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Ida Marie Tvedt

Promoting Psychological Safety for the Development of Positive Digital Mindsets

Expanding knowledge of the design phase of construction projects

Doctoral thesis

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of Philosophiae Doctor
Faculty of Engineering
Department of Civil and Environmental Engineering

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Summary

Digitalization requires significant changes in organizational and project structures. Human factors are critical to the success of both small and large digital initiatives. Construction project design teams are highly interdisciplinary environments with rapidly evolving subject knowledge, and digitalization constantly changes their work processes. The existing research on construction management is insufficient in explaining how people in design teams think about these changes and how this impacts collaboration.

This thesis aims to bring the construction industry one step closer to understanding what is needed to accelerate digitalization by focusing on human factors in the design phase. I assess team climates that may support human responses to technology changes. I do this by bridging the theories of psychological safety and digital mindsets from the organizational behavior field to enrich the construction management literature.

Using the critical realism research paradigm, I have employed in-depth case studies, relying primarily on empirical research using retroductive reasoning as a method for analysis. I also created frameworks based on existing literature, which I used as lenses for data collection and comparison in the analysis.

In the following paragraphs, I present the findings on what impacted psychological safety, how psychological safety and digital mindsets were connected, and how psychological safety and digital mindsets may be a foundation for purposeful digital industrial transformation.

First, I found that distinct workplace characteristics in construction design teams impact psychological safety. For example, tight collaboration can lead to conflict and harm psychological safety due to intergroup tension. Also, speaking up was found to be more vulnerable in virtual environments than in physical ones due to a lack of social cues.

Second, to develop high levels of psychological safety, I found structural elements such as task design, team composition, and context supports such as adequate resources and information to be essential. In virtual environments, accountability and accessibility were critical to guarantee that work was progressing and that they were included in the workplace. The main barrier to psychological safety in temporary design teams was found to be variety and separation diversity because it caused intergroup tension and thus caused knowledge barriers.

Third, positive digital mindsets and psychological safety are interlinked and influenced by team composition, leadership, and context. Importantly, I found that psychological safety impacts team members' beliefs about their ability to learn and that collaboration expands success. In other words, psychological safety provides the climate where positive digital mindsets may grow. Furthermore, I found the relation between the two phenomena to be reciprocal. I argue that implicit theories about learning and perceptions about resources support psychological safety in explaining why individuals behave as they do toward digitalization.

Lastly, viewing the findings through socio-technical system theory strengthened the arguments for psychological safety and digital mindsets as essential conditions of the social aspect of digitalization. A climate of psychological safety cultivates positive digital mindsets, which motivate employees and team members to adjust their behavior. The loose and tight couplings theory helped explain how industry characteristics complicate the development of psychological safety within project boundaries. Also, I found that loose couplings of firms limit the benefits of learning environments in projects for a future digital industrial transformation.

Related to the findings of this thesis, I consider the following to be the top contributions.

- A strengthening of psychological safety as a team climate construct
- Knowledge of the unique challenges that may arise in design teams in establishing learning team climates
- Guidance for leaders on how to focus on what matters most in framing learning environments
- Knowledge of how digitalization impacts team members, how it directs their behavior, and how mindsets may be facilitated to achieve support for digitalization strategies

Preface

The process of arriving at the topic of psychological safety as a condition for digital mindsets was shaped while working on the thesis. Still, prior to starting the Ph.D., I became intrigued by the design phase, specifically how to bring together people with varied viewpoints and attitudes to create novel solutions.

My curiosity about the design process began as a child when I visited my father's engineering office. I remember being fascinated by the conversations that took place around the old technical drawing boards. Digitization in the 1990s transformed the way civil engineers worked, and due to illness, my father was unable to adjust to the office's digitalization. I witnessed the consequences of a lack of knowledge about supporting and including workers with different digital prerequisites.

Following in my father's footsteps, I majored in civil engineering. Summer jobs working with engineering structures piqued my interest in meetings and interdisciplinarity. As a result, I completed my master's thesis in 2018, for which I studied the secrets to successful design management. As a result, I gained professional and personal motivation for this thesis.

The Ph.D. position I accepted was titled "formalities and human behavior", and the purpose was to broaden our understanding of how formalities influence human behavior in order to make optimal decisions in the digital age. Thus, the concepts of organization, the human, and technology were included. As the position would necessitate knowledge outside of project management, the thesis was left open for me to interpret and shape. As part of the process of building my research paradigm, I had to travel to BI Norwegian Business School, the University of California, Berkeley, and the world of research philosophy.

Digitalization has advanced since the 1990s, and digital transformation has been knocking on the construction industry's door for years. Despite breakthroughs in 3D modeling, management, and interaction technologies, understanding the human-technology relationship remains abstract and difficult to apply. As a civil engineer, I have taken it upon myself to bridge the gap between project management research and organizational behavior theories in order to shed light on this subject.

Oslo, February 2023

Ida Marie Tvedt

Acknowledgments

Writing a thesis is a lonely journey, but just like in life, it is shared and influenced by others who accompany you. There are many people I would like to give my greatest thanks.

First and foremost, I would like to thank the two persons who raised me to have the resilience needed to finish this thesis. To my mum, thank you for challenging me, pushing me out of my comfort zone, and, most importantly, for always being there when it occasionally gets too much. You are my rock and best friend. To my father, you are undoubtedly the most unselfish person I have met; you inspire me with your endless care for the people you come across. Thank you for your patience during the many hours of discussing math, physics, and space. The greatest knowledge I carry is the love you show me.

The person who has read, commented, and discussed my many good and bad ideas is my main supervisor, Ole Jonny Klakegg. Thank you for your patience and for allowing me to pursue my academic interests. I truly appreciate how well we worked together on the paper and the book chapter. You have encouraged me to reconsider and improve the quality of my work. Most importantly, I always left our meetings feeling energized and confident in my ability to continue on my path. I have truly appreciated and will miss your advice.

I also want to thank my co-supervisor, Per Morten Schiefloe, for giving me perspectives and guidance outside of my field. To the Ph.D. students I started with, Atle, David, and Teresa thank you for our digital talks when the pandemic was draining my motivation.

I lived in Oslo for most of my Ph.D. and was a visiting researcher at BI Norwegian Business School. Thank you, Anders Dysvik, my co-supervisor, for providing me with this opportunity. Many people at the Department of Leadership and Organization have shaped me. Thank you, Elisabeth, for introducing me to the digital mindset concept and sharing your expertise. Thank you, in particular, to Jo and Njål, who taught me the ways of academia. Ellen, you filled the long working hours with laughter and provided me with perspective. And thank you, Ingvild, Ilka, Anastasia, Kas, Bryndís, Morten, Jon, Lewend, Yooeun, and Richard, for making the office a happy place for curiosity and discussions.

I was a visiting researcher at UC Berkeley for my second case study. I sincerely thank Professor Iris Tommelein for hosting me and sharing her network. You have helped me in expanding my

knowledge of research and pushed me to strive for perfection. To Hanna and Stephanie, thanks for making the social side of the exchange as enjoyable as the academic.

I want to express my gratitude to the many people who contributed to the case studies by volunteering their time and sharing insights into their work. Undervisningsbygg allowed me to examine “Manglerud bad” in depth. Thank you, especially to Rune and Per Morten. KPFF introduced me to a case study and let me follow them through the first months of COVID-19. Thank you, especially to John-Michael, who has been a great help and co-writer, and Mark, David, and Brad for their time and assistance. Lastly, thank you to BAR architects, especially Martin and Bradley, for letting me follow their design team.

The Ph.D. has been a personal journey as well, needing social support. A special thank you to Camilla for always keeping the door open and for building me up when needed. And thank you to Signe, Mathilde, and Ingegjerd, who have listened to my frustrations. Also, I am lucky to have had the support of a caring family.

Lastly, one person has followed my journey closer than anyone. Magnus, thank you for the grammar checks, for being the shoulder to cry on, the person to scream at, and the one to celebrate the small victories with. Your patience and kindness are unique, and I would have been lost without your love and support.

Oslo, February 2023

Ida Marie Tvedt

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Abbreviations

BIM	Building Information Model/Modeling
CR	Critical Realism
DM	Design Manager
ITM	IT-Manager
MP	Managing Principal (office manager)
PBO	Project-Based Organization
PDM	Project Delivery Model
PM	Project Manager
PSC	Psychosocial Safety Climate
TPO	Temporary Project Organization
SFO	San Francisco Office
STS	Socio-Technical System

Terms

Actor:	Firm representing a discipline within the design team.
Client:	Used to refer to the project owner by informants.
Contractor:	The actor that undertakes a contract to provide materials and labor to perform the project.
Collaborative delivery model:	A delivery model where the contract is collaboratively structured.
Collaborative work structure:	Work structure that emphasizes inclusive structure creation and collective decision-making.
Design team:	In this thesis, a group of active members that has been collaborating for a substantial time.
Designer/member/individual:	An individual within the design team.
Digital mindset:	Individually held mindset about the ability to learn, combined with beliefs about situational recourses.
Positive digital mindset:	The combination of growth*expandable-sum mindset.
Project delivery model	System/strategy for organizing and financing a structure or facility, including legal agreements with one or more entities.

Chapter 1
Introduction

> "As for the future, your task is not to foresee it, but to enable it."
>
> Antoine de Saint Exupery
> French author and poet

1.1 Introduction

Digital transformation necessitates significant changes in organizational and projects social structures. Project management research, including Papadonikolaki et al. (2022), Linderoth (2017), and Çıdık et al. (2017), has clearly established that human factors are an essential contributor to the success of technology-driven changes. However, there is a lack of research on how to best manage human responses to technology in highly interdisciplinary environments where subject knowledge is rapidly and continuously evolving – for example, in construction project design teams.

This research aims to assess team climates that may aid human responses to technology changes in the context of the design phase of construction projects. This chapter introduces the study by first presenting the background and context, then the problem with current knowledge, the choice of theoretical lenses, objectives and questions, limitations, and finally, the thesis structure.

1.2 Background and context

To present the context, I must first introduce the concepts of digital transformation, digitalization, and organizational culture and climate, which I will define and elaborate on more in sections 4.2 and 4.3.

Digital Transformation is a comprehensive process of change that leverages digital technologies and strategic resources to improve the overall performance and outcome of an industry or organization (Gong & Ribiere, 2021). For organizations, it encompasses changes

to all aspects of a business, even the non-digital parts (Bowersox et al., 2005). Digital transformation also enables new collaborative patterns that alter industry boundaries (Schallmo & Williams, 2018).

Digitalization is a step toward digital transformation and means turning communication, business operation, and models into more digital ones (Schallmo & Williams, 2018). Schallmo and Williams (2018) define digitalization as "fundamental changes made to business operations and business models based on newly acquired knowledge gained via value-added digitization initiatives".

As a result, digital transformation has an unforeseeable future, and it is challenging to structure and foresee how it will affect organizational structures and industry boundaries. Even though digitalization is a smaller change in comparison, it may still disrupt an organization's social networks, requiring employees to re-learn how to collaborate (Edmondson, 2003).

To be effective, changes need to be supported by the individuals impacted by them. The impact of digital change on social networks and human factors can be identified in organizational and team culture and climate. According to Schein (2010), organizational culture is a system of shared beliefs and values that lead to norms and expectations shaping how individuals approach problems, tasks, and how they interact. Climate can be considered a manifestation of culture (Schein, 1985). Schneider and Reichers (1983) defined work climate as "a set of shared perceptions regarding the policies, practices, and procedures that an organization rewards, supports, and expects." I would argue that norms and climates direct individuals' support of and capability to adjust to digitalization, and the culture may become digitally mature through its climate.

To the context: The world has never evolved as fast as it does today, and the need for affordable housing and infrastructure puts pressure on the global construction industry to review and renew itself (Maskuriy et al., 2019). Successfully doing so will positively impact the world economy and sustainability (Barbosa et al., 2017; Javed et al., 2018; Maskuriy et al., 2019). Despite the construction industry undergoing significant digital changes during the last decade, the general perception is that society will struggle to maintain its current level and function if the industry does not increase productivity (Barbosa et al., 2017).

Therefore, much attention is paid to technology-driven innovation (Adekunle et al., 2021; Schwab, 2017). The construction industry is at the edge of a new digital era, where technology introduces new ways to plan, design, and execute projects (Bilal et al., 2016; Blanco et al., 2017; Koscheyev et al., 2019; Maskuriy et al., 2019). Still, we are not yet where we have managed to exploit the full potential. McKinsey's report from 2017 showed that the construction industry had not embraced the digital age, which is one (of several) reasons for the industry's negative labor-productivity growth compared to the growth of the total world

economy (Blanco et al., 2017). The report presents that technology itself can increase productivity by 14-15% and that reskilling the workforce can add 5-7%. Thus, there is much to gain by bettering our knowledge about how to succeed with digitalization.

In this thesis, I focus on the challenges faced in the design stage of a project's life cycle. The design phase is where changes can have the greatest impact with the least cost for the project as a whole (Knotten, 2018). The purpose of digitalization is to help design teams identify mistakes and take advantage of diverse knowledge (Liu et al., 2013; Moum, 2010). Thus, it is crucial for team members to align and adapt to digitalization strategies that are reflected in the team's climate. By doing so, the design phase can greatly benefit from digitalization.

Digitalization has already fundamentally changed design teams' working methods (Hautala et al., 2017). However, the significant changes during the last decade have led to criticism from researchers regarding the understanding of the design process (Østby-Deglum et al., 2013). Design teams are distinct from other working teams for several reasons. I argue that the most challenging part of the digitalization of this phase is due to team composition and the temporary nature of their collaboration. Several experts with diverse knowledge from different disciplines are temporarily managed to design a product defined together with a group of stakeholders (Packendorff, 1995). Temporary project teams do not benefit from longer-lasting cultures, and climates are fragile due to actors differentiating objectives.

Importantly, a future digital transformation allows for doing work in an entirely new way (Brynjolfsson, 1993), and digital information and communication technology have fundamentally changed work's nature (Schwab, 2017). Therefore, I argue that to optimize and prepare for the future, we need to focus on individuals' attitudes and adjustment to technology, as the context will continue to change. From the perspective of construction management, knowing how to lead employees working in an unforeseeable digital industry necessitates a human-centered approach. The motivation for this thesis is to take a step towards this.

1.3 What is missing in the current literature?

Keeping up with digitalization in construction and the design phase has been discussed from many points of view (Adekunle et al., 2021; Papadonikolaki et al., 2022). The temporary nature of projects is one angle. Another is that there is no similar project and, thereby, no standard strategies (You & Feng, 2020). Thus, teams of owners, designers, contractors, and suppliers change from project to project, creating fragmented data management practices, which is a problem with using BIM and trends like Big Data (Adekunle et al., 2021; Bilal et al., 2016). In theory, BIM as an information modeling tool, with cloud computing for storing, provides a unified platform to communicate and collaborate, where designers' expectations are virtually expressed (Barlish & Sullivan, 2012; Liu et al., 2013; You & Feng, 2020). However,

consultants choose their digital tools internally, and disciplines have different digital needs, making a choice and success of digital collaboration tools in these temporary teams complex (Lavikka et al., 2018; Liu et al., 2013; You & Feng, 2020).

Related is the type of work performed by design teams. Design work, "white-collar work", or "knowledge work" is often described vaguely. Also, in practice, judgments are usually made based on experts' experiences, which are not easily written down and are rarely communicated (Jaradat et al., 2013). These characteristics challenge optimization by implementing machine learning, reasoning technology, and intelligent computing (You & Feng, 2020). Also, tasks are rarely connected sequentially and are often dependent on others and shared resources (Moum, 2010). The non-linear workflow and the interdependence of tasks represent high uncertainty and often lead to revised plans and wasted resources. Also, tasks are assigned at different informatization levels, making it time-consuming for the manager to coordinate and secure consistent use of information technology.

The economy is another related aspect, as the construction industry is considered among low-profit-margin businesses (You & Feng, 2020). Implementing technology requires software licenses and skilled IT personnel. These costly add-ons to projects are difficult to defend, as the gains from the investments are difficult to quantify.

However, all of these aspects focus on how well the tools fit the creative and interdisciplinary work performed in design teams. The design phase is built on creative teamwork, and for it to be more efficient with the use of digital tools, it is critical to know more about its conditions. As long as the construction industry is structured the way it is, with temporary project teams (Packendorff, 1995), and loosely coupled firms (Lundin & Söderholm, 1995), cultures and climates will be challenging to establish (Kumaraswamy et al., 2002), impacting digitalization (Lavikka et al., 2018; Linderoth, 2016).

The current body of knowledge fails to address human responses to digitalization in the design phase and how to manage them. As a result, the existing construction management literature is inadequate in answering how people working in design teams think about the changes to their tasks and work processes and how this impacts their collaboration. In the construction management literature, research is needed to address the acceptance of digital changes, as explained by Venkatesh and Bala (2008). I would argue that the greatest challenge the construction industry is facing when going into the fourth industrial revolution is the human-technology relation. The industry has much to gain from developing an understanding of how to motivate humans to utilize available digital tools that are commensurate with understanding the usefulness of technologies. This area of research is not well developed.

1.4 Why psychological safety and digital mindsets?

Changing work processes has been shown to require a high level of acceptance from the employees affected by digitalization (Kane, 2017), which I have studied using the digital mindset concept. Change and acceptance also require a supportive culture or climate (Colbert, Yee, & George, 2016), and I have chosen to view work climate through the lens of psychological safety theory. I will briefly describe the two phenomena in the following.

Employee mindset is crucial to realizing successful change and digital advancement within an organization, according to Kane et al. (2017). A digital mindset involves not just technical proficiency but also a set of beliefs that allow employees to envision and maximize the potential of technology (Kamath, 2019; Solberg et al., 2020). Individuals' use of technology, their support of initiatives, and their interaction with co-workers are predicted to differ due to combinations of beliefs of personal and situational resources when facing digital changes or challenges (Solberg et al., 2020). In addition, mindsets vary within a team, which may hinder a shared understanding of the team climate, affecting transformation initiatives. Varying mindsets within a team can impede shared understanding and ultimately hinder transformation initiatives. As Solberg et al. (2020) emphasize, it is important to foster shared mindsets or manage individual mindsets effectively to align behaviors with the goals and vision for digitalization initiatives.

