put on this subject in the group interview and validation session. In case of a cell being marked "+", means that there was some emphasis being put on this subject, but not as much as in other cases. In case of a cell marked "white" (left blank), then the subject got no emphasis in the group interview or validation session. In this way, it is clear what themes were or were not frequently mentioned amongst the different factories, and therefore need to be considered in the further analysis of this research.

	Factory			
	A	B	C	D
Level of employee's adoption	Medium	Low	Low	Low
Pre-implementation stage				
High expectations	++	++	++	+
Excited for new digital innovations	++	++	++	+
Better monitoring of key performance indicators	++	++	++	++
Information overload	++	++		
No tailored usage for 'special' factory		++		++
During implementation stage				
Good communication by managers	+	+	++	
Employees are shown what's in it for them	++	++	++	+
Useful data collected	++	+	++	+
Managers act as role models	++	++		

Parallel roll-out of individual apps	++	++	++	++
No in-depth reports available	++	++	++	++
Lots of alternatives to CWP being used	++	++	++	++
Connection issues	++	++	++	++
Lack of staff training		++		+
No decentralized collection of feedback	++	++	++	++
Difficult to get older employees convinced	++	++		++
Current situation				
Management shows enthusiasm	++	+	++	
Managers have a positive mindset	+	++	+	+
Management show empathy, put themselves in the shoes of their subordinates	++	++	++	++
Personalized CWP training schemes realized tailored to personal needs	+	++		
Factory-specific issues, due to complexity or size		++		++
No timeline provided for future updates regarding CWP	+	++	+	++
Lacking technical know-how on site	++	++	++	
Missing of app manual	+	++	+	+
Double administration for CWP	++	++	++	++
Lacking co-development between developers and end-users CWP	++	++	++	++
No extensive pilot testing	++	++	++	++
No inter-linkage between CWP apps	+	++	+	++

Table 2: Comparison within-case narratives regarding individual factories.

Now, a cross-case comparison can be constructed from this, where the three different stages and the inductive coding of the qualitative data will be leading, supported with quotes from the key informant meetings, questionnaire, group interviews, and validation sessions.

4.2.1 Pre-implementation stage

In Figure 7, the Gioia table can be observed for the first stage of the implementation process of the CWP. As this stage is mainly focused on two aspects: initial challenges that were faced in the implementation process and the openness to innovation of the employees across the multiple factories. These two themes were dominant in this stage. The high potential of the CWP created the openness to innovation, whereas the insufficient communication, organizational issues and factory-dependent issues caused the initial challenges.

Combining Figure 7 and Table 2, the first dominant trend was that there were positive thoughts about the CWP, with **high expectations** and **employees being excited for new, digital innovations**. In factory A, B and C, these positive thoughts were really dominant in the pre-implementation stage, whereas in factory D it was not pointed out as much as in the other factories. As in factory D, there were some **doubts as to how the CWP would be implemented into their complex, unique factory**, as well as the feeling that there was **no clear, transition period** for them. This was also mentioned by empl_7: "*The transition period that we felt was necessary was kind of neglected by right away starting with implementing individual apps after a while […]*". This was also the case for factory B, as their unique factory structure made it difficult to believe in the universal application of a program like the CWP. "*Because the pattern of shifts in our factory is really different every week, which is not the case in all other factories in other countries, we were initially a bit worried that it would not work out for us […]*", was said by empl_3 in factory B. This links to the factory-dependent issues concept in Figure 7.

Another dominant trend was the happiness amongst employees that the **key performance indicators would be easier to manage** when the CWP would be implemented. This was present in all individual implementation processes, since this was one of the key values of the promised CWP.

However, there were also multiple challenges that became clear in this stage. Looking at Figure 7, the **technical issues** to get the iPads working was a struggle in multiple factories, in combination with the **information overload**. In the group interview, empl_2 in factory C stated: *"The CWP was introduced and right away there occurred some struggles […], especially regarding installing the iPads and getting everyone on board".* Confirming that, in the validation session, empl_6 said: *"There was massive struggles to get the iPads working properly […]"*. The information overload was mainly dominant in factory A and B, since

empl_2 from factory A mentioned: "*In the beginning of the implementation process of the CWP, the staff got overloaded with information […] on how to use the apps […], which could be seen as a stimulator of employee's resistance towards the program*". In factory B, this relates back to the pessimism amongst employees if the program would suit their factory, as mentioned before.

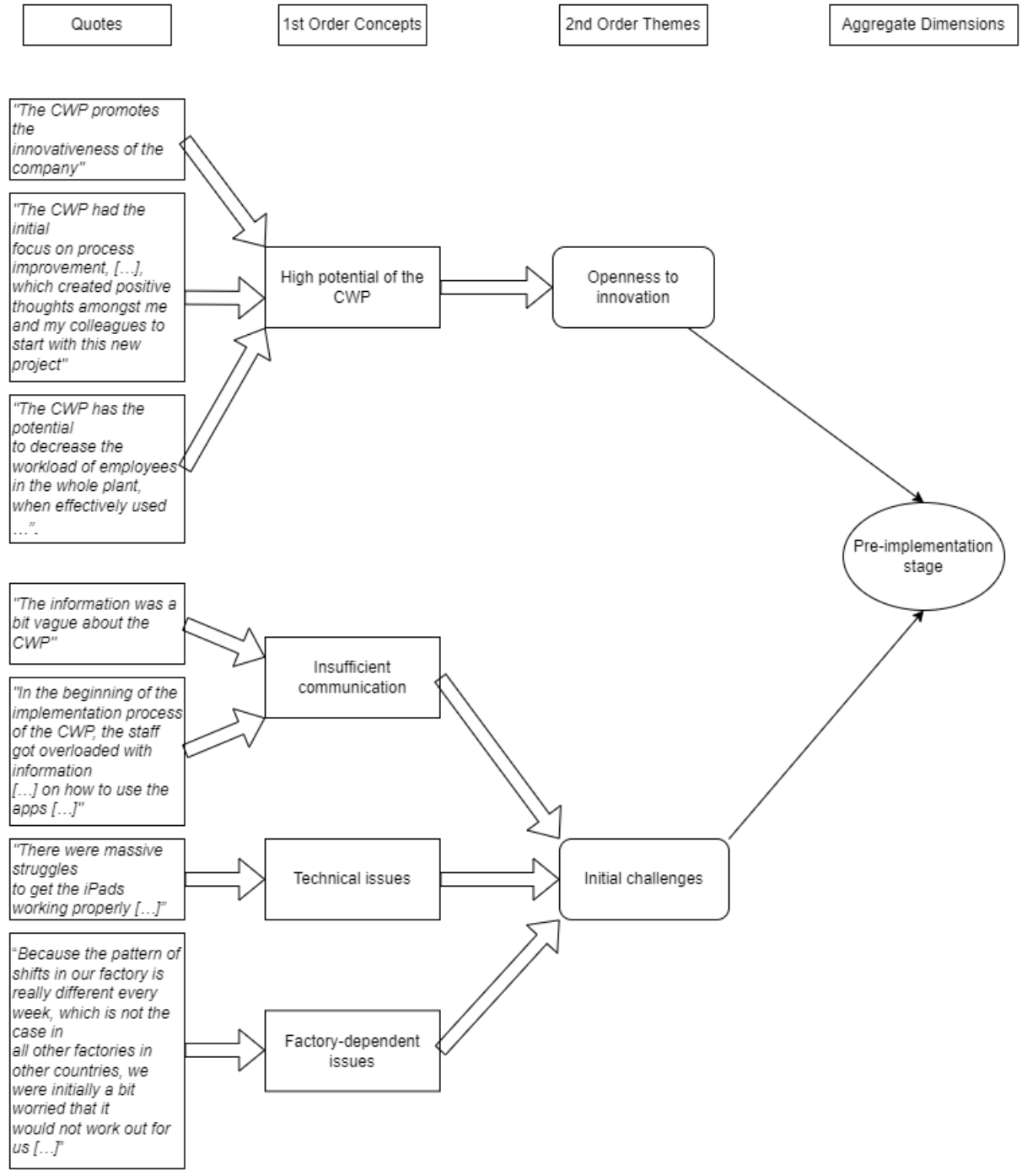

Figure 7: Pre-implementation stage data structure.

4.2.2 During implementation stage

In Figure 8, the Gioia table can be observed for the second stage of the implementation process of the CWP. As this stage is mainly focused on two aspects: employee's resistance against the CWP and technological prosperity that helped the implementation of the CWP. These were the dominant themes in this stage. The root causes for the employee's resistance against the CWP were mainly the non-existent feedback loops, an user-unfriendly app interface, the parallel app roll-out system, the non-existent co-development between individual factories, the frequently occurring technical connection issues and the technological unfamiliarity amongst older employees. The technological prosperity that helped implementing the program was caused by well-communicating middle managers, who show empathy and interest in their subordinates and the peer-to-peer learning structure regarding how to work with the CWP.

Combining Figure 8 and Table 2, the first dominant key trend was that there was **good communication from middle managers (role models)** observed in factory C frequently, as well as somewhat in factory A and B. Empl_7 from factory C said: "*Even though there is not a lot of on-site technical know-how and resources, we can reach out to the CWP team and then stay in close contact with the operators on the shopfloor, […], to eventually make sure that the employees are convinced of the potential and success of the program*". In factory A and B this was also addressed, but more implicitly, when talking about how issues got taken care of related to the CWP. In the group interview, empl_1 of factory A mentioned: "*Managers need communication skills when dealing with new, digital innovations such as the CWP, […], so you could say that the managers were more open in terms of their communication when the CWP was being implemented*". This was confirmed in the validation session by empl_10: "*Managers showed operators **what is in it for them** and stayed in close contact with them to make sure they were convinced of how the CWP would help them in their day-to-day routines*". This relates back to the concept of well-communicating leaders concept in Figure 8, which boosted the technological prosperity, as it has stimulated the usage of the CWP in those factories.