Psychological safety may be the key to enhancing and aligning the right digital mindset with design team members. Edmondson (2004) defines it as a group-level construct, describing "individuals' perceptions about the consequences of interpersonal risks in their work environment." Psychological safety explains team performance in situations that require knowledge sharing and collective learning (Huang et al., 2008). When there is a safe climate, people exchange more knowledge and experiment because there is an acceptance of learning and failing. Therefore, there are reasons to believe that such a climate would impact individuals' digital mindsets: their beliefs about their ability to learn and situational resources. Furthermore, psychological safety promotes divergent thinking, creativity, and learning (Choo, Linderman, & Schroeder, 2004) and helps alleviate anxiety related to changes and tasks that deviate from expectations (Schein, 1993) as introduced with digital-driven change.

The assumptions that this thesis is built on are depicted in Figure 1.1. The aim is to investigate the potential for psychological safety to foster positive digital mindsets. If so, psychological safety could serve as a foundation for creating support for digitalization, which is a precondition for successful digitalization. As shown in the final part of the figure, having the prerequisites for digitalization established can contribute to a purposeful digital transformation because it values both technology and human factors equally. The last box is depicted as not solid, as my research strategy cannot definitively conclude the presence of a purposeful digital

transformation. This last assumption is only an abstract theoretical discussion with the purpose of reflection.

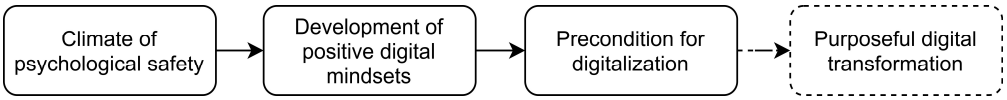

Figure 1.1: Research framework

1.5 Thesis goals and research questions

The overarching goal of this thesis is to examine the relationship between team climates and human responses to digitalization in the design phase of construction projects. More specifically, it explores the potential role of psychological safety in fostering team members' positive digital mindsets. The purpose is to advance knowledge on the digitalization of the construction industry and evaluate if the relationship may be a foundation for purposeful digital transformation.

As a result, I am opening up a black box concerning human responses to digitalization, as visualized in Figure 1.2. There are several steps, and the five research questions add distinctively to the body of knowledge. All questions must be read in the context of the construction industry and design teams.

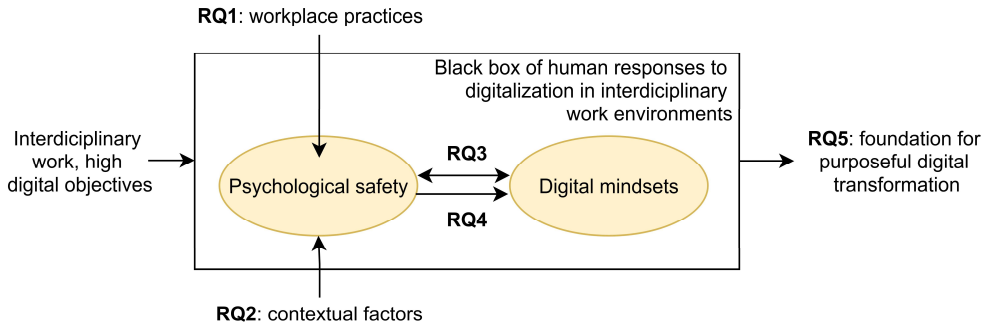

Figure 1.2: Black box illustration of research questions' interrelatedness

RQ1: How do workplace practices influence what norms matter for the development of psychological safety?

Beyond understanding how psychological safety influences digital mindsets, we must understand how it is experienced. Workplace practices establish norms by shaping behavior and expectations. For example, if a workplace practice values open communication, it can foster a norm of speaking up and actively listening within the team. The construction industry and design team practices may set the condition for which norms matter for the development

of psychological safety. RQ1 aims for descriptive knowledge, and as evident in Figure 1.2, this question focuses on perceptions of how workplace practices, including which norms that, affect the development of psychological safety.

RQ2: What are the contextual factors impacting psychological safety?

RQ2 supplements RQ1 by examining the impact of contextual and structural elements on norms that characterizes psychological safety. This question delves deeper than just exploring the connection between workplace practices and the formation of norms. Each construction project is unique and will have distinct formal and social structures; however, I argue that certain leadership behaviors, team dynamics, and organizational processes positively affect the development of psychological safety.

RQ3: To what extent do a high level of psychological safety and a high level of digital mindset occur together?

The dyadic relation is the focus of this research question, which aims for relational knowledge. RQ3 seeks to determine whether the two phenomena coexist and, if so, why. I would suggest that if a link exists, this would be beneficial knowledge for leaders who wish to improve their team's digital collaboration.

RQ4: What characteristics of psychological safety are associated with mechanisms that enable a digital mindset?

To improve the human-digital relationship, we must consider how team cultures influence individual attitudes toward digitalization. This descriptive and explanatory knowledge will make it possible to determine whether psychological safety has a negative, positive, or non-existent effect on people's digital mindsets. If there is a positive effect, leaders can develop psychological safety as a team-level strategy to cultivate members' support of and success with digitalization.

RQ5: Can the two phenomena secure that the preconditions for digital transformation are in place?

This research intends to provide knowledge about the precondition for purposeful digital transformation (the output), as shown in Figure 1.2. The goal of RQ5 is to establish whether the relation between psychological safety and digital mindsets provides a foundation required for a purposeful digital transformation of the construction industry.

1.6 Limitations

The construction industry's digital transformation concerns the industry, businesses, and the whole project life cycle, from start to end (Adekunel et al., 2021). The people involved, the

tasks, and the challenges in the development and production phases will be quite different from those in the design phase. Therefore, I will not consider the other phases or suggest that the findings will be transferable throughout all phases of the project.

Similarly, design teams consist of people who have several roles. The thesis only considers the interactions within design teams, and it is outside the scope to evaluate the effect of their overall work situations and private life, such as psychological and physical health.

Furthermore, I did not set out to find a design team with a low level of psychological safety. It would have been possible to be more certain about the facilitators and barriers to psychological safety and digital mindset if there had been cases with varied levels of psychological safety.

While the goal of the thesis is to create knowledge to assist digitalization, it is limited to looking at the development of digital mindsets in relation to psychological safety. Therefore, I will not evaluate the quality or usefulness of the technology used by the team. In the thesis, the digital mindset is evaluated as an outcome of and to coexist with psychological safety and, together, a human-related precondition for digital transformation of the industry where productivity may follow. It is outside the scope of the thesis to prove the relationship to productivity.

I collected empirical data from Norway and the USA. I planned a case from another cultural setting, which unfortunately had to be canceled due to the COVID-19 pandemic. An additional case would have enabled a discussion of cultural aspects and would have increased the likelihood of the findings being relevant for construction projects around the globe. I assume that cultural differences between Norwegian and US design teams affect the designers' understanding of psychological safety. The Norwegian culture focuses on equality, with little hierarchy, a flat structure, informal communication, and a high level of trust (Business Culture, n.d.). On the other hand, the Californian business culture appears to be more innovative and open, with on-point communication and higher competitiveness (US Business Culture, n.d.). However, due to having only two cultural settings for the cross-case analysis, a cultural comparison is outside the scope of the thesis.

Similarly, the thesis only considers construction projects. While I believe that the learning from the cases is transferable to similarly interdisciplinary teams, it is also outside the scope of this thesis to prove so.

I have chosen to focus on empirical data and provide examples of evidence, which limits the time to consider several explanations. While theoretical development based on the findings is implied, it is outside of the scope of the thesis to fully validate, as this would require a systematic comparison to other possible explanations.

1.7 Thesis structure

The thesis has an empirical and descriptive approach, which influences the balance of theory and findings. The structure is as follows.

Chapter 1 introduces the thesis in brief, placing it in the project management discipline and the early phase of construction projects.

Part 1: Theoretical Framework

Chapter 2 defines psychological safety as a team-level concept.

Chapter 3 describes the theory of digital mindset and how it is defined in the thesis.

Chapter 4 provides a theoretical framework for contextualizing the research and studying and connecting the main theories presented in the previous chapters.

Chapter 5 presents theories of socio-technical systems and loose and tight couplings.

Part 2: Methodology

Chapter 6 introduces the research paradigm, including the chosen research philosophy.

Chapter 7 presents the strategy and research designs.

Part 3: Within-Case Analyses

Chapter 8 describes the three case studies.

Chapters 9, 10, and 11 present the case studies' results and discussion, organized into the case design's research questions.

Part 4: Cross-Case Discussion

Chapters 12, 13, and 14 concern the cross-case analysis, presenting a discussion of the overall research questions.

Part 5: Conclusions

Chapter 15 answers the research questions, looping back to the aim presented in Chapter 1. The chapter presents the main contributions as well as avenues for future research.

Part 6: Bibliography and Appendices

Chapter 16 contains the full list of references cited across all the above chapters.

Chapter 17 contains the appendices.

Part 1

Theoretical Framework

Notes

In this first part of the thesis, I present the theories I use to describe and discuss my case study findings and answer the research questions presented in section 1.5.

As stated in section 1.4, I focus on two phenomena: psychological safety and digital mindsets. These two theories together provide a framework for how I go about providing knowledge of the industry issue presented in the introduction. Other theories would provide different discussions and knowledge.

My research strategy includes bringing these phenomena to the project management discipline to explain issues about the human-technology relationship in construction project design teams. As design team members make sense of their work environment, including it becoming digital, their perception of psychological safety sets the tone for the team's work climate and affects its performance, including enhancing or hindering digitalization, as visualized in Figure 1.1.

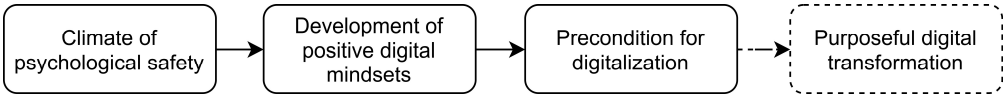

Figure 1.1: Research framework (from section 1.4)

As outlined in Figure 1.3, this part of the thesis is organized into four chapters. The first two chapters, 2 and 3, serve as the foundation for the research presented in the thesis. Specifically, chapter 2 examines the concept of psychological safety, including its antecedents and outcomes, as well as related concepts. Following this, chapter 3 delves into the concept of digital mindset, exploring the underlying theories and describing the antecedents of this phenomenon.

Chapter 4, entitled "Change and Development of Perceptions", provides a theoretical framework for contextualizing the research and studying and connecting the main theories presented in the previous chapters. The chapter begins by defining digitalization and digital transformation, followed by an examination of organizational culture and climate development. Given that psychological safety and digital mindset evolve through social processes, the chapter also introduces three social theoretical perspectives to analyze how individuals understand these mechanisms.

Finally, chapter 5, "System Perspective", presents theories of socio-technical systems and loose and tight couplings. These system perspectives are used to bring the research findings to an industry level and to provide a theoretical discussion of the final assumption presented in Figure 1.1.

Throughout all chapters, the theories are linked to existing theoretical knowledge on design teams in construction within the project management discipline.

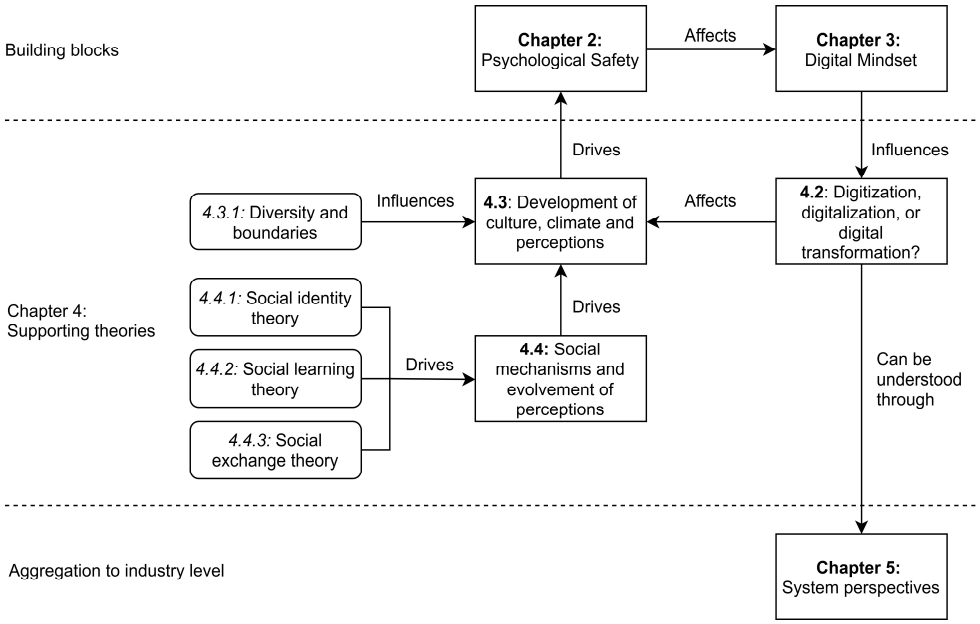

Figure 1.3: Flowchart representation of theoretical chapters

Chapter 2
Psychological Safety

> "We have a taken-for-granted belief that we're supposed to have answers, not questions."
>
> Amy C. Edmondson
> Organizational researcher

2.1 Introduction

This chapter introduces psychological safety as a concept, describes its antecedents and characteristics, and differentiates it from the similar concepts of psychosocial safety climate and trust. Lastly, it clarifies the thesis's terminology surrounding psychological safety.

Psychological safety was first explored in the 1960s by organizational scholars (Edmondson & Lei, 2014; Newman et al., 2017). Schein and Bennis (1965) explained the phenomenon as necessary in change management as it creates a tolerance for failure and reduces the barriers to change. Later, Schein (1985) argued that learning anxiety, which disrupts productive learning behavior within an organization, is reduced by psychological safety in situations that are not consistent with our expectations and hopes.

The phenomenon of psychological safety gained new interest in the 1990s and has become an important concept in collaborative-focused research today (Edmondson, 1999a, 2004; Edmondson & Lei, 2014; Newman et al., 2017). Kahn (1990) defined it as "being able to show and employ one's self without fear of negative consequences of self-image, status or career." In a qualitative study at the individual level, Kahn (1990) emphasized that psychological safety is necessary for individuals to become engaged in their work. Later, Edmondson (1999a) defined psychological safety at the group level as "a shared belief held by members of a team that the team is safe for interpersonal risk taking." Studies have shown the importance of psychological safety in facilitating collaborative work, particularly when workgroups face uncertainty and change and need to learn together (Edmondson & Lei, 2014).

These definitions suggest that psychological safety is analyzed at the individual, group/team, and organizational levels (Edmondson & Lei, 2014; Frazier et al., 2017). The research on the

different levels has been developed over time and kept its relevance. Schein and Bennis (1965) and Kahn (1990) analyzed psychological safety as an individual-level cognitive state where the outcome is related to the self. More-recent work considers psychological safety as an individual experience with outcomes attributed to engagement and creativity at work and organizational commitment (Edmondson & Lei, 2014). For example, Kark and Carmeli (2009) found psychological safety to predict involvement in creative work, and Siemsen et al. (2009) examined its effect on knowledge sharing among co-workers. Edmondson (1999a) framed psychological safety as a group-level construct, emphasizing that the team shares experiences even though team members hold individual perceptions of interpersonal risk. In recent years, the phenomenon has also been analyzed at the organizational level, emphasizing cultures for efficiency (Andersson et al., 2020; Edmondson & Lei, 2014). Fraizer et al. (2017) found validation for the multilevel composition of psychological safety and the generalizability of cross-level theories.

Today, psychological safety is most often studied at a group level, following Edmondson's (1999a) description of it being a construct that characterizes the team as a unit. Psychological safety has dominantly been treated as a mediator at the team level, explaining how context and behaviors can affect work outcomes (Edmondson & Lei, 2014; Newman et al., 2017). Most of these studies have used versions of Edmondson's (1999b) 7-item scale (Newman et al., 2017). The scale captures shared perceptions within a team as to whether individuals believe that others will not reject members for being themselves, whether team members care about each other as individuals, whether team members have positive intentions for one another, and whether team members respect the competence of others. According to Newman et al. (2017), the scale has been tested and shown to have strong content, criterion, and construct validity. For the research for this thesis, I follow Edmondson's definition:

> Psychological safety describes individuals' perceptions about the consequences of interpersonal risks in their work environment. It consists of taken-for-granted beliefs about how others will respond when one puts oneself on the line, such as asking questions, seeking feedback, reporting a mistake, or proposing a new idea. (Edmondson, 2004)

This definition of psychological safety does not entail the absence of pressure, complexity, or problems, and it must not be mistaken for meaning a cozy environment where everyone must be close friends. With psychological safety, one can focus on productive discussions for a common goal because individuals do not have to focus on self-protection (Edmondson, 2004).

Edmondson defines psychological safety in relation to organizational work teams. In this context, work teams are groups of between four and twenty people within the context of larger organizations with a clear membership and obligation for the team product. Psychological safety among team members that work closely together will be highly similar, as they are subjected to the same contextual influences and share the same experiences (Edmondson,

1999a). Similarly, McKinney (2020) compares psychological safety to relation-based systems, where the implications are based on the individuals' contexts and experiences. Therefore, an individual can have different experiences of psychological safety in the same organization if involved in several teams. For example, behavior such as speaking up can be impossible in one group but natural in another due to the beliefs about interpersonal consequences (Edmondson, 2004). Thus, Frazier et al. (2017) describe it as a workplace construct. From this description, individuals make a risk assessment of an interpersonal climate before deciding to proceed with a behavior.

Construction design teams differ from work teams, where members have permanent membership in an organization (Lundin & Söderholm, 1995; Packendorff, 1995). The design team varies in size and diversity of roles depending on, for example, the complexity of the project, the delivery model, and what phase the project is in. Project or temporary teams are often used to describe design teams, defined as interdisciplinary groups responsible for solving complex tasks over a limited period (Buvik & Rolfsen, 2015; Keith, 2017). In this context, multidisciplinary means that team members have complementary skills employed from several firms (Knotten, 2018). To utilize the potential benefits of this diversity, the project teams must integrate the relevant knowledge and skills that are distributed among their members (Packendorff, 1995). This integration requires learning through communication and collaboration without having the benefit of a stable organization and a long-perspective working relationship. Work design, especially interdependence, strongly affects perceptions of psychological safety (Frazier et al., 2017). In teams where members are dependent on each other to get their jobs done, psychological safety is more likely to develop.

Nevertheless, the temporary nature and the pressure to perform, coupled with changing permutations of team membership in design teams, can create barriers to culture and learning development (Keith, 2017; Knotten, 2018). Han and Hovav (2013) found that, due to time constraints, team members tend to use stereotypes based on previous experience in their sense-making strategy of trusting their team members. Stereotypes could lead employees to judge new teams and not engage in building a shared collaborative model. Also, the task-focused tendencies of temporary teams can limit a team's ability to form shared mental models. Based on the description of design teams, the need for psychological safety is highly relevant but challenging to achieve.

Ultimately, psychological safety may be a barometer for team success, especially in a technologically motivated change situation. However, despite the promise of positive outcomes, psychological safety alone may not be enough to succeed in innovation processes. For example, Detert and Edmondson (2011) examined implicit theories about voice and found that psychological safety did not strengthen specific beliefs about when and why speaking up is risky. They found that implicit theory, which describes individuals' beliefs regarding the

nature of human attributes (Dweck, 2012), supplemented psychological safety in explaining the variance in voice behavior. Thus, psychological safety is not necessarily enough to predict behaviors, and there are also effects from other individually held beliefs.

Similarly, Edmondson (2004) described that psychological safety is not necessarily sufficient for ensuring learning behaviors. There must also be shared goals and structural support for thoughts and actions. People are more likely to engage in learning-oriented activities if they believe that their effort makes a difference in achieving an outcome they have a relation to. Likewise, Higgins et al. (2020) describe that psychological safety works best when coupled with other levers and that it works as a catalyst that needs to be directed. They found psychological safety not to have a positive effect alone but that it amplified the positive effect of felt accountability on organizational performance over time. Without cognitive resources, e.g., inputs from others, new ideas are not likely to happen. Also, follower creativity will be higher when both psychological safety and knowledge sharing are present (Wang et al., 2018).

Nevertheless, what has been confirmed by several studies is that psychological safety creates an environment where the benefits of taking interpersonal risks outweigh the cost (Edmondson, 1999a). The phenomenon has been found to enforce personal engagement (Kahn, 1990), knowledge sharing (Frazier et al.,2017), performance (Huang et al., 2008; McKinney, 2020), speaking up (Casciaro et al., 2019; Detert & Burris, 2007), learning behavior and innovation (Edmondson, 2018), reduction in anxiety caused by changes (Schein, 1993), and team efficacy (Yin et al., 2019).

2.2 Antecedents

As psychological safety has been studied at different levels, so have the antecedents. Factors affecting the development of psychological safety can be broadly categorized as individual attributes, leader behaviors, team characteristics, and organizational context (McKinney, 2020). I will present research for each category in this section before summarizing the antecedents in Table 2.1.

Individual attributes.

Individual differences may create a variance of psychological safety as it is individually held beliefs. For example, proactive personalities are more likely to engage in change and lower their threshold for experiencing greater psychological safety (Detert & Burris, 2007). Similarly, Edmondson and Mogelof (2005) found that people open to change, have a greater perception of psychological safety when facing interpersonal risks. In their study of care teams, Remtulla et al. (2021) found that shy personalities create barriers to psychological safety, whereas vocal personalities emerged as facilitators. Psychological safety thereby relies on exploring the

personality of oneself and teammates to establish how individuals can best be supported in the work environment.

Still, Edmondson and Mogelof (2005) found that the only personality variable impacting psychological safety was neuroticism and that extroversion did not have an impact. Likewise, Google's Project Aristotle found that "the whom of the equation were not relevant," What distinguishes good teams from dysfunctional ones was how they treated one another, not their personalities or intellect (Duhigg, 2016).

Another aspect of an individual's attributes is that people do not enter a team with a blank slate. Their sense-making and perspectives are shaped by experiences and expectations (McKinney, 2020). A consequence is that individuals may attach unacknowledged roles formed by their expectations to team members, altering the team dynamic (Kahn, 1990). Individual differences and experiences may create situations where their behavior has little to do with psychological safety.

Leaders' impact and behaviors.

Leaders can reach performance goals if they put effort into fostering psychological safety. For example, Gottfredson and Aguinis (2017) describe psychological safety as how leader-membership exchange links leadership behavior and follower performance. Leaders who set clear expectations and objectives are more likely to facilitate psychological safety as employees understand their anticipations. A leader must be available, make sure the team is connected, and be "supportive, resilient, and clarifying" (Kahn, 1990). Therefore, psychological safety should be a leadership goal, not just a byproduct of collaboration.

Different leadership styles have been positively linked to psychological safety. In their review, Newman et al. (2017) found studies showing the mediation effect of psychological safety on ethical, shared, and change-oriented leadership to reach employee learning behavior. Also, the transformational leadership style has been found to be influential on perceptions of psychological safety (Carmeli et al., 2014; Frazier et al., 2017; Kumako & Asumeng, 2013; Schaubroeck et al., 2011). Kumako and Asumeng (2013) found that transformational leadership strengthens the positive relationship between psychological safety and learning behavior. Yin et al. (2019) found empirical support for the impact of transformational leadership on knowledge sharing, where psychological safety mediated the impact. Carmeli et al. (2014) concluded that transformational leadership "cultivates employees' capacity for creative problem-solving." Due to the relational focus, the transformational leader's characteristics (supportive context, facilitating goals, mentoring) are similar to the preconditions for psychological safety (Edmondson, 2018; Kumako & Asumeng, 2013; McKinney, 2020). Lately, researchers have focused on supportive leadership behaviors such as inclusiveness, support, trustworthiness, openness, and integrity (Newman et al., 2017).

Yet, having power figures in a group can also challenge psychological safety, as formal power relations affect team members' beliefs about the consequences of taking interpersonal risks (Edmondson, 2004). For example, Edmondson describes that team members' perceptions of how leaders will use their power likely affect psychological safety. Similarly, Kahn (1990) found that individuals did not feel safe when they felt disconnected, especially when there was a difference in the level of power or position.

Leader inclusiveness can help power distance and cross-disciplinary teams overcome differences to collaborate on process improvement (Nembhard & Edmondson, 2006). Leader inclusiveness is a supportive leader behavior and is defined as "words and deeds by a leader or leaders that indicate an invitation and appreciation for others' contribution" (Nembhard & Edmondson, 2006). In other words, it contains leaders' initiatives to include followers in decision-making and conversations in which their input would otherwise be overlooked. Edmondson (2004) identified three inclusive traits in leaders: accessibility, inviting input, and modeling for openness and weakness. When leaders are open to inputs and make themselves accessible and available both physically and psychologically, it may help develop perceptions of it being psychologically safe to share ideas and thoughts (Hirak et al., 2012). Notably, there must be a constructive response to the inputs, or else status boundaries will prevail. This is also described as leader behavioral integrity (O'donovan & Mcauliffe, 2020). Thus, it is a means to overcome disparity diversity, explained in subsection 4.3.1. Leader inclusiveness has been shown to be vital in developing psychological safety, which leads to speaking up and engagement (Nembhard & Edmondson, 2006), as well as learning from failure (Hirak et al., 2012).

Coaching behavior is similar to leader inclusiveness, but it describes facilitating group processes and providing clarification and feedback (Edmondson, 1999a; Nembhard & Edmondson, 2006). It includes providing feedback that helps employees better comprehend goals and responsibilities (Kim et al., 2013). Therefore, coaching behavior is essential to handle knowledge barriers that arise from variety diversity, explained in subsection 4.3.1. To understand errors and not place blame, team members need to understand and respect the unique contribution of roles and how they are interrelated (Carmeli & Gittell, 2009).

Another supportive leader behavior that reduces power distance is participative leadership. Participative leadership involves sharing decision-making and delegating authority to subordinates (Nembhard & Edmondson, 2006). It includes inviting input as for leadership inclusiveness; however, it is more directed towards tasks to move the project or organization forward. Instead of a top-down approach to managing a team, there is more of a democratic approach to leadership.

The described leader qualities or behaviors require awareness and learning, and few studies describe how leaders can practice stimulating the development of psychological safety.

Edmondson (2004) describes “practice fields” where leaders can test different strategies and learn. Having training can help them create a climate for psychological safety when it counts, and team members will see that there is an understanding that getting it right the first time is not always possible. Project and design managers in construction are under time constraints and do not have the luxury of “testing before implementing” situations of collaboration. However, they could enable casual settings where discussions are free from decision-making.

Leaders significantly impact whether perceptions of psychological safety are high or low since they directly influence followers’ sense-making, and the psychological safety climate influences employees’ perceptions of connection with the organization (McKinney, 2020). This effect of supportive leadership and a supportive context rests on social learning theory, presented in subsection 4.4.2.

Team characteristics.

Contextual factors such as team size, nature of work, and complexity (Edmondson, 2004) matter for psychological safety because they may shape group norms and practices. For example, working virtually (Feitosa & Salas, 2021; Lechner & Mortlock, 2022). Norms and workplace practices differ by industry, and the construction industry can shape what antecedents matter for psychological safety. For example, the degree of diversity described in subsection 4.3.1, which characterizes design teams.

Furthermore, as design members of a construction project are external professionals, they can base their perception of psychological safety on factors related to norms and practices within their specific discipline. Thus, having cognitive structural clarity can be salient, for example, understanding each other’s roles and valuing each team member’s unique contribution to avoid harmful competition where they do not learn from failure (Carmeli & Gittell, 2009).

Systems for information sharing are essential to avoid leaving employees in an information vacuum where team members feel unsafe and have fairness concerns (Edmondson, 2004). An information vacuum may create the feeling of not being included in the relational network and gaining from social capital (resources in the form of information and social support).

Relatedly, Fraizer et al. (2017) found that receiving support from your peers is a key characteristic of work design that facilitates psychological safety. Trust and mutual respect are essential parts of peer support (Edmondson, 2004). Even though trust is similar to psychological safety, it does not capture how valued and comfortable employees are. When individuals feel that peers value their contribution and care about their well-being, they have stronger perceptions of psychological safety (Edmondson et al., 2001; H. Lee, 2021; Schepers et al., 2008; Singh et al., 2018). An explanation is that peer support may help employees to network with each other, increasing resources, and therefore has a more substantial effect than organizational support (Singh et al., 2018).

Organizational factors.

Still, perceived organizational support has been demonstrated to support the development of psychological safety (McKinney, 2020; Singh et al., 2018). Employees' perceptions of how much the organization values their contributions and cares about their well-being are referred to as perceived organizational support (Eisenberger et al., 1986). It incorporates a guarantee that the firm will help one complete a task or deal with a challenge. Since the theory of perceived organizational support is based on the social exchange theory, defined in subsection 4.4.3, it employs the principle of reciprocity to explain the social exchange between employees and employers (Sun, 2019). Based on the principle of reciprocity, when feeling supported by the organization, individuals will adopt attitudes and behaviors expected by the organization (Sun, 2019). According to organizational support theory, perceived organizational support comes from individuals' tendency to humanize organizations (Rhoades & Eisenberger, 2002). Because of this, for example, the leaders' actions may be attributed to the organization. Therefore, it is important to be aware of how organizational structures may affect employees' perception of organizational support because a leader's action may be attributed to the organization itself. However, the effect of organizational support is more distant than that of team characteristics (Edmondson, 2004).

Edmondson (1999a) found that the significance of context support in the development of psychological safety is limited, as psychological safety can grow in the absence of individuals' perceptions of context support. Simultaneously, although psychological safety is a social cognitive process, structural elements such as task design and context support, including adequate resources, information, and rewards, have been found to have an impact on its development (Edmondson, 1999a; Frazier et al., 2017; Kahn, 1990). Access to resources and information, for example, may diminish insecurity and defensiveness in a team. Interestingly, Frazier et al. (2017) stated that work design and leadership might facilitate psychological safety more than individual attributes.

Construction projects serve as interesting examples of when organizational structure may or may not support employees, as projects differ significantly (Lundin and Söderholm, 1995). For example, PDM's structure defines the relational network, including the information flow. Miller et al. (2000) defined PDM as "a system for organizing and financing design, construction, operations and maintenance activities that facilitates the delivery of a good or service." There are several kinds of PDMs, defining roles, decision gates, and stages (Klakegg, 2017). Some PDMs have collaboration among all stakeholders as one of the main goals (Lahdenperä, 2012). Collaboration as a goal where information is transparent could help employees understand the distribution of resources and avoid the information vacuum that is more common in the hierarchy and transaction-based models and barriers to developing psychological safety.

Table 2.1 summarizes different antecedents identified in the psychological safety literature relevant to this thesis's research questions. Most of the antecedents have been found to facilitate the development of psychological safety. However, some antecedents, such as team size and diversity, may be barriers as well.

Table 2.1: Antecedents of psychological safety

Antecedents	Description
	Individual attributes
Experience	Past experience with roles can create implicit theories of who knows what depending on their role in the team or what discipline they belong to. These unacknowledged roles may harm the team dynamic (Kahn, 1990).
Personality	Individuals who are open to change are less likely to feel vulnerable in work situations (Edmondson & Mogelof, 2005). Thus, proactive and emotionally stable personalities have a greater perception of psychological safety (Detert & Burris, 2007) and are more likely to share knowledge that strengthens a climate of psychological safety (Gong et al., 2012).
	Leader behavior
Inclusive decision making	Inviting employees to participate could foster a better understanding of the team/organization's goals, thus enabling shared goals (Carmeli & Gittell, 2009). Inviting feedback is a behavior that suggests that opinions are valued (Edmondson, 2004).
Structure creating	Leaders should create a structure that facilitates opportunities for cooperative behavior, as power distinction and power distance cause people to avoid seeking help (Edmondson, 2004). Also, structural support can facilitate systematic thought and action needed for effective learning behavior to occur.
Accessibility	Leaders can reduce belief in barriers to discussions by making themselves approachable (Edmondson, 2004). Likewise, team members must feel that their opinions are welcomed (Edmondson, 1996).
Modeling for openness and weakness	Leader behavior creates beliefs about how they may use their power, and team members often mimic the behavior of leaders (Edmondson, 2004). Also, if the leader is open and coaching oriented, they will most likely learn what their employees are thinking and feeling, helping them create a safe environment.

Antecedents	Description
	Team characteristics
Team size	Smaller teams have more face-to-face interaction where psychological safety is salient. In contrast, groups of hundreds reduce the importance of psychological safety, as many relationships may diminish the number of interactions (Edmondson, 2004).
Team diversity	Teams of different disciplines have to communicate across identity group boundaries, which can affect valid data transfer when there is a lack of coordination, which impacts psychological safety (Edmondson, 1996).
Work setting	Managers should facilitate time and space for interaction among team members for them to get to know each other better, as this will enhance their perception of psychological safety (Siemsen et al., 2009).
Trust and respect	Mutual respect and trust will foster the development of psychological safety (Carmeli & Gittell, 2009). Respect is when others see one as competent, which is essential to enable idea-sharing (Edmondson, 2004). Respect may further be associated with trust in others' abilities (Hakanen & Soudunsaari, 2012; Martin, 2006).
Interdependence	Interdependence of tasks increases the need for psychological safety. When interdependence is high in a team, it can prevent individuals from withdrawing from their responsibility, increasing their interaction, which is positive for the development of psychological safety (Deng et al., 2019).
Informal dynamics	Typical characters (mom, joker, etc.) can be assigned in teamwork, and the position of these unacknowledged roles in the group can affect the experience of psychological safety (Kahn, 1990). Also, relationship conflicts can negatively impact psychological safety as they harmfully impact information sharing and group dynamics (Chen et al., 2011).
Role clarity	Roles have function-specific goals, specialized knowledge, and status differences. To feel psychologically safe, team members must understand and respect the unique contribution of each role in the team and how they are interrelated, which is needed to embrace failure and not place blame (Carmeli & Gittell, 2009).
Shared goals	In teams with different function-specific goals, there must be shared goals that transcend the role-specific goals to enable knowledge sharing, which is essential for the development of psychological safety (Carmeli & Gittell, 2009).

Antecedents	Description
Information and knowledge sharing	Several researchers have found knowledge sharing to facilitate psychological safety (Carmeli et al., 2009; Carmeli & Gittell, 2009; Chen et al., 2011). Information sharing may increase psychological safety as receiving information conveys a perception that it is safe to engage in collective behavior (Schulte et al., 2012).
Accountability	Without accountability, psychological safety may result in people becoming too comfortable, leading to poor performance (Higgins et al., 2020; Weiner et al., 2021).
	Organizational factors
Equal resources	Equal access to resources and information can reduce insecurity and defensiveness in a team (Edmondson, 2004), also described as context support. This could, for example, be an outcome of the organizational structure.
Structure	Top-down hierarchies tend to create barriers to speaking up, as people feel they have too little influence and will not be heard. Also, power distance can create fear of hurting their career or their social capital by leaving co-workers feeling betrayed if they speak up.

2.3 Observable characteristics of psychological safety

I have mentioned some of the many beneficial outcomes of psychological safety. The main takeaway for many organizations and leaders is that psychological safety has been researched and found to promote increased efficacy and performance. Most of these studies rely on self-reported measures (Edmondson & Lei, 2014). These surveys are not directly usable for field observation. As a guide to observing psychological safety, I have in the following described outcomes and developed a framework of behaviors that have been found to characterize psychological safety.

Since psychological safety as a field of interest was initially grounded in the organizational learning literature, several studies have focused on learning and performance outcomes (Newman et al., 2017). Learning from failure and dynamic learning processes as an outcome of psychological safety has kept researchers' interest, as it has been found to enable higher performance (Carmeli et al., 2009; Carmeli & Gittell, 2009; Edmondson, 1999a). Learning does not necessarily produce a change in behavior, as observable change is the product of the learning process. Still, one can identify learning-oriented behaviors as seeking help and feedback, sharing information, experimenting, and speaking up (Edmondson, 2004). These activities make the team aware of changes and the consequences of their actions.