Three more interesting key trends that relate to each other were **the non-existent feedback loops between developers and end-users** of the CWP, the **user-unfriendly interface of apps** (**no clear, in-depth reports were available**) and the **parallel roll-out of individual apps**. These issues were mentioned in all factories and heavily addressed. For example, empl_5 from factory B mentioned that: "*We would have liked to provide more suggestions*

towards the development team […], the operators on site would have a better understanding of what is necessary in our day-to-day routine than outsiders". Besides that, the system of rolling out the apps was very "*parallel-oriented*", according to all participants in the group interview in factory D. This was validated in the validation session, by empl_8: "*We need to make sure that in the future we roll out apps one after another, instead of multiple at the same time […], otherwise we will end up in trouble and then we have not learnt from our mistakes […]*". Moreover, the **connection issues related to the CWP** were frequently mentioned across multiple factories as well. For example, in factory C, empl_2 and empl_7 said respectively: "*The procedure of how to report safety issues regarding production processes sometimes does not work due to spontaneous freezing of the program […]"* and *"Bugs occur in the form of apps freezing, […]".*

In factory A, B and D, it was also observed that employees with **no technological familiarity** had issues with adopting the program. This was mainly caused due to the **age gap** between the younger and older employees. For example, in factory A, in the group interview, empl_4 mentioned that: "*Amongst the older employees, it is quite a challenge to get them on board, […], since they are not that familiar with new digital technologies like the CWP*". This was then further questioned by the researcher as to how this problem could be eased out. "*Since it was quite a challenge in the beginning, we tried to improve the situation, […], by for example letting the younger people help the older people to get familiar with the technology and by providing more staff training for them whenever necessary. […]. This was always done in close contact with higher management*". So, it was clear that managers needed to monitor this situation regarding the age split in these factories, using for example the concept of **peer-to-peer learning**, which is also shown in Figure 8. All these occuring issues relate to the creation of **employee's resistance**, which is shown in Figure 8 as a 2nd Order Theme.

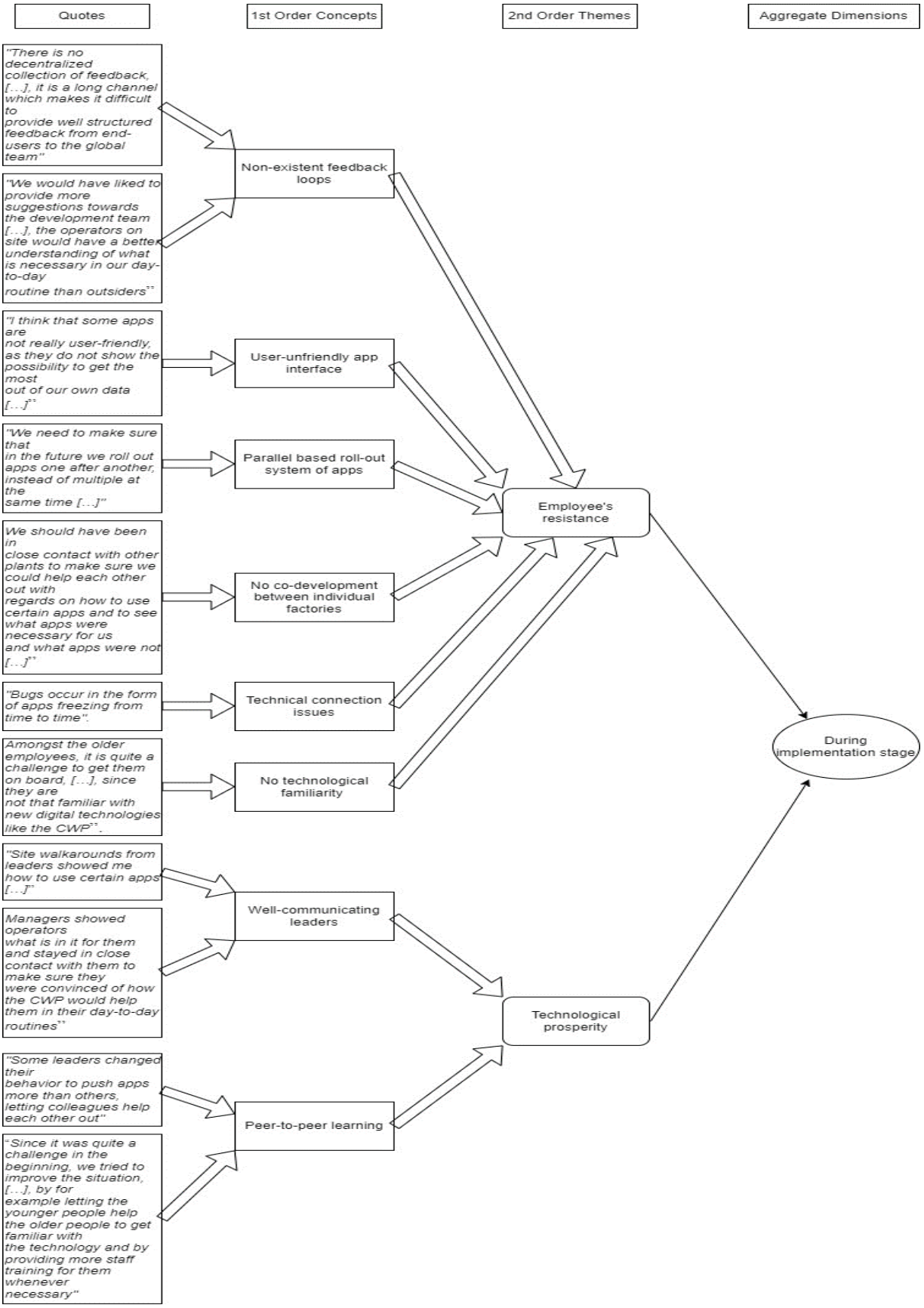

Figure 8: During implementation stage data structure.

4.2.3 Current situation

In Figure 9, the Gioia table can be observed for the third stage of the implementation process of the CWP. As this stage is mainly focused on three aspects: the current flaws of the CWP, the essential managerial skills necessary to achieve success with the CWP and the future improvements for the CWP. The current flaws of the CWP mainly consist of technological immaturity regarding individual apps of the CWP, the insufficient amount of pilot testing of the apps and the lacking inter-linkage between the apps regarding the program as a unity. The essential managerial skills to implement the CWP successfully have been showing in practice. They consist of managerial empathy, managerial patience and the role of middle management to act as role models towards their subordinates. Lastly, the future improvements of the CWP was a dominant theme in this stage of the implementation process. It consisted of establishing tailored, personal-development-oriented staff training, the establishment of an app manual, the improvement of the quality of the statistical reports that can be generated and the establishment of corporate network planning regarding updates of the CWP.

Combining Figure 9 and Table 2, the first dominant trend amongst all factories was that there has been **no extensive pilot testing**, the **non-existent inter-linkage between individual apps of the CWP**, **the non-existent app manual**, **the double administration**, and the fact that there is **no network planning (when are updates being released for the CWP)**. For example, in factory D it got mentioned in the group interview by empl_3: "*The interlinkage between the apps is not optimal, which creates a double administration […], which is difficult for employees to keep believing in the overall CWP […]*". This was also mentioned in the validation session by empl_9: "*Some colleagues on the shopfloor feel that they are doing double work sometimes, which is not ideal […]*". Empl_7 also mentioned the following in the validation session of factory D: *"[…], how great would it be if we could see what would be updated to the CWP more regularly and what new apps will be released, […], in combination with us being involved in providing more in-depth feedback, together with the end-users […]*". This was also mentioned by empl_9 from factory C: *"A negative point that needs to be addressed is obviously the internal alignment between individual applications in our CWP. […]. Now, a lot of double administration is being done, which is not really effective"*. Moreover, in factory B the following was mentioned by empl_1: "*Whenever we want to see how to use a certain app, we have some short Sharepoint files, but an app manual would be way better, […]*". This was also mentioned by empl_2: "*For me, the onboarding process was a bit different, as I am working here shorter than the others in this session, so I would agree*

with that". These all relate to the **current flaws of the CWP**, which is a 2nd Order Theme in Figure 9. In line with that, aspects of the current flaws theme in Figure 9, could be translated into possible **future improvements for the CWP**, which is also mentioned as a 2nd Order Theme in Figure 9 with supportive quotes in the left column.

An interesting key trend that was observed was the **personalized CWP training schemes, tailored to personal needs**, which were dominant in factory B and somewhat addressed in factory A. In the current situation in factory B, management is now focusing on providing staff training, but with a touch that is focused on "*personal development*". Empl_2 mentioned the following: "*Right now, we have seen challenges regarding the CWP and the application of it, […], it differs from age to age how effectively people can use it, so therefore we need to get training sessions made specifically for every individual's needs*". This was confirmed in the validation session by empl_8: "*We try to see what every employee needs in terms of training, […], and we also focus on their strengths and weaknesses to see how we can improve everyone day-by-day, without losing track of a human touch*". Also, in the questionnaire, this was mentioned as "*personalized trainings are provided*" and "*everyone gets specific training*". In the group interview of factory A, empl_4 mentioned that: "*Sometimes it is key to put yourself into the shoes of the employees on the shopfloor to make sure you have enough feeling for how they are perceiving the situation […]*", which is a sign of taking personal needs into account with regards to the CWP training, as well as **managerial empathy and patience**. This relates back to Figure 9, as well as to the role models concept, which all contributes to **essential managerial skills** for middle management when implementing an innovation like the CWP.

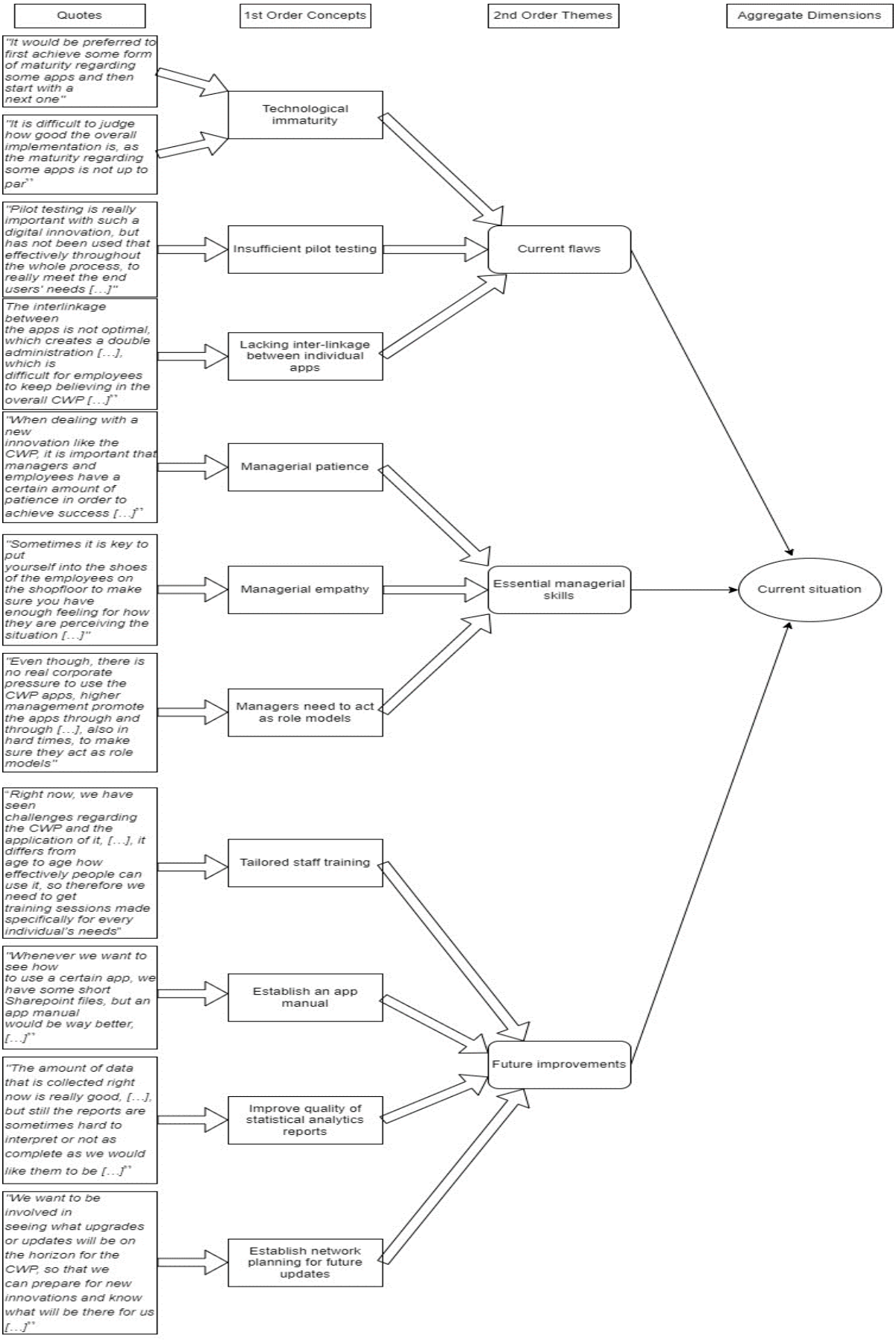

Figure 9: Current situation 'stage' data structure.

4.3 Analysis of the cross-case Gioia tables

The three Gioia tables showed the key trends and themes from all factories combined in the established, respective stages of the implementation process of the CWP. Linking this to the research question: "How do leadership and the role of emotions impact the employee's adoption over time of a connected worker program in the workplace?", the answer to this can be derived from the previous sections.

The employee's adoption of the CWP across the four different factories can be classified as moderate to low. Even though the organizational maturity prior to this research did vary, the perception of management is that the employee's adoption is relatively the same for all factories. However, as can be seen in the respective team maps, the evolvement of the lines did vary, through various reasons listed in the cross-case comparison. Not all themes were as frequently mentioned in all group interviews and validation sessions, which explains the difference in the direction of the lines throughout the implementation process. An example of this can be seen in the team map of Factory B and D, as their adoption lines stagnated around the current situation, as they are both considered a very complex factory in terms of structure. This can then be observed in Table 2 were they both have "++" on "factory specific issues".

Starting off with the first stage of the implementation process, the openness to innovation has been a key factor in a well executed pre-implementation stage. This can be linked to management, since they need to act open towards new, digital innovations, in order for their subordinates to follow along. This also links to the comments made in the current situation stage, where managers acted like role models to increase the employee's adoption of the CWP in the respective factories. This shows the importance of leadership, to not overload the staff with information about the new innovation and making sure that a program can be tailored to the needs of a specific factory is important for leaders to take into account, as respectively factory A and B, and factory B and D have shown.

Besides that, the initial challenges (e.g. insufficient management communication) faced in the pre-implementation stage required certain key managerial qualities for middle managers that were discussed in the current situation stage. As in the pre-implementation stage, the managerial communication was insufficient, which was then counteracted in the current situation, as managers started to show empathy and patience towards their subordinates in order to create technological prosperity in their factories. Technological prosperity started to thrive as the implementation process of the CWP was stimulated by the managerial empathy,

patience and role models that arose. Since the people in level 6 and 7 of management should lead by example (middle managers), this was then observed by the employees in level 8, which boosted the adoption. This was observed amongst all factories. Therefore, it can be said that there is strong connection between the individual observed stages of such an implementation process, since they are interlinked through concepts that evolve over time.

Moreover, it is not only about the connection between individual stages, also the concepts (leadership qualities from middle managers, the role of emotions and the employee's adoption of the connected worker program) from the research question evolve over time. Leadership qualities were included in the pre-implementation stage discussion part, but later on, during the current situation stage, they were mentioned more frequently. The same goes for the role of emotions, as in the later stages of the discussions, the role of the emotions of the employees on the shopfloor were considered to be of great importance in order for the CWP to be broadly adopted. Moreover, as can be seen on the individual team maps, there were multiple sticky notes categorized as purple or blue, which meant they were linked to either leadership factors or emotional factors. An example of this is factory C and D, where the most purple and blue sticky notes linked to those concepts, were present in the later stage of the implementation process. However, looking at the team maps for factory A and B, it also shows that during the earlier stages of the implementation process, these factors still play an important role.

Another interesting finding is that not only the importance of stimulators of adoption (such as: leadership and managing one's and other's emotions) is shown during the implementation of the CWP, but also the counteractors of the potential success of implementing the CWP. Looking at the during implementation stage, there were many concepts addressed that linked to a second order theme called employee's resistance. As this has proven to be of great impact on the employee's adoption in a negative way in this research, it can be said that this is essential for managers to take into account. Moreover, the role of emotions does also evolve over time. The further employees go within the cycle of such an implementation process, the more challenging it can get for managers to mitigate that resistance, which also has to do with all the technical issues that occurred with the CWP. As in the pre-implementation stage many question marks that were raised about the CWP were already addressed and taken care of, it proved to be a real challenge to tackle this resistance or disbelief in the CWP later on in the process. Therefore, it can be said that managing soft and hard aspects of a socio-technical

innovation is equally important, to make sure an innovation can be implemented successfully, since the CWP has proven that it can be a real challenge.

5. Discussion

This study showed that there are multiple factors that show how leaders can boost the adoption of employees of the connected worker program in the workplace across the different stages of the implementation process. During the pre-implementation stage, the high potential of the connected worker program led to openness to the innovation from the employees, where also some initial challenges occurred. These were considering insufficient communication, technical issues and factory-dependent issues. In the during-implementation stage, employee's resistance occurred, due to more technical issues and missing network planning. However, the perception of technological prosperity was realized due to well-communicating leaders and peer-to-peer learning. In the current situation stage, current flaws of the connected worker program were mentioned, accompanied by essential managerial skills that were necessary in this stage. Additionally, some future improvements were mentioned that also linked to the technical flaws of the program and how they could be solved.

The findings were discussed while comparing the findings with employee's adoption of other Industry 4.0 innovations than the CWP. This leads to a conceptual framework (see Figure 10) that was developed to present the propositions of this study, which will be elaborated below.