Edmondson (2018) described that the opposite of psychological safety would be a culture of silence. Employees may not speak up for a variety of reasons, including fear of new routines (Schein, 1985), location created barriers (Edmondson, 1999a), or hierarchy creating power differences (Bisel and Arterburn, 2012). Fears that obstruct the open interchange of ideas, concerns, or questions cannot be seen directly (Edmondson, 2018). Only the person who withheld facts or knowledge would completely understand what had occurred. Dyne et al. (2013) described that there is a difference between the absence of employees' voices and employee silence. Employee silence is when individuals intentionally withhold ideas, information, and opinions relevant to improvements in work and work organizations. Silence can be motivated by disengagement, protection of others, or self-protection, as with a low-level of psychological safety. The problem with the absence of voice is that it provides fewer cues for the observers to use in their sense-making processes. Voice is especially difficult when team members are dislocated (Feitosa & Salas, 2021; Lechner & Mortlock, 2022).

Another broader outcome category is innovative behavior, or innovation in itself (Edmondson, 2004). With a climate of psychological safety where leaders invite input, people are more likely to offer their insights on improvements. When information sharing and experimenting is a collaborative norm, the quality of innovation may increase as team members' cognitive resources increase with new valuable knowledge. Also, when people participate in innovation processes, they are less likely to resist the following changes. Schein (1996) goes as far as saying that change is better defined as managed learning. Behaviorally, innovation can be observed as, for example, experimenting and offering new ideas. Despite the documented benefits, Baer and Frese (2003) described that psychological safety is often neglected in process innovation.

Today, the list of publications on the outcomes of psychological safety is increasing. Table 2.2 is not exhaustive, but the observable behaviors have been chosen to help inform the research questions concerning psychological safety in section 1.5.

Table 2.2: Observable characteristics of psychological safety

Observable outcomes	Behaviors and high-level of psychological safety	Behaviors and low-level of psychological safety
	Individual behavior	
Speaking up	Team members speak up to clarify mistakes or have a discussion across status and role boundaries (Edmondson, 2004).	People do not speak up about concerns or mistakes as they fear they are stepping outside their responsibility and might be judged (Bisel and Arterburn, 2012; Edmondson, 2004).
Seeking help	When facing problems, individuals seek help from the team (Edmondson, 2004). Help-seeking can increase awareness of opportunities for collaboration.	Individuals perform their tasks alone. Help-seeking is low when there are clear power boundaries and the possibility of being judged (Edmondson, 2004).
Seeking feedback	Individuals seek feedback on their work. An environment that diminishes the belief of being humiliated can encourage feedback-seeking (Edmondson, 2004).	Less psychological safety creates learning anxiety and loss of self-esteem, hindering people from requesting feedback (Edmondson, 2004; Schein, 1996).
Engagement	Individuals connect with others and promote active and full role performance, as the self and role exist in a dynamic relation (Kahn, 1990).	Individuals withdraw and defend themselves when performing their roles, as they feel a need to uncouple themselves from the role to protect themselves (Kahn, 1990).
Learning	Supportive groups help individuals overcome anxiety, making learning easier (Schein, 1993).	Individuals tend to get stuck or frozen in changing situations (Kahn, 1990).
Flexibility	Individuals need to feel safe to change their behavior (Schein & Bennis, 1965). Thus, individuals take the freedom to be flexible when it comes to new challenges.	Team members hesitate or avoid taking on extra tasks outside their responsibility to help the team when challenges require it.

Observable outcomes	Behaviors and high-level of psychological safety	Behaviors and low-level of psychological safety
Creativity	Individuals generate useful ideas or problem solutions. Trust relationships facilitate individuals' creativity (Gong et al., 2012).	Individuals hesitate to explore, as creative solutions seem unrealistic, and involvement may lead to negative personal outcomes, such as looking foolish (Wang et al., 2018).
	Team characteristics	
Collaboration	Psychological safety prevents the negative effects of relational conflicts (Bradley et al., 2012). Individuals will collaborate across role and discipline boundaries. Team members handle their tasks together, utilizing collective intelligence (Edmondson, 1999a).	In teams with less psychological safety, people tend to blame each other and not interact across role boundaries (Edmondson, 2004).
Experimenting	Team members look for creative solutions (innovative behavior) to become more efficient (Edmondson, 2004).	Team members hesitate to engage in innovative behaviors and are resistant to changes (Edmondson, 2004).
Improvement	Improvement is a collective commitment, not only the leader's responsibility. Psychological safety is a condition for constructive task conflict (Chen et al., 2011; Edmondson, 1999a)	Improvement is the leaders' responsibility, and employees do not cross the responsibility perceived within their role (Carmeli & Gittell, 2009).
Knowledge sharing	Psychological safety increases with the frequency of sharing tactic knowledge (knowledge that is not necessarily correct) (Siemsen et al., 2009).	Individuals do not share knowledge voluntarily, leading to leaders having to search for who knows what in the team (Siemsen et al., 2009).

2.4 Similar concepts

A problem with theories is that they can be similar, making it confusing to maneuver among different academic disciplines. This applies to psychological safety, which crosses boundaries with several concepts (Bell et al., 2012; Schneider et al., 2012). In the following, I separated psychological safety from two of the most similar concepts: psychosocial safety climate and interpersonal trust.

Psychosocial safety climate.

A newer construct, psychosocial safety climate (PSC), has been described as having similarities to psychological safety. PSC stems from organizational climates, which address the meaning people attach to their work experience (Schneider et al., 2012, p. 380). As a consequence of organizational climate theory being criticized for being too general to be meaningful (Schneider & Reichers, 1983), the concept of safety culture was developed, focusing on the organizational climate of physical health and safety. Safety culture is defined as shared perceptions of the commitment and performance of employees regarding safety practices, which is crucial at, for example, construction sites with a high risk of accidents (Shen et al., 2015). PSC was later described by Shen et al. (2015) as the conceptualization of safety culture at the individual level, emphasizing psychological health.

PSC was introduced and defined by Dollard and Karasek (2010) as shared perceptions of organizational policies, practices, and procedures to protect workers' psychological health and safety. Dollard and Bakker (2010) describe PSC as an antecedent for psychological safety. In the psychological safety literature, safety is directed by the working conditions, whereas in the PSC literature, work conditions create the conditions for safety. Also, safety in PSC goes beyond interpersonal factors, including freedom from psychological harm and injury, such as work pressure and low job control. In contrast to psychological safety being optional, Dollard and Bakker (2010) explain that conditions for PSC can be mandated legally through laws at the societal level to protect workers.

Applying PSC requires a structure-based approach, researching how one can create a structure for safety behaviors from an organizational and managerial perspective. In regard to the questions raised in this thesis about how design team members cope with digitalization, I argue that the first step is to understand individuals' acceptance and help-seeking when it comes to technological changes. A next step could be applying PSC to design policies, practices, and procedures in line with an understanding by combining the theory of psychological safety and digital mindsets. However, this next step is outside the scope of this thesis.

Interpersonal trust.

A more established concept related to psychological safety is trust. Both concepts describe intrapsychic states in interpersonal situations, especially the perceived risk of vulnerability (Edmondson, 2004). Mayer et al. (1995) defined trust as "the willingness of a party to be vulnerable to the actions of another party, based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party." From this definition, trust is a multilevel concept.

Interpersonal trust offers a group-level understanding of trust (Rockstuhl & Ng, 2008). As Jingjing et al. (2019) described, interpersonal trust refers to confidence in another person or between two persons and a willingness to be vulnerable to that person or each other. Research conducted within organizations has extensively investigated personal, dyadic, and contextual factors that motivate interpersonal trust and the consequence of interpersonal trust for the trustor and the trustee (Jingjing et al., 2019). Thus, psychological safety and interpersonal trust overlap, but the concepts differ in focus, timeframe, and often the level of analysis.

First, trust places the focus on the *other's* action of trustworthiness, giving them the benefit of the doubt (McKinney, 2020). When choosing to trust someone, people make an evaluation of their advantages from the other person's action and their incentives to honor that trust. In that matter, people manage the risk associated with interpersonal situations by monitoring others (Edmondson, 2004). Psychological safety indicates that others give *you* the benefit of the doubt when you, for example, report an error or a mistake. Psychological safety includes how valued and comfortable employees feel in a work setting. In an unsafe environment, people will monitor their actions to protect them from vulnerability.

Second, the construct of trust consists of anticipated long-term consequences, whereas processes of psychological safety consider the short-term interpersonal consequences one expects from engaging in a specific action (Edmondson, 2004). For example, the experience of being humiliated when seeking help will affect the perceived risk in a similar situation later. Notably, the consequences of a negative experience when asking a question can discount long-term consequences of not speaking up or seeking help harming the team collaboration.

Third, there is a difference in the level (individual, group, organization) at which the two concepts exist. Trust tends to happen in dyadic relations between individuals or firms. Edmondson (2004) describes that psychological safety is an emergent property of the collective. The presence or absence of psychological safety tends to be experienced at a group level, as team members are exposed to the same influences and shared experiences.

2.5 Clarification of terminology

The terminology surrounding psychological safety has grown as research in this area expands. In this thesis, I adopt Edmondson's preferred term, "psychological safety." To clarify the specific connotations of the terminology used, I provide definitions and reference relevant studies where the term has been employed. In addition, these connotations summarize the prior sections.

Psychological safety refers to a shared belief that the workplace is safe to take risks, express opinions and ideas, and ask questions without fear of negative consequences (Edmondson, 1999a). The level of psychological safety felt in a team describes the group level of the phenomenon.

Characteristics of psychological safety refer to behaviors that may be observed, such as speaking up, engagement, and collaboration (Edmondson & Lei, 2014). It may also describe norms that facilitate psychological safety.

Perceptions of psychological safety is a general term that refers to how any group of individuals perceives the safety of their work environment (Nembhard & Edmondson, 2006). An individual's perception of psychological safety refers specifically to the individual.

Psychologically safe is an adjective used to describe an individual's perception of their work environment (Nembhard & Edmondson, 2006).

The climate of psychological safety refers to the overall climate or environment of an organization or team in terms of psychological safety (Bradley et al., 2012).

The development of psychological safety is an ongoing process that requires conscious effort and investment from leaders, managers, and employees alike (Carmeli & Gittell, 2009). It involves creating a supportive and inclusive environment where everyone feels valued, respected, and heard.

The antecedents of psychological safety refer to the factors or conditions that lead to the development of psychological safety (Edmondson & Mogelof, 2005). Contextual effects are closely related and refer to how the physical, social, and organizational environment can impact the level of psychological safety within a team or organization.

Barriers to psychological safety refer to factors that prevent individuals from feeling psychological safety (Remtulla et al., 2021). For example, it may be power balance, unclear roles, lack of trust, poor communication, lack of inclusion, and diversity.

Outcomes of psychological safety refer to the result or outcome of a climate of psychological safety (Edmonson & Lei, 2014). These outcomes may include increased creativity, innovation, productivity, and job satisfaction.

Chapter 3
Digital Mindset

> "It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change."
>
> Charles Darwin
> British naturalist, geologist, and biologist

3.1 Introduction

This chapter presents the concept of digital mindset. In the following, I first contextualize digital mindsets to the design phase, then define digital mindsets, and lastly, their antecedents.

Digital mindsets must be understood in the context of digitalization. Digitalization will be discussed more comprehensively in section 4.2, and it is only dealt with here insofar as it offers a context to digital mindsets. For initial reference, digitalization can be defined as turning communication, business operation, and models into more digital ones (Schallmo & Williams, 2018). It includes transforming processes and necessitates change.

What is unique about technology usage in the design phase compared to longer-lasting work teams is that design team members have different experiences with the usage and processes of technology. Often they use different discipline-specific technology decided by their employer company. Nevertheless, the team is part of a temporary project organization (TPO) and will have a shared experience in using information management and collaboration tools. Project-specific tools are not necessarily new for some members, while for others, they are. Also, the wanted value from using the technology may differ from their previous experiences, as their usage depends on the digitalization strategy for the specific project. For example, collaborative delivery models are structures affecting work processes, partially motivated by the possibilities provided by information technology (Whyte, 2019). This nature of how technology is implemented and changed represents an ambiguity that makes it difficult to manage.

Technology usage in construction is constantly changing, and individuals working in TPOs need to adapt quickly to digitalization. The technology acceptance model has been widely used to understand the acceptance and usage of new technology (Y. Lee et al., 2003). However, the

model is extensively focused on technology adoption in the form of usefulness and ease of use. Digitalization presents larger forms of change and requires more than a top-down strategy; there must also be voluntary employee engagement (Solberg et al., 2020). A digital mindset is a set of attitudes and behaviors that enable employees to see and understand possibilities that come from technology, not only the tools' ability (Kamath, 2019). The ability to use technology eases the possibility of gaining a digital mindset, but there must also be motivation and willingness to do so.

3.2 Digital mindsets

In this section, I describe and define what a digital mindset is in the context of this thesis. Digital mindset has become a buzzword to express the need to think differently in relation to digitalization and digital transformation (Solberg et al., 2020). A digital mindset is not merely about the ability to use digital tools. It is not the same as being digitally savvy. Digital is just as much about people as it is about technology. Efficiency in digitalization requires bringing together people and technology. Technology implementation success differs in organizations that appear similar, as the people involved in the process may interpret the benefit and challenges differently (Edmondson, 2003). A successful digital transformation in organizations is not a digital organization but a confederation of inspired people empowered by technology. Thus, having a digital mindset is equivalent to having an organizational climate or culture that emphasizes the importance of and supports digitalization.

With the background of efficiency in the digital age, a digital mindset refers to people being able to incorporate technology into the work tasks as they have a learning mentality and see digitalization as an enrichment to the team, making them better (Kane, 2017; Kohnke, 2017). Kane et al. (2017) stated that the mindset of the employees is the key to successfully achieving digital maturity in the organization. They stated in their report that "…digital initiatives are two to three times as likely to be successful if there is sufficient commitment behind them." Also, their results show that the right mindset combined with a collaborative network will support an organization to become more digitally mature.

Mindsets can vary within a group (Solberg et al., 2020). Individuals' mindsets about their ability to learn the digital tools and the status of resources can contribute to or hinder a shared understanding of the culture, which will affect transformation initiatives. It is vital to develop a shared mindset or the tools to understand how to manage a variety of individually held mindsets for aligning behavior towards goals or visions regarding digitalization or digital transformation initiatives within organizations.

Solberg et al. (2020) created a model based on implicit theory and social cognition research, where they looked at employees' belief systems and how they were used as sense-making

guidelines to understand the changes that come with digital (business) transformation, which in turn direct their behavior. The argument is that employees will rely on simplifying strategies when facing complexity and uncertainty, requiring an efficient cognitive processing strategy. In my case studies, I used the digital mindset model by Solberg et al. (2020) to gain knowledge of the attitudes and behaviors the design team members have towards technology. The model is based on two individually held beliefs based on implicit theories of the self and zero-sum situations, which are described in the following.

3.2.1 Fixed versus growth mindset

The concepts of fixed and growth mindsets originate from implicit theory. The core of implicit theories are beliefs held by individuals about the nature of human attributes (Dweck, 2012). Implicit theories are essential in interdependent teams, as they can predict how people will judge others. Fundamental beliefs lead to expectations, and expectations lead to actual behavior. For example, if a design manager holds a specific view about a designer's intelligence, that will likely determine how the manager reacts to the team member and what opportunities the designer will receive.

Fixed vs. growth mindset in the context of digital transformation is a discussion of individuals' beliefs about their ability to learn and develop skills when facing new technology (Solberg et al., 2020). Dweck (2012) describes that implicit theories have the greatest effect when people are confronted with challenging tasks or setbacks. Digital tools and new processes take time to learn and can require greater expertise and competence in existing roles. In these situations, people will assess their technical skills and beliefs about the possibility of learning. Dweck (2007) describes fixed vs. growth mindsets as the guidance to our interpretation processes; a mindset is an internal monologue that influences our judgment of and response to tasks. It boils down to individuals' beliefs about effort, failing, and learning when facing complexity that requires continuous learning. We all have a mixture of the two mindsets; however, one of the mindsets tends to be dominant. The balance of the two mindsets affects how we engage when change is required (Nottingham & Larsson, 2018).

A person with a fixed mindset believes personal resources, for example, intelligence and ability, are static and cannot be changed. A situation will either be understood as succeeding or failing (Dweck, 2007, p. 11). People with a fixed mindset constantly need to prove themselves, as every situation is perceived as an evaluation of their limited personal resources. Thus, they feel powerless when things go wrong and do not take action to improve things. It holds people back, as effort is seen as not being smart enough in the first place. Learning from failing is also seen as proof of not being talented enough; smart people always succeed the first time. Thus, people with a fixed mindset tend to avoid situations where they feel out of their comfort zone and give up quickly, turn away, or do not seek help.

On the other hand, people with a growth mindset believe personal resources can be enhanced through efforts, strategies, and help from their environment (Dweck, 2007, p. 11). It entails that people's potential is unknown, and what they can accomplish with learning and training is unknowable. People will differ in their initial skills in a digital context, but everyone can change and grow through application and experience. Not feeling that one is failing and understanding a situation of change as a learning opportunity seems to be the key. Thus, people with a growth mindset will make an effort when facing difficulty, as they see it as a need or opportunity to learn and develop, and they tend to seek out and accept help to reach their learning goals (Solberg et al., 2020).

3.2.2 Zero-sum versus expandable-sum beliefs

The zero-sum vs. expandable-sum is a discussion of people's choices of collaborating or competing when outcomes are interdependent, and resources are believed to be limited (Solberg et al., 2020). The two concepts originate from game theory (Różycka-Tran et al., 2015; Sirola & Pitesa, 2017; Von Neumann & Morgenstern, 2007), which claims that "human behavior is driven by the interplay of self-interest and other-interest." Technology changes how we work, some tasks can be eliminated, and new roles may be required in an organization or a team. How employees believe that these alterations affect them and their co-workers will affect how they respond to the changes.

For people with zero-sum beliefs, resources are limited, whereby the win corresponds with the loss for another. As a result, self and other interests become incompatible and become opposite poles of a situation (Różycka-Tran et al., 2015; Stefaniak et al., 2020). This belief tends to make people compete, which can be positive if the situation requires it, for example, in sports. However, in an organizational setting, people with zero-sum beliefs tend to compete even when it is unnecessary, resulting in poor collaboration (Solberg et al., 2020; Sirola & Pitesa, 2017; Stefaniak et al., 2020). The belief of having to compete for resources can make people avoid the competitor, or it can hinder them from succeeding in the situation.

People with an expandable mindset believe that resources are generally expandable, including that there is an opportunity for all in the given situation to gain. Success is seen as something that grows so that there is enough for everyone involved (Sirola & Pitesa, 2017). The effect is that individuals are just as concerned with helping others succeed as themselves, as gaining is reached through collaborative networks.

3.2.3 The digital mindset matrix

Solberg et al. (2020) created several predictions of individuals' behavior based on the combination of personal (fixed and growth mindset) and situational (zero-sum and expandable-

sum beliefs) resources. Figure 3.1 shows the four combinations they argue can predict peoples' perceptions and responses to technology-driven change.

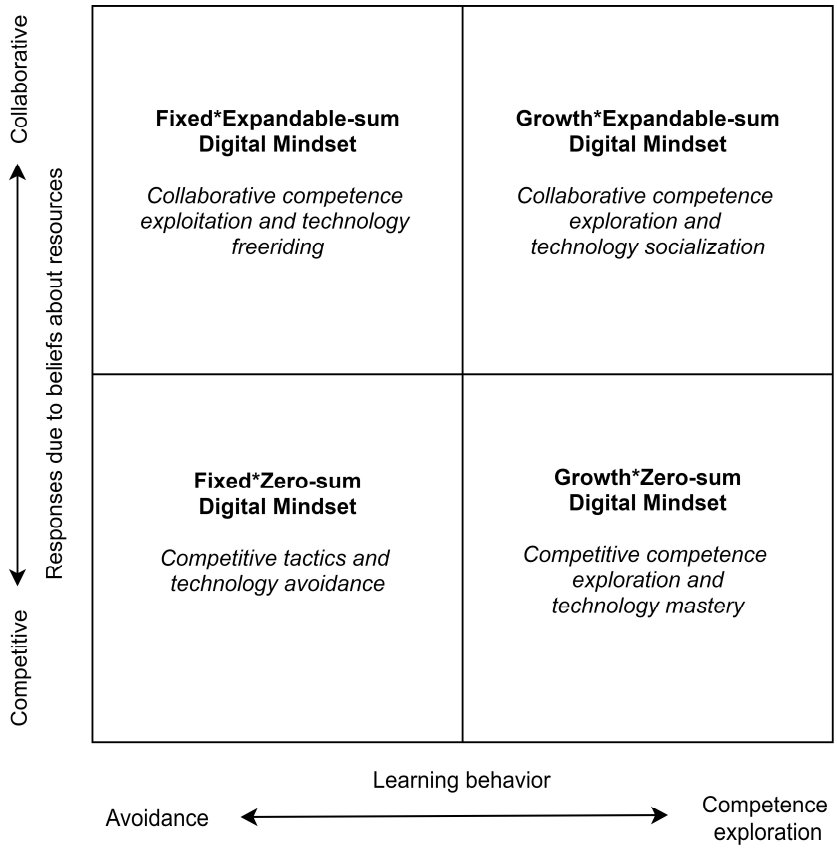

Figure 3.1: Digital mindset matrix, from Solberg et al. (2020)

Figure 3.1 categorizes digital mindsets together with the likely response to technological initiatives. Individuals' use of technology, their support of initiatives, and their interaction with co-workers are predicted to differ due to combinations of beliefs of personal and situational resources when facing digital changes or challenges. How these roles are played out is further described in Table 3.1 on the next page.

It is important to be aware of the different mindsets as they can hinder or support technical initiatives, requiring different facilitating strategies to reach organizational goals. Having a fixed mindset can help you become who you want to be and how to be that. For example, if your manager expects you to have digital competence, then the path to be respected and get confirmation from your manager is to perform well when facing technology. It is a form of gaining self-esteem. Solberg et al. (2020) advise that individuals are made conscious of their digital mindset to either alter it or find solutions to better align with the organization's goal for

digital initiatives. This reasoning is similar to Dweck's (2007) description of how mindsets can be changed and that there is a way to obtain a growth mindset through consciousness and practice. A fixed mindset is often triggered when facing a challenge, failing, feeling competition, or when knowledge is tested. These variables are unavoidable in design teams with constant tasks, processes, and team dynamics changes. Changing to a growth mindset requires taking risks and embracing things that have felt threatening, for example, change.

Table 3.1: Mindset and beliefs about technological changes, based on Solberg et al. (2020)

Beliefs and behavior	**Fixed*zero-sum digital mindset**	**Fixed* expandable-sum digital mindset**	**Growth* zero-sum digital mindset**	**Growth* expandable-sum digital mindset**
		Individual behavior		
Mindset about their ability to develop new technological skills	Limited	Limited	Believes in their ability to learn and grow and enjoy the challenges	Believes in their ability to learn and master new technology
Belief about resources	Technology is threatening, especially when information is hidden	Sees the potential of technological changes for themselves and the organization	Resources are limited, and changes are an opportunity to win	Resources benefit all. Thus, digital initiative is a social experience with information and knowledge sharing
Use of technology	Doubtful and avoidant, seek what they can already	Minimizes interaction with technology	Makes an effort to learn and expands role boundaries to engage in new tasks	Takes the initiative to learn and improve the functionality of tools and processes
Support for digital change	Undermines initiatives and redefines their role to avoid or discredit new technology	Technology cheerleaders that benefit from technology without engaging directly with it	Actively embraces technology-driven change	Optimistic and engages in bottom-up innovation by being proactive and collaborative
Interaction with others	Frames situations as win/lose and will encourage competitive behavior	Finds others with technological skills to collaborate with	Changes their role to secure competitive advantage, reluctant to share knowledge	Engages in collaborative processes, teaches others, and shares knowledge

Beliefs and behavior	Fixed*zero-sum digital mindset	Fixed* expandable-sum digital mindset	Growth* zero-sum digital mindset	Growth* expandable-sum digital mindset
Strategies to assist/ change the different digital mindsets				
Changes individuals can make when aware of their digital mindset	Find a mentor to help them to assess the situation differently, change mindset, or leave for another career	Work closely with others to positively support the technological innovations	Use their competitive view of resources to be leaders or stars of the digital changes	Be change agents and be aware of who needs help and how to integrate new technologies and processes
Leader behavior	Be critical advisors, help change mindsets or to a new job	Pair them with skilled individuals, and find nontechnical tasks positive for the digital initiatives	Provide opportunities for engagement with and mastery of technology	Provide resources for them to be agents of change by helping others become more engaged in the digital initiatives

Employees will always be different, and there will not be a homogenous design team consisting of only a growth/expandable-sum digital mindset. However, according to Solberg et al. (2020), there are ways of supporting employees, for example, through leadership behavior. Table 3.1 provides examples of management strategies to accommodate the different digital mindsets. However, leaders should also take on a broader perspective, looking at the situation to enable the mindsets needed for the specific situation of digital change. This top-down approach is treated as an antecedent in this thesis.

3.3 Antecedents

The mindsets and beliefs about situational and personal resources are conscious and unconscious thoughts that affect behavior (Ancona, 2012; Dweck, 2007; Solberg et al., 2020). When individuals face a new situation, they will have general beliefs, but their engagement and behavior will also depend on their sense-making as they interpret and draw conclusions about what is happening in the specific situation (De Jaegher et al., 2010; Edmondson, 2003). Sense-making is a social activity influenced by contextual factors and actors.

The leader plays a crucial role in influencing employees' sense-making, as their behavior sends signals about what is expected in a situation (Dragoni, 2005; Solberg et al., 2020). Table 3.1 exemplifies what individuals can do and how leaders can help them with their current digital mindset. However, leaders can also actively influence the development and strengthening of

desired mindsets within a group through their achievement priority, role modeling, and guidance (Dragoni, 2005). Based on human cognition research and organizational learning theory, Edmondson (2003) explains that when leaders present technology as a learning opportunity and emphasize the opportunity from technology, technology implementation efforts are more successful. Changes are learning challenges, where shared perceptions about risks and benefits are just as important as the skills needed for the new technology. Edmondson describes this process of creating meaning as framing, where the frame is dependent on individuals' experiences and the understanding of the particular situation. Like the growth/expandable-sum mindset, individuals can have a learning-oriented and goal-achieving frame or a performing-oriented and self-protective frame, similar to the fixed/zero-sum mindset. However, people can learn to reframe, and it rests heavily on leaders' behavior. Given this possibility of a top-town influence, Solberg et al. (2020) emphasized what leaders should be aware of when they are leading a technological change, summarized in Table 3.2.

Table 3.2: Leader strategies for enhancing digital mindsets, from Solberg et al. (2020)

Leader behavior	Explanation of why and how
Develop greater self-awareness about one's digital mindset.	Leaders need to be aware of what signals they send their team/employees about technological changes by monitoring their digital mindset and trying to understand how it influences others.
Personal and situational assessment, is it accurate?	Leaders must assess their understanding of the situation of change and take on a broader perspective regarding resources. For example, it is possible to reskill employees instead of letting them go.
Frame the context in such a way that more positive digital mindsets will flourish.	Frame the change as a learning opportunity. Signal that situational resources are expandable by creating collaborative learning environments and ensuring employees that competence is needed in different ways.
Develop the personal resources and provide the situational resources that enable positive digital mindsets.	When technology changes the organization/team structure, allocate employees by creating new positions and ensure that there are resources for employees to develop the skills needed for the new tasks. These behaviors create situations that enable positive digital mindsets.
Pay attention to, manage, and leverage the diversity of mindsets within the organization.	There will always be a mixture of different mindsets within a team, and individuals will not be either/or in accordance with Table 3.1. But leaders should have an understanding of how to identify and leverage employees' mindsets.
Think critically and seek to understand.	There are situations where the positive digital mindset is not necessarily what the situation needs. Therefore, leaders must assess the situation and seek to understand what mindsets will benefit the technological change process.

In design teams, individuals have different bases for digital mindsets, for example, age, education, and geographical factors. Traditionally, project and design managers get their positions due to years of experience. Their use and understanding of technology will differ from that of younger engineers.

Digitalization may alter experienced leaders' processes and replace them with new procedures that are still in the innovation phase. Another aspect is the nature of design teams, where disciplines and firms have their own traditions and procedures for using technology and training. With digital changes, there will be new practices and processes, and these shifts must be managed in a manner that allows design teams to thrive. For digitalization to be a tool to reach productivity, there must be frameworks for different digital mindsets that allow employees to grow and expand.

Chapter 4
Change and Development of Perceptions

> "There are things known and there are things unknown. And in between are the doors of perceptions."
>
> Aldous Huxley
> English writer and philosopher

4.1 Introduction

This chapter introduces the theories used to study and discuss the thesis' two main phenomena, psychological safety and digital mindsets, as well as connecting them.

The chapter starts by defining digitalization and digital transformation and discussing how the concepts are used in the thesis. Notably, both phenomena cause changes to processes and how things are done (Schallmo & Williams, 2018).

Naturally, the following section defines organizational culture and climate. Culture forms the expectations of how individuals approach, for example, changes caused by digitalization (Schein, 2010). The climate is the manifestation of the culture, and it is easier to study and change (Schein, 1985). The chapter puts forward the argument that psychological safety is a type of team or organizational climate because it describes "individuals' perceptions" and it is "a shared belief" (Edmondson, 1999a). For research questions one and two, I research the development of and impacts on psychological safety. Meaning how such a climate develops and what challenges it in the contexts in which my research takes place. Theories of culture and climates are important for this discussion and the distinguishing between Cases 1 and 2 as temporary project organizations (TPO) and Case 3 as a project-based organization (PBO).

During the analysis of my case studies, the identified barriers to the development of psychological safety caused a need for tools to analyze it. Therefore, diversity and the boundaries it may create are defined in a subsection of culture and climate development.

The last section presents three social theoretical perspectives: social identity theory, social learning theory, and social exchange theory. These theories are used to analyze how my research objects comprehend social mechanisms, such as diversity, and how perceptions evolve. In addition, the theories are essential for discussing the impact of psychological safety on digital mindsets and how it may be a precondition for digitalization because they explain how individuals make sense of their environment which directs their behavior.

4.2 Digitization, digitalization, and digital transformation

To discuss the assumptions made in Figure 1.1 posed in the introduction (p.6), one must clarify what digitization and digitalization mean in the context of digital transformation. The three concepts are closely associated, and for the arguments of this thesis, it is valuable to make a clear distinction between them and related terms. The descriptions provided in the following are not extensive, and other definitions exist.

Digitization.

In its original sense, digitization is creating a digital version or representation of something analog (Schallmo & Williams, 2018), for example, converting a paper document to a PDF. Digitization as a concept does not encompass the replacement of the original non-digital version, only that it has been digitized. In terms of processes, digitization aims to improve workflows enabled by digital information. Digitization implies that information is easier to share across groups and levels. New knowledge is created as information and processes connect people, which further provides intelligence and actionable insights.

For example, design teams utilize 3D programs to produce drawings. From a process perspective, new knowledge and insights are enabled when the drawings are available for all team members, and collision controls provide value as costly mistakes are detected early (Liu et al., 2013; Whyte, 2019). Thus, the digitization of the drawings creates a smoother workflow. The macro-level changes in social structures and practices due to these forms of digitization are explained as digitalization.

Digitalization.

Without digitization, there is no digitalization. Schallmo and Williams (2018) define digitalization as "fundamental changes made to business operations and business models based on newly acquired knowledge gained via value-added digitization initiatives". Digitalization is a concept needing engagement and insight systems, leveraging technologies, digitized data, and processes. Thus, it means turning communication, business operation, and models into more digital ones. Transforming processes differ from digitization, as they include changes, not simply making a physical process into a similar digital version. Digitalization is

challenging, as technology can disrupt an organization's social networks, requiring employees to re-learn how to collaborate (Edmondson, 2003). Digitalization is often seen as the road towards digital transformation, digitalizing the organization along the way and developing new digitally-based business models.

Today, digitalization has fundamentally changed design teams' working methods (Hautala et al., 2017). Designers utilize digital information models to store relevant information from conceptual design to the final drawings. Another aspect is that digitalization has forced changes to how people communicate and work: all meetings, discussions, and solutions are processed from information provided in a virtual model. Digitization of information and digitalization of communication through 3D models has improved efficiency and accuracy in design processes.

Digital transformation.

Digital transformation is a broad concept with several definitions (Gong & Ribiere, 2021; Weritz et al., 2020). The definitions span from describing the transformation of businesses (organizations), industries, and society in general. What is common for the descriptions is that digital transformation is a paradigm shift that affects industries and companies globally. However, some definitions of the term fail to include the prerequisites that enable transformation, which is the use of technologies and data to create additional value for businesses and customers (Schallmo & Williams, 2018).

Digital transformation is most often used in relation to organizations. Digital business transformation encompasses all aspects of a business, even the non-digital parts (Bowersox et al., 2005). Studies have shown that organizations focus on incorporating specific digital tools to boost productivity and adapt their internal structures to fully utilize technology (Koscheyev et al., 2019). The main driver behind this transformation is the potential for technological innovation and gaining a competitive edge (Weritz et al., 2020). Today, the availability and advancement of digital solutions force organizations to apply digital tools to stay competitive. Organizations that seize new technology opportunities can potentially force the process of Industry 4.0 and change the markets (Hautala et al., 2017; Maskuriy et al., 2019).

Digital industry transformation and Industry 4.0 are often used interchangeably, but Industry 4.0 is most commonly used to describe the transformation in the ways products are produced and delivered (Sony & Naik, 2020). It goes further than digital business transformation by including, for example, the industrial Internet of Things and the Internet of Services. The scope of Industry 4.0 is beyond the discussion in this thesis; however, the discussion of industry actors' mindsets toward future digital changes is highly relevant because introducing boundary-changing technology needs common industry goals.

In sum, digital transformation is a comprehensive process of change that leverages digital technologies to improve the overall performance and outcome of an industry or organization

(Gong & Ribiere, 2021). It involves integrating digital tools and methodologies in various aspects, including operations, processes, and customer experience. This results in a significant improvement for all stakeholders, leading to the adoption of new digital platforms, methods, cultures, strategies, and structures, thus fundamentally changing the way of working or thinking. Thus, digital transformation describes new networking possibilities due to exchanging information and initiating new processes (Schallmo & Williams, 2018). For the purpose of this thesis, I have followed the definition by Gong and Ribiere, focusing on a holistic description of digital transformation:

> A fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity* and redefine its value proposition for its stakeholders. (*An entity could be: an organization, a business network, an industry, or society.) (Gong & Ribiere, 2021)

Digital transformation of or within the construction industry can be discussed at the industry and business/project levels. The discussion of Industry 4.0 in construction takes on a broader perspective. For example, cyber systems, AI, big data, VR, and wearable tech may improve construction health and safety (Adekunle et al., 2021). Another example is blockchain technology which disrupts traditional practices, increases transparency, and causes companies to adopt survival strategies such as collaboration. Applying these technology-driven changes throughout the project life cycle requires organizational boundaries to change (Hossain & Nadeem, 2019; Maskuriy et al., 2019).

The benefits of Industry 4.0 are still mainly conceptually described (Maskuriy et al., 2019). The fragmented supply chain with small and medium-sized enterprises limits innovation, and a lack of dedicated implementation strategies and alignment with business goals has hindered adoption. To fully realize the potential of Industry 4.0, which can automate design and manufacturing processes and handle large amounts of information, there is a need to transform the construction industry's overall business strategy.

Thus, the digital transformation of the industry has an unforeseeable future and is more challenging to structure compared to smaller change initiatives. In a bibliometric study, Adekunle et al. (2021) defined digital transformation in construction as:

> Construction digital transformation involves the significant, disruptive change to construction processes (vertically, horizontally and longitudinally) for improving construction output and productivity to achieve project outcome and better client satisfaction through the adoption of information, computing, communication and connectivity technologies. (Adekunle et al., 2021)

Based on the definition, digital transformation encompasses more extensive knowledge sharing and new collaborative patterns that alter industry boundaries for future construction.

Digital disruption.