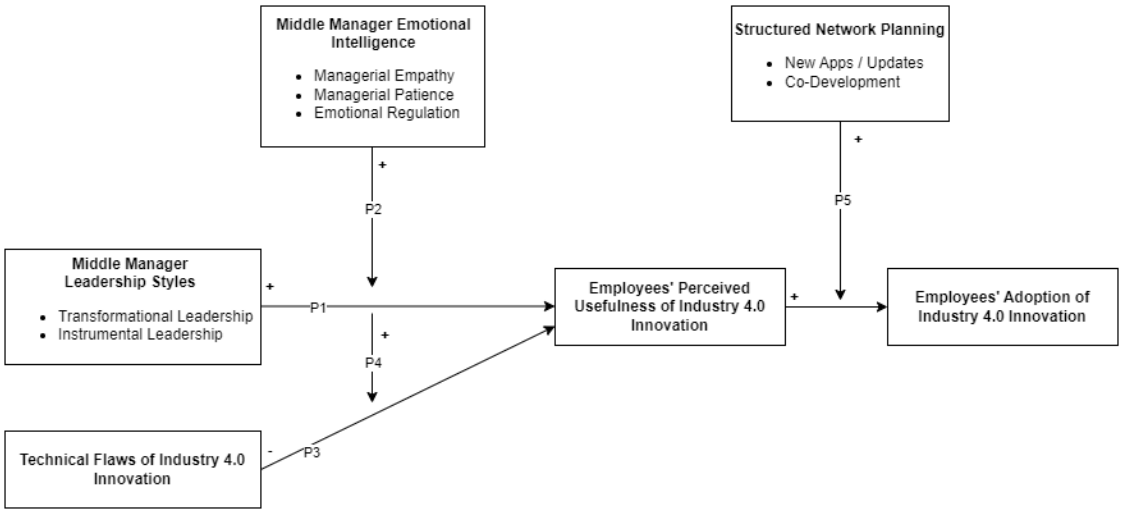

Figure 10: Conceptual framework of the propositions.

First of all, it can be observed that middle managers leadership styles have a positive influence on the employees' perceived usefulness of the Industry 4.0 innovation. Middle management are in between senior managers and the employees on the shopfloor (Huy, 2001). In this research, the outcomes have shown that managers were acting as 'linking pins' between the employees on the shopfloor and senior management. This shows that middle management has an essential role in promoting the connected worker program and increase the perceived usefulness amongst employees through stressing the high potential of the program, as well as show a problem-solving mindset where they are always there to help the employees on the shopfloor. "Middle managers allot considerable energy to finding the right balance between keeping the company working and promoting radical change" (Huy, 2001, p. 78). This also showed in practice, since the middle managers were responsible to keep the program working and fully operational, as well as promote this radical change, which were new apps linked to the connected worker program.

Transformational leadership and instrumental leadership are, according to the literature, most likely to have a positive influence on the employee's adoption of Industry 4.0 technologies (Siangchokyoo et al., 2020; Chen & Cuervo, 2022; van Dun & Kumar, 2023). Transformational leadership consists of four subdimensions, namely: idealized influence, inspirational motivation, intellectual stimulation and individualized consideration (Bass, 1990). Since this research has proven that managerial role models are key to stimulate the employee's adoption of Industry 4.0 innovations, this can be linked to these subdimensions of transformational leadership, for example to idealized influence, where middle managers (level 6 and 7) need to act as role models towards subordinates (level 8). Moreover, since the tailored staff training is mentioned as a future improvement for the connected worker program (see Figure 8), but already present in factory B, this can be linked to the subdimension of individualized consideration of leaders towards their subordinates. Therefore, the importance of transformational leadership traits is to be considered when dealing with an Industry 4.0 innovation implementation process, as it positively influences the employees' perceived usefulness of the Industry 4.0 innovation, which eventually leads to comprehensive employees' adoption of the Industry 4.0 innovation.

Besides the transformational leadership traits, there are also instrumental leadership traits that are stimulators of the employee's adoption over time of an Industry 4.0 innovation. Instrumental leadership consists of four subdimensions, namely: environmental monitoring, strategy formulation and implementation, path-goal facilitation and outcome monitoring

(Antonakis & House, 2004; Rowold, 2014). This research shows that mainly environmental monitoring and path-goal facilitation are essential for comprehensive adoption of employees of the connected worker program, instrumental leadership is key in this situation. Since environmental monitoring is about scanning the environment for opportunities for growth and development (Antonakis & House, 2004), this shows to be very important in practice too, looking at the results of this study. The connected worker program had high potential according to the employees in the pre-implementation stage (see Figure 7), which boosted the adoption initially. Besides that, the path-goal facilitation proved to be key as well, since this considers the ability of leaders to remove obstacles along the way for subordinates and providing them with sufficient resources (Rowold, 2014). In this research, the connected worker program showed several technical flaws, as well as factory-dependent issues, which had to be dealt with by leaders. For example, in the current situation stage (see Figure 9), the technical flaws of the program were considered to also classify as future improvements, which will positively influence the employee's adoption in case these challenges are being tackled. Besides that, providing staff with enough training and manuals to make sure they properly know how to work with the connected worker program also contributes to this. This links to the path-goal facilitation from the theory as it positively influences the employees' perceived usefulness of the Industry 4.0 innovation, which eventually leads to comprehensive employees' adoption of the Industry 4.0 innovation.

It is also important to consider the constantly changing perspective of the employees. Employees should be convinced of the added value of the new innovation and about what is in it for them (related to the CWP implementation process). This relates to the theoretical concept of perceived usefulness from employees towards a new technology related to Industry 4.0. This should always 'be there', at a satisfactory level for the employees to be convinced that it well create an overall better working experience (Nguyen & Luu, 2020; Khin & Kee, 2022). This relates back to the high expectations that were present in the pre-implementation stage of the CWP implementation process. Otherwise, this could result in employee's resistance (Weinmann, 2017; van Dun & Kumar, 2023), which would cause complications for the organization when trying to implement the new technology. This did happen however, in the later stages of the implementation process, which shows that even though the perceived usefulness should be satisfactory from the beginning, the perceived expectations regarding the innovation, should be met or exceeded to ease out that resistance. Therefore the first proposition is:

1. *Middle managers leadership styles, such as transformational and instrumental leadership, positively influence the employees' perceived usefulness of the Industry 4.0 innovation, which, in turn, positively influences the employees' adoption of the Industry 4.0 innovation*

Next to that, middle managers emotional intelligence proves to be present in the relationship between the leadership styles and the perceived usefulness of the employees of the Industry 4.0 innovation, which positively influences the employee's adoption over time of an Industry 4.0 innovation over time. Emotional intelligence, as can be read in chapter 2, consist of four interrelated abilities, which are perceiving emotions, using emotions, understanding emotions and managing emotions (Salovey & Mayer, 1990; Kerr et al., 2006). This was then further developed, where a model was created around emotional intelligence regarding five subdimensions: self-awareness, self-regulation, motivation, empathy and social skills (Goleman, 1996). This means that an emotional intelligent leader has to show these abilities in practice to be classified as 'emotional intelligent'. Emotional intelligent middle managers play a crucial role when managing an Industry 4.0 innovation implementation process (Gottge et al., 2020; Peña & Caruajulca, 2022; Torres et al., 2023). Especially during the early implementation stages, it is key for middle managers to act supportive and make sure that all employees feel comfortable with the innovation that lies ahead (Torres et al., 2023). Looking at the results of this research, middle managers with abilities related to emotional intelligence play a crucial role as well, when dealing with an implementation process of an Industry 4.0 innovation, and to be able to achieve comprehensive adoption of employees in the workplace, as it increases the perceived usefulness of the Industry 4.0 innovation. Looking at Figure 8 and 9, key managerial skills that relate to emotional intelligence have been mentioned in the during implementation and current situation stage, which means that employees have noted these skills to help the implementation process, or felt that an ability was missing in that stage. This then shows the importance of emotional intelligence. For example, in Figure 8, well-communicating leaders (middle managers) are listed as stimulators of technological prosperity, which indicates the importance of the ability to regulate emotions of subordinates when dealing with Industry 4.0 innovation implementation processes. This can also be perceived from Figure 8, where managerial empathy is closely linked to the concept of being able to regulate emotions of subordinates (Joseph & Newman, 2010). Besides that, middle managers that are behaving effectively, put a lot of consideration into values like: continuous improvement, honesty, participation, as written by Van Dun et al. (2017). This links to

emotional intelligence, since these values are linked to regulating emotions, as it is important to make your subordinates behave with honesty and focusing on continuous improvement. Moreover, in theory it is stated that especially the subdimension of self-regulation in combination with empathy increases the chances of employee's adoption of the Industry 4.0 innovation (Goleman, 1996; Duuren, 2019; Dhanpat et al., 2020; Stachowicz et al., 2021). In this research, the managerial empathy of middle managers has proved to be important, especially in the during implementation stage, as well as regulating their own emotions and those of others. Therefore, emotional intelligence of middle managers moderates the relationship between the leadership styles and the perceived usefulness of the Industry 4.0 innovation, which then positively influences the employees' adoption of the Industry 4.0 innovation. Hence, proposition 2 is:

2. *Middle managers emotional intelligence positively moderates the relationship between middle managers leadership styles and the employees' perceived usefulness of the Industry 4.0 innovation, through managerial empathy, managerial patience and emotional regulation, which positively influences the employees' adoption of the Industry 4.0 innovation*

Thirdly, an important perspective on the employee's adoption over time of an Industry 4.0 innovation is that both soft and hard aspects influence this to an equal extent. Within this research, it became clear essential managerial skills were crucial to establish a successful implementation process of the CWP. However, managers did show these essential managerial skills in their leadership behavior and still the implementation did not always result in comprehensive employee's adoption of all the CWP apps. Therefore, it is also really important to take hard aspects into account regarding the Industry 4.0 innovation, which were the technical issues, also shown in Figure 7. This is also in line with the socio-technical perspective (Cherns, 1976; Pasmore, 1995), that is shown in the Toyota Way as well (Vanichchinchai, 2023). The socio-technical perspective views an organization as a complex system in which social ('soft') and technical ('hard') elements are intertwined. Changes in one system can have ripple effects on the other (Pasmore, 1995; Vanichchinchai, 2023). For example, introducing new Industry 4.0 technologies can impact how people work and interact with each other, and changes in work processes can necessitate adjustments to technology (Cherns, 1976). Therefore, both the soft and hard aspects have an equal extent to which they influence the employee's adoption over time of an Industry 4.0 innovation. This can also be seen in Figure 9, where current flaws of the connected worker program impact the employee's

adoption, even though managerial essential skills have been used to stimulate the adoption. Taking it one step back, it can be said that the technical flaws of the Industry 4.0 innovation have a negative influence on the perceived usefulness of the employees of the Industry 4.0 innovation, as this then leads to a reduced level of employees' adoption of the Industry 4.0 innovation, which creates the third proposition of the model. In recent literature, there has been stated that that the technical flaws of an Industry 4.0 are negatively influencing the perceived usefulness of the Industry 4.0 innovation (Falkenthal et al., 2016; Nedelko, 2019; Bokrantz et al., 2020; Udochukwu & Agunwamba, 2021; Ali et al., 2022). This is in line with the results of this research, as the technical flaws have had a big influence on the perceived usefulness of the connected worker program. Therefore, proposition 3 is:

3. *Technical flaws of the Industry 4.0 innovation have a negative influence on the employees' perceived usefulness of the Industry 4.0 innovation*

Next up, emotional intelligence of middle managers also moderates the relationship between the technical flaws of the Industry 4.0 innovation and the perceived usefulness by employees of the Industry 4.0 innovation. Looking at the subdimensions listed in the model: managerial empathy, managerial patience and emotional regulation, it can be said that all three also show their presence in the outcomes of this research.

First of all, in the pre-implementation stage, there occurred some initial challenges, which all had different roots that caused them, as can be seen in Figure 7. During this stage, it was important for middle managers to show their empathy towards subordinates to make sure they stayed convinced of the potential of the program. This links to theoretical dimension of emotional perception and understanding (Joseph & Newman, 2010).

Secondly, in the during-implementation stage, employee's resistance towards the connected worker program occurred, which was counteracted by effectively communicating leaders. Middle managers had to act as a linking pin, as well as being able to regulate the emotions of their subordinates to make sure everyone was on the same page regarding the perception of the connected worker program. This links to the theoretical dimension of emotional regulation (Joseph & Newman, 2010). Even though there were many technical flaws, the middle managers had to stay in close contact with their subordinates to make sure the perceived usefulness of the connected worker program stayed at a satisfactory level. This is also written in the literature, as the 'hard aspects' of an Industry 4.0 innovation are to be managed by

middle management (Hanafi et al., 2018; Lindley, 2022), so that the technical flaws are eased out.

Lastly, in the current situation, multiple future improvements were mentioned, as can be seen in Figure 8. These all arose through the perception of employees that certain aspects were missing, such as the low quality of statistical reports, or a missing app manual. To counteract these feelings of subordinates in the later stages, middle managers had to show, again, managerial empathy and patience, to make sure they comforted their subordinates by understanding their emotions. This also links to the dimensions discussed in the theory (Salovey & Mayer, 1997; Joseph & Newman, 2010), which are self-regulation, empathy and social skills (Goleman, 1996; Sadri, 2012; Kim & Kim, 2017). Therefore the fourth proposition is:

4. *Middle managers emotional intelligence positively moderates the relationship between the technical flaws of the Industry 4.0 innovation and the employees' perceived usefulness of the Industry 4.0 innovation, which positively influences the employees' adoption of the Industry 4.0 innovation*

Moreover, it is important to establish a structured network planning regarding the Industry 4.0 innovation to stimulate the perceived usefulness of employees, which then positively influences the employee's adoption of the Industry 4.0 innovation. As can be seen in Figure 8, the connected worker program had several current flaws that related to the network planning of the implementation process. In the literature, there can also be read that network planning is essential when dealing with advanced Industry 4.0 innovation implementation processes (Jakob & Nilsson, 2018; Kumar et al., 2021). Network planning creates clarity for employees about the future, which is important when dealing with uncertainty in times of change (Sony & Naik, 2020a; De Beelde et al., 2021). This then boosts the perceived usefulness by employees of the Industry 4.0 innovation. As Industry 4.0 innovations can be perceived by employees as uncertain (Kumar et al., 2021), the network planning is key to ease out these thoughts by creating well structured network planning in the organization. This also links to the results of this study, as transparency towards future updates has been perceived to be 'very important', which can be read in the cross-case comparison across the different factories included in this research. Additionally, structured network planning in this research consists of transparency on bug fixes, new apps or updates and co-development between end-users and developers regarding the connected worker program. Especially during the during implementation and current situation stage, these aspects became clear in this study, looking

at Figure 8 and 9, regarding the factors that did create employee's resistance and the future improvements of the program. All these three subdimensions of structured network planning were felt missing, both by middle managers, as well as employees on the shopfloor.

According to the literature, the implementation process of an Industry 4.0 consists of various stages. In theory, an Industry 4.0 innovation should arise from a revolutionary stage, flow into the actual implementation stage and then move into the current situation (Davies et al., 2017; Cordeiro et al., 2019). A crucial factor is the transparency about future steps in the implementation process and how this is being communicated to employees on the shopfloor (Cordeiro et al., 2019; Neumann et al., 2021; Peña & Caruajulca, 2022). If employees are not informed about what lies ahead, it is likely that there perspective towards the new innovation will change, which could create employee's resistance (Harlan, 2020). This research proved this in practice, as the complete opposite to structured network planning was installed. There was no transparency about the future updates and bug fixes, as well as potential future co-development which could improve the overall effectiveness of the connected worker program.

Therefore, the fifth proposition is:

5. *Structured network planning, including transparency about new apps and updates and co-development, positively moderates the relationship between the employees' perceived usefulness of the Industry 4.0 innovation and the employees' adoption of the Industry 4.0 innovation*

6. Implications, limitations and suggestions for future research

In this section the theoretical and practical implications will be presented, as well as the limitations of this research, accompanied by some suggestions for future research opportunities.

6.1 Theoretical implications

This study has taken an inductive approach to see how leaders can boost the employee's adoption of an Industry 4.0 innovation over time. Therefore multiple propositions were presented to be effective in practice, but also in literature. The concept of Industry 4.0 innovations have been extensively researched over time, even though the concept is relatively

new (Lee et al., 2014; Hermann et al., 2015; Lu, 2017; Gadre & Deoskar, 2020; Sony & Naik, 2020b; van Dun & Kumar, 2023). However, in this research, a connected worker program was the considered Industry 4.0 innovation, which has not been the focus in many previous research attempts on Industry 4.0 innovations. Therefore, in the context of a connected worker program, there was little known about how leaders could boost the employee's adoption over time. This paper aimed to fill that gap up to show examples of how leaders could boost the employee's adoption of a connected worker program over time, while reflecting on the implementation process of the innovation.

This study showed that transformational leadership, instrumental leadership, the perceived usefulness of the innovation, the combination of hard and soft aspects, network planning, emotional intelligence and managerial role models all contribute to the employee's adoption of a connected worker program in the workplace. Firstly, this study proposed a positive effect between managerial role models and the relationship between leadership and the employee's adoption of Industry 4.0 innovations. Through showing managerial empathy and patience, accompanied with the ability to regulate emotions, the employee's adoption of the Industry 4.0 innovation gets boosted, since the perceived usefulness of the Industry 4.0 innovation by employees did increase.

Secondly, this study has showed that employees need to perceive a satisfactory level of usefulness regarding the Industry 4.0 innovations being implemented. When employees feel that the innovation could help them in their day-to-day routine and make their work easier, then it is more likely to be a success in practice. This then translates into more comprehensive adoption by employees. Therefore, this study proposed that the perceived usefulness of employees occurs gets stimulated through middle managers leadership styles.

Thirdly, this study has showed that a combination of 'soft' and 'hard' aspects are key when dealing with an implementation process of an Industry 4.0 innovation. Soft aspects that link to managerial skills when managing the implementation process, are equally as important as for example hard aspects such as the technical interface of the new innovation. Besides that, network planning also proves to be crucial when trying to boost the employee's adoption of an Industry 4.0 innovation. Middle managers need to structure the implementation process well and make sure that employees are aware of next steps and future updates. Therefore, this study proposed that there is an equal extent to which hard and soft aspects influence the relationship between leadership and employee's adoption of the Industry 4.0 innovation.

Moreover, this study proposed that network planning influences the relationship between the employees' perceived usefulness and the employee's adoption of the Industry 4.0 innovation.

Lastly, this study proposed that emotional intelligence, together with transformational and instrumental leadership, are crucial to attain comprehensive adoption of Industry 4.0 innovations in the workplace. Since transformational and instrumental leadership are intertwined and consist of multiple important managerial abilities, they need to be considered when leaders are trying to achieve comprehensive adoption of an Industry 4.0 innovation amongst employees. Emotional intelligence is essential as well, since this is in line with managerial empathy and patience that reflects back in the subdimensions of the concept. Therefore, this study proposed that these two leadership styles, accompanied by emotional intelligence, influence the relationship between leadership and the employee's adoption of an Industry 4.0 innovation over time.