Another related term is digital disruption. Disruption refers to a shift in power in relationships. Digital disruption is used to describe the change that occurs when new technology or business models alter the value of existing products or services (Skog et al., 2018). For example, when an actor leverages digital technologies and interrupts existing industry structures, established firms are pressured to respond to stay competitive. The response could force changing their operations, identity, and need for knowledge and employees. Digital disruption is quicker than digital transformation. Also, it is a manifestation of innovation processes with the aim to attack or undermine, whereas digital transformation is an aggregated effect of digitalization processes. As for transformation, disruption is a human issue. It is humans' reactions to and adoption of change that need to be understood. Technology itself is rarely the problem.

In the construction industry, there could be cases of digital disruption. An example is Spacemaker AS, a Norwegian technology company that provides artificial intelligence (AI) based solutions for urban planning and design (see Spacemaker, 2022). The company is causing digital disruption in the construction industry as the use of artificial intelligence (AI) and machine learning algorithms in their platform is transforming the traditional design and planning process, making it more efficient and accessible. Traditionally, the planning and design process for construction projects can be time-consuming and labor-intensive, involving numerous stakeholders and multiple iterations of design and review. With Spacemaker's AI platform, developers and designers can quickly generate and analyze multiple building designs and evaluate their performance in real-time.

However, in the design phase, implementing technology is still aimed at increasing collaboration and making the team more efficient (Knotten, 2018). The effect of a consultant being more digitally savvy than another in, for example, the hiring process, is outside the scope of this thesis.

Usage of terms.

Which term, then, should be used to describe the changes due to technology in design teams? Even though the scope of this thesis is limited to the initiatives or changes concerning design teams working together for a temporary period, the choices made in the design phase have a considerable effect on business operations (Knotten, 2018). The design phase is the stage where the resources and needs of the project organization are matched with its objectives. For example, choosing inadequate communication technology or implementing it insufficiently in the early phases could hinder a smooth workflow going into later stages. This view encompasses all aspects of the project life cycle and thus leans toward digital (organizational) transformation discussions.

Another factor is that the characteristics of the design process change during a project (Eikeland, 2001). When disciplines are involved in the project, the intensity of their interdependence will vary. Also, tools are used in new ways, updated, or changed as better alternatives are presented within the industry. This constant need to adapt seems to be more compatible with the challenges presented with digitalization than those of digital transformation. Even though technology usage in one project may not present an abstract future, it is often a learn-as-you-go process where designers may not work in the same way again. This nature of how technology is implemented and changed represents an ambiguity that makes it difficult to implement initiatives from the top down.

Technology is implemented in the design phase to gain efficiency (Knotten, 2018). For example, the effectiveness of communication and team-based working. Building Information Modeling (BIM) has been argued to be at the core of this technological advancement (Liu et al., 2013). Also, there has been a change in working processes, for example, Integrated Concurrent Engineering Sessions (ICE) and Virtual Design and Construction (VDC). Some would argue that it would be a situation of digitalization, others of digital transformation. In the context of this thesis, I explain the isolated processes in design teams as digitalization, not as digital transformation in itself, as digital transformation requires changing from one status to another in a broader context than one phase of the life cycle of a specific project. However, digitalization is still the road toward digital transformation.

4.3 Development of culture, climate, and norms

Digitalization and digital transformation create changes to work and work processes. The effect of these changes may be observed through an organization's culture and climate. Also, the distinctions between the outcomes of perceptions (psychological safety) and the conditions for them are ambiguous. The debates cover theories on the relationship between organizational culture and climate. This is a historical and deep topic (Ashkanasy et al., 2011), which I will merely touch on to contextualize my research. As a result, in order to better grasp where perceptions end and norms begin and where norms end and climate begins, I will define, separate, and integrate the two related concepts of climate and culture.

In organizational studies, the terms culture and climate are frequently used interchangeably (Schein, 1985). Yet, the two concepts are defined differently theoretically and have different academic origins. Climate is derived from Lewinan (psychology) theory, characterized by quantitative approaches, while culture is derived from anthropological literature, distinguished by qualitative approaches. Understanding the two notions is essential for distinguishing and comprehending my discussion of RQ1 concerning *norms that matter for* and RQ2 about *contextual factors impacting* the development of psychological safety.

Researchers have debated if climate was to be defined as a property of the individual or an organization (Kuenzi, 2008). This includes whether climate is a set of conditions or perceptions about the work setting that individuals share. There are several definitions of the concept, but most agree that it is perceptual in nature. Schneider and Reichers (1983) defined work climate as "a set of shared perceptions regarding the policies, practices, and procedures that an organization rewards, supports, and expects." Thus, psychological safety as "a shared belief held by members of a team that the team is safe for interpersonal risk taking" (Edmondson, 1999a) would be covered by Schneider and Reichers' definition of a work climate.

McKinney (2020) described that the specifics of what influences perceptions can be elusive, and the drivers could be hidden and exist at the individual level, as perceptions are outcomes of individuals' sense-making processes. Through social mechanisms (e.g., social exchange, social learning, social identity theory), team members develop shared beliefs, knowledge, and meanings as they observe the team and the environment for clues about acceptable behaviors and values. However, even though perceptions are shared, they are still the property of the individuals in the team, group, or organization (Kuenzi, 2008). Therefore, according to psychological climate theory, a climate of psychological safety is a function of individuals' sense-making of a situation, and they may have different experiences of it. Still, Edmondson (1999a) reasoned that when individuals work closely together, they will have similar perceptions as they are exposed to the same experiences.

Conditions for psychological safety are what I define as the group's norms, as seen in Figure 4.1 later on. Norms related to the development of psychological safety are what I refer to as the outcomes of a culture that supports such a climate, similar to the characteristics of psychological safety listed in Table 2.2 on p.26. Google's researchers of Project Aristotle described norms as "traditions, behavioral standards and unwritten rules that govern how we function when we gather," which can be unspoken or openly acknowledged (Duhigg, 2016). Norms are beliefs regarding how to behave and are aspects of organizational culture (Cooke & Rousseau, 1988).

McKinney (2020) described that it is challenging to distinguish between where psychological safety (perceptions) ends and where the work climate begins. He suggested that a team with high psychological safety would be a psychologically safe work climate, whereas low would be a non-psychologically safe work climate. This is because the aggregated perceptions form the work climate. It is also just as challenging to identify when norms (part of the culture) end, and a climate of psychological safety starts.

Organizational culture has been debated and formed over many years, and it can be described as either something an organization has or what it is (Schneider et al., 2012). Schein (2010) described it as a system of shared beliefs and values that lead to norms and expectations that guide the way people approach problems and tasks and how to interact. The deeper layer of

culture consists of "shared basic assumptions learned in a group as it solved its problems of external adaption and internal integration. These assumptions have worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to problems" (p. 18). The deeper layer of culture is the baseline for the ideal culture about "how things should be done", as shown in Figure 4.1 later on. Culture is the way we are expected to behave based on a set of written and unwritten rules. Therefore, norms would be a part of the culture. Culture is also shared, similar to climate, but it also defines the group, which creates a level of stability (Schein, 1985).

Schein (1985) described that the climate could be thought of as the manifestation of culture. Climate does not explain itself, and therefore Schein (2000) defines it as "a cultural artifact resulting from espoused values and shared tacit assumptions." Shared tacit assumptions are causal factors of the ideal culture, made up of perceptions of "how things are currently done", shown in Figure 4.1. Understanding the climate is important, as it is the key to changing the culture. Norms in this context of change are important, as compared to the ideal culture; it informs the gap between the actual culture and the values the organization would like to exist. Climate is short-term and much easier to change than culture. If a culture is "dead", one cannot change it with existing values and norms, and culture is, in its very nature, resilient to change. Thus, the work climate is more tangible than the culture as it is easier to understand, see, measure, and change. Individuals observe changes, process them, and use them to develop new beliefs about how they and others should think and behave (norms), which changes the culture. Zohar and Hofmann (2012) argued that organizational climate could be a lens through which organizational culture can be viewed. Importantly, as suggested by Schneider (2000), there is a reciprocal relationship between experiences and attributions. Thus, climate causes culture and the other way around.

Figure 4.1 shows how I have interpreted and connected culture, norms, and climate, supporting the arguments I have made and will make in the discussion chapters. The model is based on Zohar and Hofmann's Organizational Culture Model (2012) and Cook and Szumal's (2000) framework for the Organizational Culture Inventory. Zohar and Hofmann's model incorporated Schein's (2010) description of the three levels of culture as having deeper layers consisting of values and basic assumptions. The figure may guide the reader to where the discussions in Part 4 take place in the climate development phase.

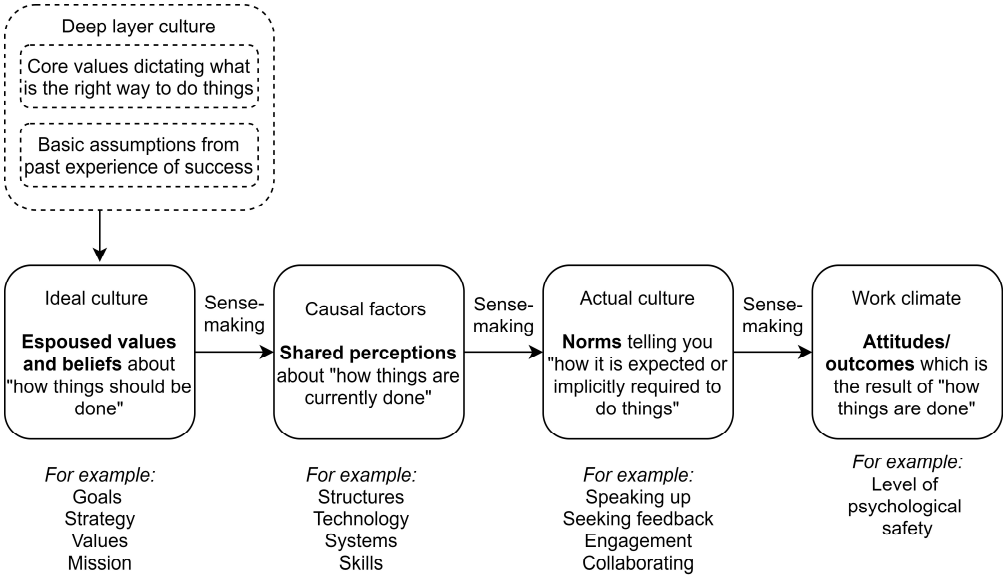

Figure 4.1: Culture and climate development phases

Case 3 of this thesis is what can be defined as a PBO, and the design teams of Cases 1 and 2 are what Packendorff (1995) defined as part of a TPO. Design teams do not have a long history in which organizations build up over the years, and the internal character is distinct from that of permanent organizations. As Lundin and Söderholm (1995) described, TPOs are limited by time, with a start and an end. TPOs are also created for a specific task that focuses on action (e.g., construction project), compared to organizations that focus on long-term goals. The team is formed to complete a specific task that requires conscious, organized efforts and is not just a group of employees (Packendorff, 1995). Team membership is thus for a limited time, meaning they have other firms they depend on during and after the project is finished. Also, actors are contracted at different times, which can change the social interaction of the team. Core values and basic assumptions may not be evident in a TPO's culture. Still, as pointed out by Schein (2020), a climate does not explain itself. Thus, TPOs should have a form of espoused beliefs about "how things should be done."

Little attention has been paid to culture on the project level in construction (Zuo & Zillante, 2005). The culture that is developed in a project is often a reflection of the leadership or the delivery model. It is important to note that in a construction project, several sub-cultures (e.g., organizational, professional, operational, and individualistic) together describe the project culture (Kumaraswamy et al., 2002). There have been attempts to shape project cultures from an industry perspective, for example, focusing on the dominant cultures of stakeholders (Andersen, 2003). I have chosen to understand project culture through its tangible climate with my psychological safety lens.

4.3.1 Diversity and boundaries

Because design teams are interdisciplinary, their work call for learning and communication, which are essential characteristics for psychological safety to be useful and develop (Deng et al., 2019; Edmondson & Lei, 2014). Communication across different boundaries is essential for work to progress. However, interdisciplinary design teams generate several diversities through the number of roles, firms, personalities, and experiences. The various actors (e.g., architects, contractors, engineers, and owners) bring different ways of thinking, attitudes, and work practices (Ankrah & Langford, 2005).

Communication failures at the boundaries between actors or team members are common in multidisciplinary teams. While working on complex problems, team members must cross multiple types of barriers, the most difficult of which are the invisible taken-for-granted assumptions and attitudes that individuals have in different groups (Edmondson, 2012a). For instance, the "correctness" of their own beliefs and values. Thus, Harrison and Klein (2007) stated that it is critical to distinguish what is the dominant diversity and its effects.

Diversity as a theoretical concept is difficult to synthesize, much because the literature is so diverse (Edmondson, 2012a, p.197). I have followed the definition of diversity by Harrison and Klein (2007): "the distribution of differences among the members of a unit with respect to a common attribute, X." Diversity refers to the presence of a variety of individual characteristics within a unit, such as a group or organization. When describing the diversity of a specific attribute within a unit, the focus is on the unit as a whole. They further divided the diversity construct into three types; disparity, variety, and separation.

Disparity diversity.

Disparity diversity refers to inequality in socially valued assets of a particular attribute within a group or organization (Harrison & Klein, 2007). For example, prestige, power, and status. Disparity diversity assumes that within a group, members can have different amounts of the valued resource, and that the way in which the resource is distributed among members can have important consequences. The concept also assumes that the direction of the difference along the resource continuum is important and that disparity is asymmetric. For example, disparity is high if a small portion of a group's members hold a large amount of the resource, while the majority holds very little, and low if the majority holds a large amount of the resource, while only a small portion holds very little.

Edmondson (2012a) described that disparity diversity is often the most challenging boundary for individuals to cross, as it means interpersonal risks such as speaking up to members of a higher status and power.

Variety diversity.

Variety diversity refers to how members of a group differ qualitatively on a categorical attribute (Harrison & Klein, 2007). It describes differences in experience, knowledge, expertise, or education (Edmondson, 2012a; Harrison & Klein, 2007). Harrison and Klein (2007) describe that the predicted outcomes of such diversity are "greater creativity, innovation, higher decision quality, more task conflict, and increased unit flexibility."

However, the greater the demand for specialization, the more difficult it is for individuals to keep up with other close fields. As a result, their crossing knowledge to other disciplines becomes more limited. Edmondson (2012a, p.200) described that a common issue with variety diversity in construction is when "knowledge boundaries based on expertise are confounded with knowledge boundaries that exist between companies." The negative effect of knowledge boundaries arises when boundaries between groups are not crossed due to misunderstandings and mistrust. What typically happens in construction projects is that actors handle the effect of knowledge boundaries through legal contracts instead of building trust and collaborating.

Separation diversity.

Separation diversity encompasses differences within units (e.g., a group or organization) in regard to their position along with a single continuous attribute. This attribute can be any characteristic, such as organizational commitment, values, attitudes, physical distance, work process, or values. The extent to which members of a group are spread out along this continuum determines the level of separation diversity within that unit (Edmondson, 2012a; Harrison & Klein, 2007). This can range from minimum separation, where all members occupy the same position along the continuum, to maximum separation, where members are equally split and located at opposite ends of the continuum.

The theory of social identity is often used to explain the effects of separation diversity (Harrison & Klein, 2007). Minimum separation is likely to be psychologically comforting and leads to higher levels of cooperation and trust. In contrast, maximum separation is likely to lead to polarization, reduced cohesiveness, more interpersonal conflict, distrust, and decreased task performance.

4.4 Social mechanisms and evolvement of perceptions

In this thesis, I have used three relevant theories to help explain how employees comprehend social mechanisms and how shared perceptions evolve: social identity theory, social learning theory, and social exchange theory. These theoretical perspectives have been widely used in research to describe the processes through which psychological safety emerges (Newman et al., 2017). Because these theories are relevant to climate development, I will present them here.

4.4.1 Social identity theory

Social identity theory builds on the idea that a person's sense of who they are is based on their group membership (Tajfel & Turner, 1986). The theory explains conflicts between groups, which occur because of what happens when we join groups. Also, it has been used to understand prejudice and discrimination, that is, why groups may mistreat others in the absence of competition.

Tajfel and Turner (1986) define social identity theory as a three-step process. The social categorization process is the first thing that happens when we enter a group, as we start by putting people in categories (groups).

The next step is that we make direct comparisons between in-groups (where we belong) and out-groups (the others). In-groups are groups of people that an individual identifies with and feels a sense of belonging and affiliation towards (Tajfel & Turner, 1986). According to social identity theory, in-groups are defined as a subset of people who share a common social category. Members of in-groups often see themselves as being similar to one another and tend to view the in-group more favorably than out-groups. This intergroup social comparison is motivated by individuals' underlying need for self-esteem (Hogg & Terry, 2000). The self-esteem hypothesis describes that belonging to a group can help if the group is better than others – a "superior group." Therefore, individuals tend to make biased comparisons where they favor their in-group characteristics.

A consequence of comparison is that individuals tend to discriminate against or compete with groups they do not identify with, which is the third and last step of the social identity process (Tajfel & Turner, 1986). Individuals differentiate by creating positive stereotypes for the in-group and negative ones for the out-group. For example, engineers as an in-group, whereas architects become an out-group. It can be described as a process of depersonalization, where the stereotype, and not the people, is the source of judgment. The stereotypes lead to prejudice, where members are negatively judged because they belong to an out-group. Thus, a new architect entering the team will be judged based on the group other team members deem the person to identify with. Conflicts occur as it becomes an "us vs. them" situation. In that case, norms that facilitate psychological safety will not be established in the common larger group as there will be a possibility of being judged by others who are not in the same in-group.

An important aspect of the social identity process is that the perception of the permeability of group boundaries is a significant characteristic that impacts individuals' behavior toward different group statuses (Terry et al., 2001). Terry et al. (2001) described that "from a social identity perspective, the extent to which a person identifies as a group member is the central mediating variable in explaining group phenomena, given that it reflects the psychological

importance of the group membership." If the group identity is not seen as fixed due to the self-esteem hypothesis, team members aspire to move to a higher-status group.