6.2 Practical implications

This study has analyzed multiple cases within the same organization regarding the implementation process of the connected worker program, so it cannot be generalized to all organizations. Nevertheless, there are several key takeaways for managers, and especially leaders, that could lead to significant benefits in the future when dealing with the implementation process of an Industry 4.0 innovation. Leadership has a key role when trying to achieve comprehensive adoption amongst employees of an Industry 4.0 innovation. In Figure 11, the practical implications have been visualized over time.

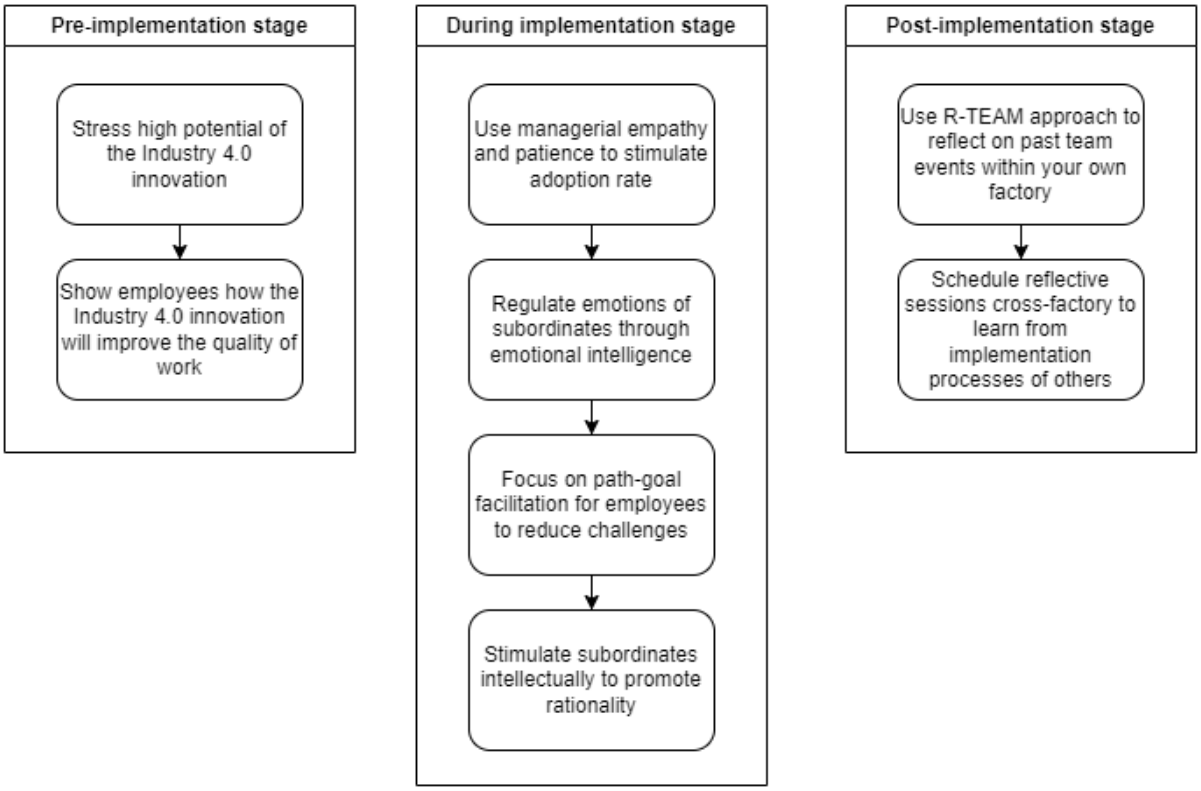

Figure 11: Visualization of the practical implications following from this research.

This study has showed that managers have a key role in the implementation process of an Industry 4.0 innovation. Since the implementation process consists of multiple stages, the role of managers changes throughout the time. In the beginning, it is important to stress and show the high potential of the new innovation and how it will improve the quality of work of employees in the workplace. This adds to the level of perceived usefulness by employees, which will ease out the employee's resistance towards new technologies (Khin & Kee, 2022; Taqi et al., 2023).

In the during implementation stage, managerial empathy and patience are key to make sure the adoption gets boosted. This links to the concept of emotional intelligence, where managers need to be aware of how they can manage the emotions of subordinates (Salovey & Mayer, 1990). Managers need to act as role models towards their subordinates and make sure the communication is clear for everyone. Besides that, managers need to promote intelligence and rationality of subordinates and provide personal attention wherever possible (Bass, 1990). This links to the subdimensions of transformational leadership. In that way, the adoption of an Industry 4.0 innovation by employees is positively influenced, which is favorable in every situation.

Moreover, the dimensions of instrumental leadership are important to take into account for managers as well. The path-goal facilitation has already been mentioned to be of great importance when trying to stimulate the employee's adoption of Industry 4.0 innovations. Managers need to be aware of their role in tackling challenges and resolving problems regarding the Industry 4.0 innovation and be transparent about these processes with their subordinates. In that way, the employees in the workplace will be best stimulated to adopt a new technology. This study has showed that many challenges and problems can occur when implementing a new Industry 4.0 technology, so this is essential for managers to take into account. Suggestions, provided in Figure 8, like installing extensive feedback loops, creating app manuals and start with co-development between end-users and developers could all be interesting initiatives to stimulate the employee's adoption even further. This also links back to the subdimension of transformational leadership about intellectual stimulation, since you want to promote intelligence and rationality amongst your subordinates as a manager, to make sure you have the highest chances of achieving comprehensive adoption of new technologies.

Lastly, a key takeaway from this study for managers is the R-Team approach (van Dun et al., 2022). During the execution of this research, it has been stated multiple times by participants of the case company that the method used of reflecting back on the implementation process through retrospective team mapping, was very helpful in identifying key events and trends across multiple different factories. Reflecting through this approach could help managers and their subordinates to learn from each other and see how they could improve similar process in the future. Especially because Industry 4.0 innovations are often difficult to implement, due to employee's resistance occurring. This could be counteracted through implementing reflective sessions in line with the R-Team approach throughout the implementation process of the new innovation or post-implementation.

6.3 Limitations

This study has been executed with utmost careful consideration of the researcher, but a few limitations and suggestions should be discussed. The first limitation can be linked to using only one case company in this research. Even though multiple factories have been used in this research, they are all connected to the single case company. Therefore, the findings of this research cannot be generalized for companies in different industries or that have different Industry 4.0 innovations implemented. Even though this method of including multiple cases

within a single case company creates enriched data and allows for more detail in the findings (Yin, 2003, 2015), the external validity and generalizability tends to be a point of discussion.

Besides this, it is important to stress the fact that across the multiple factories used in this research, the start of the implementation of the connected worker program did vary. This means that, for example, the factory in Western-Europe started their implementation of the connected worker program earlier than the one in Eastern-Europe. Therefore, the implementation process could be considered to be more advanced in factory A than in factory D. This allows the cross-case comparison to be reduced in external validity, since not all cases have had the same time span regarding the implementation of the Industry 4.0 innovation that is being considered. In an ideal situation, the multiple cases would have started at the same time with implementing the program to allow for a fair comparison between the cases. Moreover, the average age of the people working in those factories where not equal, as can be observed from Table 1. Therefore, now it could be that this varying average age did have an influence on the outcomes of this study.

Moreover, the R-TEAM approach allows for extensive, retrospective reflection on team events (van Dun et al., 2022), but does not take into account that cultural differences could play a role in the extent of how people reflect back on past events. In this study, factories have been studied across different continents, which means that participants originated from completely different cultures and backgrounds. This has an influence on how they reflect on past events, which has not been touched upon by this study. Therefore, this is also a limitation that needs to be addressed.

Furthermore, in this study, the questionnaire was designed to be filled out in the native language of the participants. This was done, so that participants could voice their honest opinion on the questions being asked. However, in the group interviews and validation sessions, the spoken language during the sessions was English. Even though the management levels that were invited to the meetings were proficient in English, there is still some consideration around the fact that they maybe not have fully voiced their complete honest thoughts. The language barrier therefore needs to be addressed as a potential limitation.

Lastly, recency bias could be a limitation to this study. Reflecting back on an implementation period, people tend to be biased towards recent events (van Dun et al., 2022; van Dun & Kumar, 2023). In this study, it can be seen that later stages of the implementation process, have had relatively more input on the team maps and the Gioia tables. Therefore, recency bias

could be a potential limitation to this study. Besides that, in some cases the researcher had to ask questions during the group interview or validation sessions that somewhat directed the discussions into a certain direction. This is often the case with qualitative studies (van Dun et al., 2022), but also needs to be mentioned regarding the limitations of this study.

6.4 Suggestions for future research

This study has provided also some suggestions for future research opportunities. Resulting from the limitations of this study, a similar study could be conducted where the time span of the implementation processes across different cases is equal. This allows for a more extensive comparison that has a higher generalizability with regards to the outcomes.

Besides that, the R-Team approach has provided to be effective when retrospectively reflecting on implementation processes. However, since this study only considered a connected worker program as the Industry 4.0 innovation, it could be interesting to see how effective this method is when other Industry 4.0 innovations are considered. In this study, the connected worker program proved to consist of several technical flaws that were difficult for management to solve by themselves. Therefore, involving other Industry 4.0 innovations in a similar research could be interesting, when they are less likely to show technical flaws. In that way, the focus could be shifted more towards the 'soft' aspects related to managing the Industry 4.0 innovation (Babatunde, 2021; Ali & Johl, 2022).

Moreover, the propositions made by the researcher in Figure 10 can be elaborated and tested through finding empirical evidence. This could then result in a better understanding of propositions and how they translate into practice for managers on how to boost employee's adoption of an Industry 4.0 innovation.

Lastly, because this research considers only three stages regarding the implementation process of an Industry 4.0 innovation, it could be interesting to take a broader scope. For example, in this study, there are three stages listed: pre-implementation, during implementation and the current situation. A more extensive scope on this stage division could be interesting to perform future research on. For example, what comes before the pre-implementation stage and what is the role of leaders in that stage? The focus could also be on the future, since this research caps out at the current situation, since the connected worker program is an ongoing project within the case company.

7. References

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Appendix

Appendix A: Kick-off call guide company X

Kick-off call planned on 22nd of February, 2023. Multiple questions have been prepared beforehand:

- Since my research is focusing on Industry 4.0 I want to know what Industry 4.0 innovations have been introduced in what business units in company X in the past 5 years?
- Which of those innovations would be the most interesting to analyze? Maybe some of them have raised more employee's resistance or have been a real success for the organization?
- What business units would be willing and able to participate in my research? Preferably, I want to base my research on three different business units within company X to create a more representative scope for my research.
- [Explain the research methodology] Do you think the approach of my research is suitable for company X? If not, what would you change or do differently?
- Are there any future Industry 4.0 innovations that are close on the horizon for company X? I want to know this, since I could then include this to my discussion section of my report to apply this research method to in the future.

Summary: A connected worker program is the most prominent Industry 4.0 technology in company X that has just been introduced. This has already been implemented in a factory in North America, Mexico, Serbia and Germany. Information about this will be send to me via email about what it consists and how it has been implemented. It is likely that these factories will participate in my research. I could then analyze this implementation process with regards to emotional intelligence and leadership as potential facilitators for a more successful implementation of this technology. This could then be used by company X to take into account when opening their new factories in Asia, which are close on the horizon.

Appendix B: Key informant meetings

Introduction of the R-TEAM method

The method includes:

- A survey that will be sent out to all the participants of this research (e.g. all the employees of the respective, selected factories)
- A well-structured and facilitated group interview and validation session, where multiple representatives of the factories will be present to voice their perspective on how the employee's adoption of the connected worker program has evolved over time and how leadership and emotional intelligence did play a role in that. In this session, key events during that process will be identified. Ultimately, there will be a corporate validation session, where the results of all the factories will be presented and included in one, universal model.

Moreover:

- The output of the group interview will be a poster which will visualize the history of the implementation of the connected worker program within that factory. All members of the factory that are present will be asked to participate actively during the session.
- The data recorded in this session will be handled with care and will be reported confidentially in the report of this research.
- The R-TEAM approach aims to stimulate the team learning process and tends to be of great importance when improving future team processes through the analysis of previous activities (van Dun et al., 2022).

Main questions

- Could you take us step-by-step through the start of the implementation to the current situation of the connected worker program? What phases did you went through and what key events happened?
- What have been the benefits and drawbacks of implementing the connected worker program in your factory?

- How have the employees in the workplace experienced the implementation of the connected worker program (as far as you know)?
- How has your role as a leader in this situation influenced this implementation process of the connected worker program?
- Have you perceived that the employees in the workplace felt differently after implementing the connected worker program? If so, please explain.
- How did you deal with your own feelings and the feelings of employees during such an implementation process? Please explain.
- What are the main takeaways for you when looking back at the implementation process of the connected worker program? What are the key lessons that you learned?

Conclusion and planning

- The survey will be send out to you and I would like you to champion this survey amongst all employees of your factory to ensure a high response rate.
- Based on the survey, multiple members of the factory (level 6 and 7 of management) will be invited by the researcher to attend the online group interview session, preferably around 4 to 5 people.
- A date will be planned for the group interview session and the validation session. The group interview will most likely be around 2 hours, since this allows for an in-depth reflection of the implementation process of the Industry 4.0 technology (van Dun et al., 2022). When shall we plan this?
- After the research has been completed (around November), a corporate validation session will be planned to discuss the results. Could I contact your secretary to find a fitting date?

Ending

- If you have any questions or if anything is unclear, do not hesitate to contact me either by email or by giving me a call.
- Thanks for your participation.

Appendix C: Questionnaire

Introduction

This short survey is part of my master thesis research that aims to see how leadership influences employee's adoption of the Connected Worker Program over time. This survey aims to gather information about your factory and you as an individual.

Please answer the questions as honestly as possible. No one other than myself as the researcher will learn about your individual responses: the survey is completely anonymous and the data will be handled confidentially.

Questions

1. As you know, the connected worker program has been implemented in your factory. How have you experienced the implementation process of the Connected Worker Program? How has it affected your feelings?
2. What has influenced your adoption of the Connected Worker Program over time? What has changed compared to when you first started to work with it?
3. What are positive aspects about the Connected Worker Program? And what are negative aspects about the Connected Worker Program?
4. How have leaders enabled or inhibited the adoption of the Connected Worker Program from the start, during, and after the adoption of the Connected Worker Program? Could you please offer one or two examples how leaders acted precisely?
5. Please answer the following questions:
    a. What is your gender?
    b. What is your age?
    c. How long have you worked in this factory?
    d. How long have you worked within this organization?
    e. What is your highest level of education?
    f. Do you work full-time or part-time in this organization?

Ending

Thanks for your participation. If there are any questions or if anything is unclear, you can get in touch by contacting this email address: [email address].

Appendix D: Participant selection group interview and validation session

According to the conducted key informant meeting and the surveys within the respective factory, a selection procedure will be happening to determine who the attendants will be for the group interview session. This will be done according to multiple criteria:

From every selected factory, a purposive sampled group of members will be drawn. This will be done according to the provided answers in the team survey and convenience matters whenever someone is not able to attend in case of time constraints or excessive workloads at the moment of selection. The group interviews will be attended by a sample of management level 6, whereas in the validation session, level 7 will be invited (see Figure 1 in section 3.2).

Following from this procedure, the selected participants for the group interview and validation sessions will be contacted. If someone is not able to attend the session, a valid replacement will be determined according to the participant selection criteria.

Participant	**Department**
Empl_1	Safety Manager
Empl_2	Digital Engineer
Empl_3	Hygiene Engineer
Empl_4	HPS Engineer
Empl_5	Maintenance Planner
Empl_6	Head of Maintenance
Empl_7	Head of HPS
Empl_8	Head of SHE
Empl_9	Head of Engineering
Empl_10	Head of Quality

Table 3: Coding participants group interview and validation session.

As can be seen in Table 3, empl_1 until empl_5 are invited to the group interview sessions and empl_6 until empl_10 are invited to the validation session. This is in line with the management levels of the chosen company.

Appendix E: Group interview guide

This will be the guide for the group interviews. These will be semi-structured sessions. These will be organized via MS Teams and visualizations (e.g. the visual map) will be created through Miro. There are three different stages visualized on the Team Map (introduction CWP, start implementation and the current situation) (see Figure 12), which makes it easier for the participants to link an event to a certain time step of the implementation process).

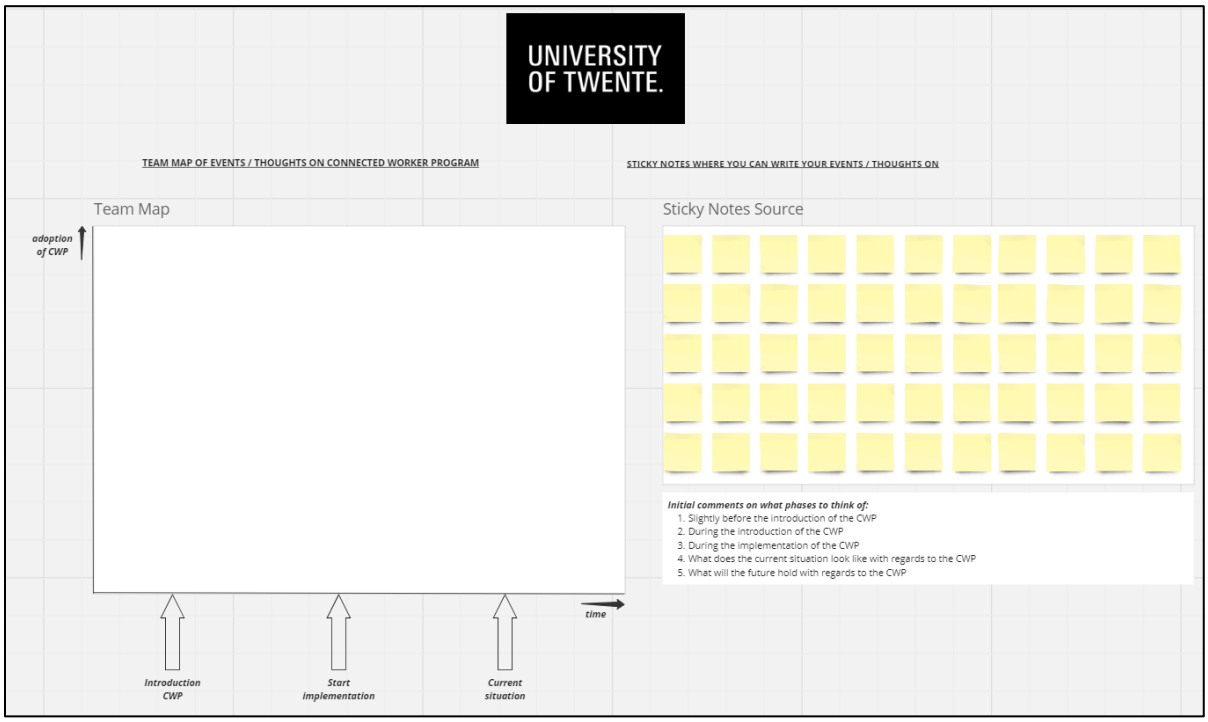

Figure 12: MIRO Template for Group Interviews.