A sense of belonging is powerful, also for temporary teams. In design teams, team members have several groups they may identify with: their employee firm, their trade, or the design team. The identity that is salient decides which group and, therefore, intergroup relationships direct individuals' behaviors (Hogg, 2000).

Also, mergers are common for TPOs, as new firms and team members are brought in when the project progresses. Hogg (2000) described that a merger or the acquisition of one organization by another poses special problems for intergroup relations. This is explained as the social identity process being motivated by the need to reduce uncertainty about one's perception of behavior. Uncertainty is "a product of contextual factors that challenge people's certainty about their cognitions, perceptions, feelings and behaviors, and ultimately, certainty about and confidence in their sense of self." Certainty refers to one's confidence in how to behave in a situation. A new actor entering a team may create uncertainty, as explained by Hogg (2000), as statuses or group dynamics can change.

The social identity theory is limited to being a social research approach and does not consider biological factors, for example, if some individuals are more likely to enter conflict (Tajfel & Turner, 1986). Also, there could be social learning effects as to why groups have conflicts. Importantly, the theory does not consider cultural values. It could be that the different cultures have a larger effect than just belonging to a group.

4.4.2 Social learning theory

Social learning theory also describes social mechanisms and has been used to explain how followers will emulate the behavior of leaders or peers to ensure conformity to expected norms (Bandura, 1977). In other words, individuals tend to behave according to the social environment.

Individuals form their expectations about the potential consequences of future responses based on how current responses are reinforced or punished. New employees, especially, may imitate the behaviors of peers in an effort to fit in with the work culture. When there is a change in the environment, there may be a change in their behavior. The theory places great weight on the environment and neglects the importance of accountability and how a person handles or processes information. Still, it explains how a context may direct learning.

Team members are sensitive to the behavior of leaders and examine their behaviors for information on what is expected and acceptable in the group. Nembhard and Edmondson (2006) described that authorial and unsupportive leadership makes the perception of speaking-up behavior and engagement risky, whereas supportive and democratic leader behaviors will

enhance psychological safety. Leaders who listen, support, and provide clear instructions may serve as role models for interpersonal risk-taking (Zagenczyk, 2006). When employees regard their leaders as role models, they will tend to act similarly due to the exchange relationship between leader and follower. This implies that leaders must make an effort to be open and coaching-oriented to create a climate of psychological safety (Edmondson, 2004).

4.4.3 Social exchange theory

Social exchange theory employs the principle of reciprocity to explain social exchange between employees and employers (Sun, 2019). The theory suggests that individuals look at relationships through a cost-benefit lens. Blau (1964) described social exchange as "voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do in fact bring from others." In other words, social exchange is an economic metaphor for how we make decisions about relationships. The theory predicts that as long the rewards outweigh the cost, the relationship is profitable, and individuals tend to stay and work for that relationship.

Perceived support is an example of how social exchange theory is applied in research. Sun (2019) explains that the perceived organizational support, which reflects the relationship between the employee and the organization, is a social exchange. Also, the outcome of the relationship between leaders and employees may be understood as a social exchange process (Mckinney, 2020; Newman et al., 2017). When leaders treat employees fairly and support them, employees will reciprocate fair treatment by engaging in constructive and supportive behaviors, creating psychological safety for the rest of the group. While acknowledging that social exchange processes may promote psychological safety, Newman et al. (2017) stated that the effect will be stronger when psychological safety is built through stimulating learning by leaders.

Chapter 5
System Perspectives

> "From a cognitive perspective, systems thinking integrates analysis and synthesis."
>
> Pearl Zhu
> Technology management author

5.1 Introduction

The last research question of the thesis aims to aggregate the outcomes of the preceding four research questions to an industry level. I do this to discuss research question five; whether or not the combination of psychological safety and digital mindsets may serve as a foundation for a purposeful digital transformation of the industry. To do this, I have chosen two theoretical lenses; socio-technical systems and loose and tight couplings. Other theories would have provided different views.

Both theories build on system thinking, general system theory, and open system theory (Orton & Weick, 1990; Ropohl, 1999). The concepts are all related and involve understanding how different parts of a system interact and influence each other. A system is an entity that transforms inputs into outputs (Ropohl, 1999). The system is also a set of elements and the relations between them. Systems thinking and general systems theory provide the general framework for understanding systems, while open systems theory specializes in understanding systems as open to their environment.

Systems thinking is a holistic approach that looks at the relationships and interactions between different components rather than just focusing on individual parts (Arnold & Wade, 2015). It involves identifying key variables, understanding feedback loops, and analyzing the system as a whole to understand how changes in one part of the system will affect the whole. Because system thinking enables thinking in the abstraction of analysis, it is beneficial to show larger trends and difficulties at an industry level.

General systems theory is a more formalized and scientific field that seeks to understand and describe the underlying principles of systems in general across different fields and disciplines

(Von Bertalanffy, 1972). It draws on ideas from mathematics, physics, biology, engineering, and other fields to develop a general framework for understanding systems.

Open systems theory is a subfield of general systems theory. Open systems are defined as systems that are affected by and interact with their environment; they exchange matter, energy, and information with their surroundings (Von Bertalanffy, 1972). The theory was developed after World War II in reaction to the current view on organizations as self-contained entities. Today almost all modern theories of organizations utilize the open system perspective.

System perspectives have been used to discuss the need to change traditional construction management techniques (Peters, 1996; Redmond & Alshawi, 2017). In project management, the system perspective is often concerned with the difficulties presented by dynamics, boundaries, and elements in projects (Kolltveit et al., 2007). System perspectives have also been used to describe the industry's complexity (San Cristóbal et al., 2018). Complexity in that context is the sum of the differentiation of functions between project actors, dependencies between systems and subsystems, and the consequential impact of a decision field.

As described in section 4.2, digital transformation is an extensive form of a complex technology change process involving multiple ongoing initiatives and interrelated actors (Solberg et al., 2020). Digital transformation could encompass more extensive knowledge sharing and new collaborative patterns that alter industry boundaries for future construction. The unforeseeable future of how the industry will look when the Internet of Things enables BIM 5D and connecting materials virtually is similar to the description by Solberg et al. (2020). This industry transformation requires a shared sense of purpose and culture change across all key industry stakeholders.

Therefore, system perspectives are useful for understanding digital transformation in the construction industry because they provide a holistic view of the various components and processes that make up the industry, as well as the relationships and interactions between them. This can help identify potential barriers to digital transformation and help develop strategies to overcome them. Overall, using system perspectives can help organizations in the construction industry better understand the opportunities and challenges associated with digital transformation and make more informed decisions about how to move forward.

In the following, I first describe socio-technical systems, then loose and tight couplings.

5.2 Socio-technical systems

Socio-technical system (STS) theory has been around for over 60 years, created in the context of labor studies in the fifties (Trist, 1981). The theory was established to stress the reciprocal interrelationship between humans and machines and to facilitate work's technical and social

conditions (Ropohl, 1999). According to the theory, a system's social and technological aspects must be considered to reach optimization and development (Davis et al., 2014). Later, STSs have been used to inform technology design, the integration of new technology with existing social systems, and organizational change strategies.

The fundamental premise of STS theory, which comes from open system theory, is that organizations share features with all other living systems (Scott, 2006). For example, goals, boundaries, feedback, input and output, and environment. Meaning that a system is a subsystem of a larger system.

Trist (1981) described STSs as three interrelated levels: the work system, the organizational system, and the macrosocial system. Work systems are systems that perform tasks within a set-bounded subsystem of the organization, where the group must have a purpose that unifies individuals and activities. Organizational systems are self-standing workplaces with a steady state in the environment. Trist described that the macrosocial systems are systems in communities and industries at the societal level. A change in either of the levels will impact the other two (Ropohl, 1999). Thus, understanding the overall system is necessary to understand its underlying complexity and avoid oversimplified cause-effect relationships (Vorraber et al., 2019).

The socio-technical systems theory provides a comprehensive framework for examining issues that involve interdependent social and technical components (Baxter & Sommerville, 2011). Because the theory adopts a holistic approach, it may result in more lasting and successful improvements that satisfy the organization's and its employees' needs. As a result, the theory benefits companies wanting to change their technological and social structures. The consideration of employees may improve performance, satisfaction, and engagement. As it applies to all "systems" (Clegg, 2000), this might be interpreted as a useful framework for digital transformation of industries. Industry players may design more adaptive, effective, and user-friendly solutions that ultimately drive industry innovation by considering technological and social factors.

Sony and Naik (2020) described Industry 4.0 as a socio-technical system requiring specialized skill sets and human interaction. They found that current research has mainly focused on the technical aspects of Industry 4.0, but there is a need to consider socio-technical features to ensure sustainable implementation. Similarly, Davis et al. (2014) found that social aspects of work are too often overlooked in STS.

The arguments by Sony and Naik (2020) apply to the digital transformation of the construction industry. The infrastructure of the construction industry is a socio-technical phenomenon belonging to the macrosocial level, according to Trist's (1981) description. PBOs are organizational systems, and TPOs may be regarded as a temporary form of a self-standing

workplace. TPOs are also complex systems comprising many interrelated factors (Dubois & Gadde, 2002). Davis et al. (2014) provided an expanded framework for STSs in complex systems that takes into account the relationships between goals, people, infrastructure, technology, culture, and processes/ procedures. Thus, it goes further than merely optimizing the system for human factors and technology. Lastly, design teams would be work systems.

Ropohl (1999) explained that the idea of STS was designed to cope with the theoretical and practical problems of working conditions in industries. Therefore, STS should be understood as a theoretical construct to understand technology innovation.

5.3 Loose and tight couplings

The loose and tight coupling theory was introduced by Weick (1976) as an alternative to the bureaucratic theory for explaining organizational structure (Arango-Vasquez & Gentilin, 2021). Weick argued that educational organizations and other complex systems consist of interdependent components or "couplings." The theory is based on the open system theory, which states that different parts of a system have interdependent elements with diverse dependencies (Orton & Weick, 1990). Distinct organizational entities have specific roles and positions within a broader industrial framework but are all connected. In other words, couplings describe the interconnectedness of individuals, work, and organizations.

Tight coupling implies direct dependency between components where behavior influences the system in an intermediate, constant, and significant manner (Orton & Weick, 1990; Weick, 1976). Centralization is an element of tight couplings, describing that communication, work processes, and decision-making often must flow through central parts of the system.

Orton and Weick (1990) described elements or units that have few variables in common and are relatively independent of each other as loosely coupled. In this case, parts of a system would be able to continue despite the occurrence of problems because the mutual influence of units is reduced. Loosely coupled parts affect each other, but the effect tends to be negligible, occasional, indirect, and eventual (Weick, 1976). Therefore, loose couplings may be more adaptable to their environment than tight couplings, as there is more room for innovation and variety (Gadde & Dubois, 2010).

Dubois and Gadde (2002) applied Weick's theory to clarify the specific couplings in construction. They described that the construction industry has been divided into permanent and temporary networks due to the need to make sense of project complexity. Since projects are the actions that connect firms, teams are tightly coupled, whereas firms are loosely connected through project organizational boundaries (Gadde & Dubois, 2010). As a result, the industry as an open system has boundaries that exist for teams, TPOs, and permanent

organizations (Scott 2006). Boundaries are defined as “coherent and object-like contours of an organization that manage the complexities between the organization and its context, and a boundary is considered to be both an enabling and a constraining structure” (Gohary & Karrbom Gustavsson, 2012).

According to Lavikka et al. (2018), decision-makers in the construction sector do not view inter-organizational collaboration as essential, much due to the industry’s loosely coupled nature. Moreover, due to the industry’s practice of lowest-price tendering, current stakeholder relationships are frequently short-sighted and driven by market forces. For instance, the actors in the sector are concerned with maintaining the established business procedures that have allowed the growth of their profits. Nevertheless, this stance limits innovation and cross-organizational cooperation.

Due to the different levels of boundaries and couplings, the connection between the change in projects and the industry is weak. Weick (1976) argued that loose coupling could be both a strength and a weakness of organizations, providing flexibility and resilience on the one hand but also making it challenging to coordinate and manage the system as a whole. The theory indicates that the combination of loose and tight couplings favors short-term projects but not necessarily the learning and innovation of the construction industry’s overall network. Attempts have been made to overcome the constraining effects of firm boundaries, for example, collaborative delivery models (Tvedt, 2019). Still, the industry is made up of multiple independent actors and sub-systems, which operate with little interdependence and coordination (Gadde & Dubois, 2010).

Part 2

Methodology

Notes

My Ph.D. journey has been particularly inspired by the deeper philosophical questions of research – *what* is reality, *how* do we get knowledge of it, and *why* does society need the knowledge I produce? Thus, this second part of the thesis is not limited to the introduction of the research strategy but is devoted to my research paradigm.

This part is structured as follows. It starts with chapter 6, explaining my interpretation of the research paradigm, including my choice of research philosophy. Next, in chapter 7, I introduce the strategy and research design, including data collection methods, data analysis, and ethical concerns.

Chapter 6
Research Paradigm

> "Research is formalized curiosity. It is poking and prying with a purpose."
>
> Zara Neal Hurston
> American author and anthropologist

6.1 Introduction

This chapter starts by introducing my understanding of the research paradigm. Then, in the following chapter, I define research philosophy, followed by my choice of philosophy and the consequences of that choice.

Research paradigm has its origin in Greek and means pattern (Kivunja & Kuyini, 2017). My paradigm constitutes my abstract beliefs about existence, how I interpret the world, and how I act within it. I follow Lincoln and Guba's (1985) description of the research paradigm as the sum of metatheoretical (research philosophy) and methodological (research strategy) choices. I have found that a vital aspect of reflecting on metatheory before designing the research strategy is to understand the method's underlying arguments – it is not about abstracting away the importance of the outcome but verifying it and creating a trustworthy pattern.

To start building the research paradigm, Sigismund (2016) argues that one must first clarify who the audience is, including what conversation one wants to participate in. Similarly, Kuhn (1996) argues that it is not sufficient only to assure a solution to a problem: "There must also be rules that limit both the nature of acceptable solutions and the steps by which they are to be obtained." Hence, according to Sigismund and Kuhn, one must get familiar with the traditions within the chosen discipline, or the academic conversation one wants to join. For some scholars, established paradigms provide beliefs about what should be studied, how to study it, and how to analyze the findings (Kivunja & Kuyini, 2017). These traditions have significant implications for the research process.

My research is framed within the project management discipline, belonging to the bigger social science domain. Some schools and disciplines traditionally follow the simplest distinguishing

of research paradigms: the subjective vs. the objective approach to reality, or between qualitative and quantitative methodologies. However, these differentiations are not sufficient when research is interdisciplinary or grounded within the project management discipline, as there are multiple philosophies and research strategies in the field (M. N. Saunders et al., 2015). Biedenbach and Müller (2011) and Drevland (2019) argue that there is a lack of focus on metatheory in the field, and researchers avoid expressing their positions. The focus is on the methods, not the reflections supporting the choice. A consequence is research not being published, as disagreements stay at a method level, not at a metatheoretical level where it belongs.

As a researcher, I choose to position myself as a *pluralist* towards several strategies and mixed disciplines, seeing it as an enriching contribution to help academics to view project management from different perspectives. The challenge of being in the project management field and being a pluralist is that I do not follow a set tradition of a research paradigm. Starting with research philosophy (metatheory) when building the research strategy is an alternative approach to conventions (Biedenbach & Müller, 2011; Ragin, 1987).

A researcher should know the consequences of positioning toward research philosophy, especially when one approaches unfamiliar research areas, for example, bridging theories between disciplines (Klakegg, 2016). Similarly, Biedenbach (2015) states that being conscious of the research paradigm's philosophical foundation can help researchers get legitimacy outside of their field.

6.2 Research philosophy

Research philosophy is defined by M. N. Saunders et al. (2015) as "…a system of beliefs and assumptions about the development of knowledge." It consists of assumptions regarding reality (ontology), human knowledge (epistemology), and the impact of personal values (axiology) (Gul, 2011).

Ontology addresses how things are, and it is referred to as the nature of reality (Blaikie, 2009). Topics addressed in ontology would be the nature of being and how things persist and change over time. The central question is whether social entities, such as society and organizations, should be perceived as objective or subjective. This question has created two distinct directions: objectivism and constructivism (Collis & Hussey, 2014). Objectivism views the world as objective and independent of social actors. Constructivism or subjectivism views the world as socially constructed and thereby in a constant state of change.

Epistemology in Greek means knowledge and is described as the theory of knowledge (Klakegg, 2016). The position of epistemology implicates some criteria of what can and cannot create knowledge (Hallebone & Priest, 2009), meaning "the way of knowledge" or "how we

know." It focuses on perceptions, methods, and reasoning that result in knowledge. Thus, researchers are epistemologically distinct, creating four commonly described stances: positivism, realism, interpretivism, and pragmatism (Biedenbach, 2015). Positivism believes that knowledge is objective and can be measured, like the laws of nature (M. N. Saunders et al., 2015). Realism also sees the world as external; however, it is more cautious about the creation of knowledge due to the ontological view of reality being interpreted through social conditions. Realists, therefore, often explain within a context. On the other side is interpretivism, which sees the world as too complex for generalizable knowledge and focuses on details of situations. Pragmatism accepts both the subjective and objective stances, and views knowledge as contextually bound to what is needed to solve a problem. Thus, these epistemological beliefs are dictated by an ontological stand.

Axiology refers to a researcher's values and the role those values have in the research (M. N. Saunders et al., 2015). The practical meaning of axiology would be the aim and the contribution of the research. When positioning within axiology, you must know if your focus is to find causations (predict and explain the world) or if your aim is to understand a piece of it. The research would be value-free for researchers with objective ontological beliefs and value-laden with a subjective stance where knowledge can be misunderstood. In the latter, the researcher must be transparent about worldviews and the research context, as it will inform the reader about any potential biases.

6.2.1 My research philosophy

In the early process of designing my research strategy and taking a stand within research philosophy, I found critical realism to be the philosophy that harmonized with my understanding of reality and how to study my abstract interdisciplinary industry problem. I will explain the reasoning I used to arrive at critical realism before describing the philosophy and the consequences of this choice.

To start with, the meta-theoretical consequence of being a pluralist is that I accept theory with an objective and subjective view of reality. Consequently, ontologically, I accept research treating the nature of reality in different ways (practical, abstract, mind-depended), which raises the question of epistemology.