The group interview outline has been pilot tested a week prior to the planned group interviews with peer students. The structure is provided through a guide below:

Opening

- Everybody is welcomed and thanked for their attendance.
- The goals of the group interviews will be presented, in combination with the ground rules for group interview sessions:
    - Everybody is expected to listen carefully;
    - Everybody is expected to treat another with respect (e.g. let each other finish their sentences, making sure everyone gets involved in the session);

    - No statements or comments are false;
    - Everybody is allowed to voice their perspective on the matter that is being discussed
- Everybody is asked if they consent with the group interview being audiotaped.
- Everybody is asked if they understand the procedure and if someone has a question that will be answered before the session starts.

Main body

- The researcher starts this section by mentioning the connected worker program that the session will be focused on.
- The researcher asks every attendant of the session to write down various key events from the past period that relate to this program. This could consider the moment it got introduced to the factory, or actual implementing steps of the program. These key events can be thought of by letting the group brainstorm for a couple of minutes. Then, the researcher will start by asking some attendants to tell the group about what they wrote down.
- Following from these initial thoughts and events that the attendants wrote down, multiple follow-up questions have been constructed in advance to stimulate the flow of the group session, such as:
    - Could you explain that a bit more?
    - What actually happened during that event?
    - How did this influence the adoption of your team with regards to the new innovation?
    - Could you summarize that and write it down on a sticky note?
    - When did the event happen?
    - What is your opinion about the program and that certain event?
    - How did your colleagues value your opinion during that event?
    - How did that affect your feelings?
    - How was the communication from the organization and management about this event? Was it clear, concise, or could it have been better? Could you give a precise example of when leaders acted in what way?

- When a certain event has been mentioned by one of the attendants, it will be summarized accordingly and written down on a sticky note on Miro. It will then be placed on the poster in front of the room where the session will take place. This process will be repeated several times so that the poster will end up saturated with events that relate to the implementation/adoption of the connected worker program.
- If the discussion falls short at some moment in time, the researcher may provide new thoughts that have been gathered through document studies, team surveys or key informant meetings. This could then initiate the discussion further.
- If someone had written down a relatively similar event to someone else, they will still be asked to elaborate further on the event wherever possible. This may result in additional perspectives on a single event, which will enrich the output of the group interview session.

Conclusion

- After the poster has been saturated with sticky notes that resemble the key events that relate to the introduction/implementation process of the connected worker program, the events will be linked to the key concept of this research: employee's adoption of Industry 4.0 technologies. A line will be drawn that resembles the adoption of the factory workers over time. This will be done by the researcher, where the team members need to agree on the direction of the line.
- If this has been done, the individual events that have been attached to the poster will be considered again. It could also be that it is clear that one of these concepts was felt missing by the team members. Then, that could be insightful to bring up. The researcher will then afterwards put them into context and link them to subdimensions of emotional intelligence and leadership, wherever possible. This is not done during the group interview or with the group, as this would cause bias to purposely apply theoretical constructs on a practical case.
- If any changes need to be made with regards to the team adoption's line, this could be done if mutually agreeance is achieved by the team. This could then by included in the report for additional learning in the process.

Ending

- At the end of the group interview session, evaluative questions will be asked to see whether there is room for improvement. These consider both the researcher as a leader during the discussion, as well as the general procedure of the interview.
    - How did you experience this group interview session?
    - What surprised you?
    - To what extent do you think we included all the main events regarding the connected worker program?
    - What could be improved to the structure of this session in the future?
    - What could the researcher have done differently in leading the discussion?
- Again, thank all the attendants for their effort and time and explain what the further procedure will be. If someone has any questions, these will be answered.

Appendix F: Validation session guide

This will be the guide for the validation sessions. These will be semi-structured sessions. The structure is provided through a guide below:

Opening

- Everybody is welcomed and thanked for their attendance.
- Everybody is asked if they consent with the group interview being recorded (so that a summary can be written afterwards for research purposes). If questions are being raised, then I can answer them.
- Researcher introduces himself and gives all participants the chance to introduce themselves as well.
- The goals of the validation session will be presented (team learning, how has the CWP been implemented in your factory, ups and downs, what problems did arise, what challenges did occur, voice your honest opinion), in combination with the ground rules for validation sessions:
    - Everybody is expected to listen carefully;
    - Everybody is expected to treat another with respect (e.g. let each other finish their sentences, making sure everyone gets involved in the session);

    - No statements or comments are false;
    - Everybody is allowed to voice their perspective on the matter that is being discussed.
- Everybody is asked if they understand the procedure and if someone has a question that will be answered before the session starts.
- Everybody needs to have access to the Miro Online Room, which is shared through a link in the MS Teams chat (a duplicate of the original being made for the group interview, so that the original stays intact alongside the one changed in the validation session), so that everybody can write down their events and thoughts. This needs to be confirmed with all the participants of the session.
- Everybody is made aware of the fact that honest answers are well respected and only being handled carefully by the research team and no one else.

Main body

- The researcher starts this section by mentioning the connected worker program that the session will be focused on (e.g. the apps present on the shopfloor + iPads introduced in the production lines).
- A presentation is provided through MS PowerPoint to present all the key findings regarding the group interview, which then could be discussed by looking at the MIRO board.
- The session will be a 30 minutes group interview like discussion, where general questions are being asked to the participants:
    - What did you think about the way in which CWP was introduced? Can you provide examples?
    - How have you boosted the usage of the CWP? Can you provide examples?
    - How have the employees on the shopfloor reacted to the implementation of the CWP? Can you provide examples?
- The map made on MIRO in the group interview session, was then shared with all the participants of this session (level 6 management) for further validation during an audiotaped online team meeting. This will be separated in three parts, where all the individual stages (pre-implementation, during implementation and the current situation) will be discussed separately. This is all visualized in a Powerpoint

presentation and the MIRO board is hiding the other stages that are not yet being discussed. Curbing researchers' bias, in this step open team discussion took place around questions like: "To what extent does this map accurately capture what happened with regards to the implementation process of the Connected Worker Program?" and "To what extent do you agree with this interpretation of the adoption of the Connected Worker Program across employees in your plant?". During this discussion, the researcher is obliged to act as a neutral process moderator (Krueger & Casey, 2015), to avoid bias. Two leading questions in this part are (posed in every single stage):

    - Do you agree?
    - How does your perspective differ?

- The researcher asks every attendant of the session to write down various key events from the past period that relate to this program, in case if anything is missing. This could consider the moment it got introduced to the factory, or actual implementing steps of the program. These key events can be thought of by letting the group brainstorm for a couple of minutes. Then, the researcher will start by asking some attendants to tell the group about what they wrote down. These events will be written on different color sticky notes than those made in the group interview session to make sure the changes/additions are clearly visible.
- Following from these initial thoughts and events that the attendants wrote down, multiple follow-up questions have been constructed in advance to stimulate the flow of the group session, such as:
    - Could you explain that a bit more?
    - What actually happened during that event?
    - How did this influence the adoption of your team with regards to the new innovation?
    - Could you summarize that and write it down on a sticky note?
    - When did the event happen?
    - What is your opinion about the program and that certain event?
    - How did your colleagues value your opinion during that event?
    - How was the communication from the organization and management about this event? Was it clear, concise, or could it have been better?
- When a certain event has been mentioned by one of the attendants, it will be summarized accordingly and written down on a sticky note. It will then be placed on

the MIRO poster. In case of it already being written down on the map, it does not have to be included again, but this will be noted by the researcher, as this is an indication of validation of an important event or perspective on the CWP.

- If the discussion falls short at some moment in time, the researcher may provide new thoughts that have been gathered through document studies, team surveys or key informant meetings. This could then initiate the discussion further.
- If someone had written down a relatively similar event to someone else, they will still be asked to elaborate further on the event wherever possible. This may result in additional perspectives on a single event, which will enrich the output of the group interview session.

Conclusion

- After all the sticky notes have been discussed on the poster and maybe some additional ones have been added, the discussion moves to the adoption lines being drawn in the group interview session.
- If any changes need to be made with regards to the team adoption's line, this could be done if mutually agreeance is achieved by the team by drawing an additional line for a certain app of the CWP. This could then by included in the report for additional learning in the process and is a sign of disapproval (non-validation).

Ending

- At the end of the validation session, evaluative questions will be asked to see whether there is room for improvement. These consider both the researcher as a leader during the discussion, as well as the general procedure of the interview.
    - How did you experience this validation session?
    - What surprised you?
    - To what extent do you think we included all the main events regarding the connected worker program?
    - What could be improved to the structure of this session in the future?
    - What could the researcher have done differently in leading the discussion?

- Again, thank all the attendants for their effort and time and explain what the further procedure will be. If someone has any questions, these will be answered.