The two directions, positivism and interpretivism, contradict my view of knowledge as being strictly one way or the other. Both pragmatism and realism harmonize the notion of connecting objectivism and subjectivism, where reality is external to human thoughts but connected to the existence of social actors. Ontologically, pragmatism views reality as being multiple and chooses the understanding of the world that is most suited to solve a practical problem. Thus, *how we know* is not relevant, but *what we need to know* is. I have come to believe that there are

multiple interpretations of reality, not that there are multiple objective and subjective realities, similar to M. N. Saunders et al.'s (2015) description of realism.

However, when going deeper into knowledge development, and epistemology, I disagree with the scientific approach within the classic, or naïve realism, where "you get what you see." Critical realism (CR) is a direction within realism created by Bhaskar in the 1970s, which explains reality as layered, meaning that ontology is not objective or subjective, but a complex sum. Sayer (2000) describes it as a *fallibilist* philosophy, arguing that since events that we have knowledge about are surprising to us, there must be an external world existing independently of our thoughts about it. Consequently, critical realists must be careful in the proclamation of the truth, as our knowledge of the world is limited to our understanding at a specific time. Thus, this philosophical direction is not concerned with law-seeking but with necessity and contingency. Working within the social science tradition like me is about explaining changes in open systems (social systems), including the acceptance of causal processes producing different results, depending on the context.

Even though CR believes that knowledge is constrained, rules help us judge what descriptions and explanations are better than others (Sayer, 2000) or differentiate what *must* be true from what *can* be true. It is important to note that CR is not a methodology but a set of philosophical positions affecting the method.

6.2.2 Defining critical realism

Ontologically, CR is stratified, describing three layers: the real, the actual, and the empirical (Bhaskar, 1989). As shown in Figure 6.1 (based on Mingers, 2006), the real is all that exists of natural and social character. The real is also the causal power (mechanisms) and structures (Sayer, 2000). Thus, structures are "internally related objects or practices" or the combination of several, which possess a power due to the distinct structure (Sayer, 1992). The actual is what happens when these powers are activated and the effect of the powers. Notably, the structures and their powers can be present even though they do not generate regular patterns of events. Therefore, the real represents the potential in the world, and knowledge about it would give us awareness about what is possible when structures (objects) go together (the actual). The empirical is what we observe and experience. It can give evidence to what is successful; however, this knowledge is contingent on knowing the real or the actual.

Structures belonging to the real can be observable and unobservable. When searching for the possibility of the world, a critical realist must therefore acknowledge that unobservable structures can generate the cause of observable events. Due to the ontological layers, CR acknowledges that there are intransitive (constant) and transitive (changing) dimensions of science (Bhaskar, 1989), where both are needed. Even though theories are transitive and can

be rivals, they could be about something that does not change (the real), which is intransitive knowledge.

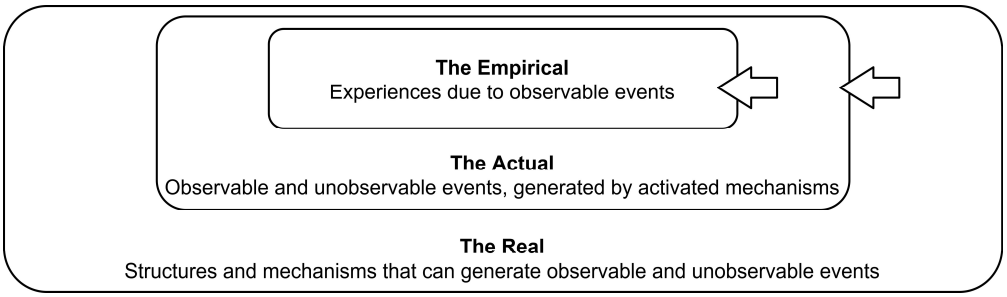

Figure 6.1: The three domains of reality (Mingers, 2006, based on Bhaskar)

CR aims for a deeper knowledge of an external reality, but our reasoning tools are socially constructed (Bygstad & Munkvold, 2011). For example, when explaining social phenomena such as actions, texts, and institutions (the empirical), it is the sum of the combined structures (observable and unobservable) that activate mechanisms (powers). However, the social process also depends on materials available and the humans' interpretation of the event, objects, and each other. Objects that we see with our eyes first become perceptions when they are connected to concepts – concepts that exist as socially constructed knowledge. Therefore, what we experience as the "empirical world" is theory-laden and conceptually mediated (Sayer, 2000). Also, humans are not static but can learn from and change their interpretations, and thereby the relationship to material circumstances is not fixed but vary. In other words, the social reality is emergent and transformed by agents (humans).

Sayer (1992) stated that "in order to understand and explain social phenomena, we cannot avoid evaluating and criticizing societies' own self-understanding" (p.40). This is because this self-understanding is a product of relations and interpretations. Thus, when I try to understand why a design team behaves in a certain way, I need to critically evaluate the formal and informal theories that have described and informed the actions of the team members, the project, and the firms. More importantly, it is the practices and the material structures that legitimize the theories that need to be evaluated. Being critical means accepting that our common sense is mostly socially produced and helping social scientists go beyond initial judgment and provide alternative knowledge. Knowledge becomes more a means for acting in the world than representing truth.

Due to creating knowledge, we cannot make statements about an object without considering that research is a social activity. Also, to know the object, we must understand the subjects. In line with Sayer (1992), I see my research as a transformation of existing knowledge (data, information) through the knowledge and skills I possess within methods. The expressed and

written language of my research will be a product of social interaction and the interpretations from the reader. As such, the process of developing knowledge can change its object of study. Thus, even the knowledge I produce as a singular researcher is not fixed. Even though I put forward a generalizing statement, I acknowledge that it cannot exist outside the social context of my study. All knowledge is, therefore, revisable, making explanations incomplete.

Even though this epistemological view makes knowledge context-dependent, the study's object determines how critical realists produce knowledge. Sayer (1992) explains how different oriented research deals with realism thinking. First, when aiming for abstract theoretical research, the focus is on the laws and actions of social objects, where the events are the outcome. Abstract research starts with concrete research (observations), but is also the basis for it. So abstract research does generalize by saying something about reality, but it is motivated by the necessary properties of objects (concepts) and not patterns seen in events. Second, concrete research studies the events and objects which have been identified and explained through abstract research. Third, generalization also studies events and objects but treats them as simple and not concrete. Sayer describes a fourth kind of research that combines concrete and abstract research with generalization, better known as mixed-method.

To sum up, CR is an ontological paradigm; however, as explained, it influences epistemology (Fleetwood, 2014). We can gain knowledge about society through what we observe, but what we see is open to misinterpretation, as explained by the arguments above. This epistemological understanding affects axiology, the third philosophical stand. I acknowledge that my explanations are built on my existing and changing knowledge. Thus, my research is value-laden, as I play a large role in interpreting the results. As expressed by Sayer (1992), "Social relations of the production of knowledge influence its content" (p.6).

Doing value-laden research requires me to be transparent about my approach while developing knowledge and my background. This information is a part of the research context, as is information about informants and the research setting. I will illustrate why with some examples. Before starting my Ph.D., I undertook my master's in civil and environmental engineering at the Norwegian University of Science and Technology. But my knowledge about concepts began as a child through my parents and continuously developed in kindergarten, and elementary school, through sports and friends, and all the networks I have consciously and unconsciously gained and lost. Also, I was raised and still live in Norway, which has contributed to a cultural effect on my interpretations. So, the list of possible effects on my current understanding of the empirical is endless. To accommodate the effect, I will have to be clear in my writing and explain the concepts I use and create and why I find them useful. It is then for the reader to read my work through this concept framework.

6.2.3 The consequences of choosing critical realism

The explanation of what it means for me to be a critical realist is summarized in Table 6.1, as my assumptions about the development of knowledge (M. N. Saunders, 2015), and the rules that limit the nature of acceptable solutions, as stated by Kuhn (1996). Also, on the right is a description of how it affects the strategy, explained in the next section.

Table 6.1: Critical realism and the effect on designing the research strategy

Metatheory	Description	Effect on the research strategy
Ontology	There is an external world independent of our thoughts and interpretations. This reality is layered, creating observable and unobservable structures that may or may not create events due to their internal or emergent power.	Nature and social systems are objective; however, they are interpreted, and our knowledge of them is theory-laden and, therefore, transitive. Also, reality can be hidden from our senses. To gain intransitive knowledge, we need to aim for a deeper understanding of the research object(s), focusing on necessity and contingency. Knowledge is a means for acting, not a representation of the truth.
Epistemology	Knowledge can come from observations, creating credible data and facts. The empirical is open to misinterpretation, especially social phenomena.	What we observe *can* or *must* be true; therefore, in social science, knowledge is context-dependent. Observations must be described and not explained, as explanations are biased by perceptions. Existing theories are useful but transitive. The decision about methodology, reasoning, and the relationship between knowledge and research depends on the research object(s) and aim.
Axiology	The research process and the produced knowledge are value-laden due to the researcher's subjective interpretations.	The research process must be transparent, and the research setting and events must be described and not explained to diminish misinterpretation.

Chapter 7
Strategy and Research Designs

> "Supposing is good, but finding out is better."
>
> Mark Twain
> American author

This chapter opens by outlining my research strategy, including a brief overview of the three case studies. The next section delves into the study design for Cases 1 and 2, followed by Case 3. The methods for data collection are then explained, followed by a presentation of the data analysis and ethical considerations. Finally, the chapter concludes with a summary highlighting the key points covered.

7.1 Cross-case research strategy

Critical realism (CR) is well suited to case-study research and is often associated with intensive studies where the researcher systematically analyzes the interplay between the ontological levels (Bygstad & Munkvold, 2011). Also, due to the often complex settings, case study questions are typically raised in project management research (Brookes et al., 2015).

According to CR, I need to answer: "What must reality be like in order for this event to have occurred?" (Wynn & Williams, 2012). Although CR states that it is close to impossible to answer this, there is a need to justify claims about it. In a single case, one can compare different situations of events where the mechanism(s) is expected to occur. Comparing various events in the same design team would challenge the separation of causal factors, as there could be mechanisms in the form of, for example, individuals that are hidden from me as an observer. This challenge is due to my research objective's complexity. I do not claim that multi-studies being more rigorous than a single case, in line with Eisenhardt (1991) and Ragin (1987).

Wynn and Williams (2012) explain that one can identify and compare the activation of mechanisms in similar settings with CR through demi-regularities. They define demi-regularities as semi-predictable patterns, which means that when I look at the phenomena of interest in similar but different cases, I can compare the outcomes of each unique setting's

mechanisms and discuss if they are the same. Still, it is not about prediction but viewing the activation of the same mechanisms in each setting to better understand how they manifest, and explain corroboration.

Based on the arguments above, I carefully planned the steps of the cross-case research strategy presented in this chapter and displayed in the case study protocol in Appendix A. My research strategy has a cross-case design consisting of three independent case studies, described in Table 7.1.

Cases 1 and 2 had the same research design; however, while proceeding with Case 2, the COVID-19 crisis occurred. Despite that the case study changed to be all-digital, it proceeded as similarly as possible to Case 1. The COVID-19 crisis was an opportunity to further explore how contextual effects impacted the development of psychological safety. It also enhanced the need for digital mindsets. Therefore, the situation strengthened the research strategy.

In light of the crisis and Case 2, an opportunity for a related third case study emerged. In Case 3, I followed a project-based organization (PBO) in the process of turning into a virtual organization during the first months of COVID-19. Thus, it differed from Cases 1 and 2 in the research setting and research objects, depicted in the article based on the study in Appendix B. Still, Case 3 was designed to also inform the research questions concerning psychological safety provided in section 1.5, and it served as a comparison for Cases 1 and 2.

Table 7.1: Overview of case studies

Case	Research objects	Research design	Purpose
Case 1	Design team in a temporary project organization (TPO)	Case study	Explore psychological safety, digital mindsets, the relation of the two concepts, and preconditions for digitalization
Case 2	Design team in a TPO	Similar to Case 1, but during COVID-19	Explore psychological safety, digital mindsets, the relation of the two concepts, and preconditions for digitalization
Case 3	Leaders and employees in a PBO	Emergent case study during COVID-19	Explore psychological safety

Even though the planning of the strategy was close to linear, the research process was more similar to a process model (Langley, 1999), illustrated in Appendix C. The process model in the appendices does not display a timeline but illustrates how the different parts of the research

paradigm inform one another and the iterations needed to strengthen the research strategy throughout the Ph.D. project.

For simplicity and further descriptions, the cross-case strategy is illustrated as a linear model in Figure 7.1. The figure displays the connection between the cases, their order of completion, and which ones were conducted during the COVID-19 pandemic.

The strategy started with "defining and design," which I'll explain in detail in the following sections 7.2, 7.3, and 7.4. After that, I identified and completed Case 1. Learning from Case 1 aided the process of completing Case 2, as shown by the arrow pointing back to the initial step. Case 3 was emergent, but the design mostly followed the original strategy, as depicted in Figure 7.1 and Appendix C.

The research strategy model emphasizes the importance of considering each case as a complex unit with independent within-case analyses before comparing similarities or differences in the last stage, "analyze and conclude" (Porta, 2008).

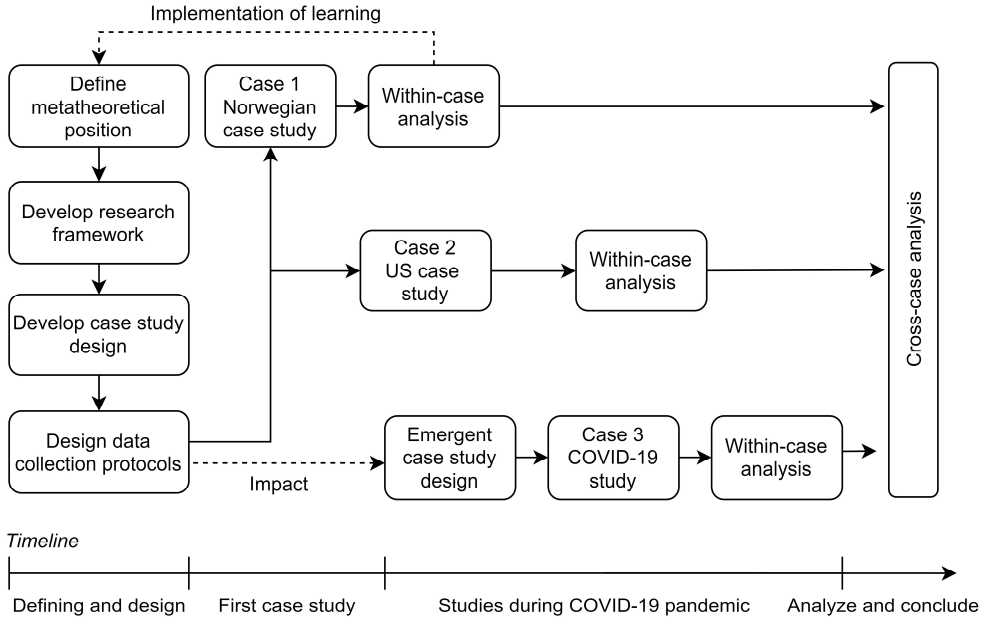

Figure 7.1: Linear research strategy model

7.1.1 Develop research framework

While formulating the research idea, I also defined my metatheoretical position, described in subsection 6.2.1. Next, I developed a proposition based on the issue of digital transformation in the construction industry and CR: "There is a knowledge gap on how individuals will

respond as digital information and communication technology substantially changes the nature of work." The proposition only served as a starting point for my work.

Theoretical retroductive starting point.

Having a proposition as a starting point is common within CR and is the first step in my retroductive reasoning (Wynn & Williams, 2012; Zachariadis et al., 2013). Retroductive reasoning is a process where one goes back and forth between observing and abstracting to gain better knowledge about structures and their powers (Malhotra, 2017).

Propositions do not rely on testable data. However, according to CR, propositions need to be valid in the form of explaining mechanisms behind the connection between the phenomena. Therefore, I started by adapting existing theoretically explained mechanisms to understand my research problem.

I went into the literature on project management, organizational behavior, behavioral economics, and social psychology to grasp the direction the conversations about digital human behavior were going, and found the two theories of *psychological safety* (Edmondson, 1999a) and *digital mindsets* (Solberg et al., 2020). The two phenomena are the main theories in the theoretical framework and were the foundation for adjusting the original proposition and defining the research questions.

Research setting: closing the system.

The next step was defining the research setting. CR sees society as an open system in change (Wynn & Williams, 2012). To produce knowledge, I needed to define a partially closed system, described as a context. Importantly, I am not referring to system thinking but focusing on regularities and events resulting from a defined setting (system) (Fleetwood, 2017). The setting is the boundary that makes my research context-dependent. I create *better-informed knowledge*, but *not* alone intransitive theories, as the knowledge I produce can be true but not necessarily occur at another time or in other contexts.

The research settings of Cases 1 and 2 were chosen similarly. The cases are limited to the building project's design phase, and I focus on the interactions within design teams. This context creates a clear boundary between the project and the relations and actors I am collecting data about. Simultaneously, a design team in construction projects consists of several actors (firms and individuals). How they are structured depends on the project delivery model (PDM) and how the project managers decide to design the process. Thus, I am safe when saying that there are never two identical projects, creating a complex research setting with numerous hidden structures affecting the behavior of the research objects. Therefore, I used the framework developed from the literature to create a matrix as a criterion for case selection,

presented in Table 7.3 in the next section. The matrix is a project profile of an ideal situation for the phenomena to intertwine.

Case 3 was emergent, and therefore I did not go through a sampling process as in Cases 1 and 2. The case was limited to the administrative structure of the PBO, which supported project-focused activities. Therefore, I focused on leaders' perceptions, employees' behavior, and the organizational culture and climate.

Research objects.

Since critical realists aim to understand their objects at a deeper ontological level, I focus on the effect that emerges when they meet. In the social world, causal powers are more likely to activate in relation structures than isolated individuals (Wynn & Williams, 2012). Therefore, the focus should lie not only on individuals but also on how their powers are causally intertwined.

Within my defined setting in Cases 1 and 2, the design teams that I studied are social structures consisting of the interacting structures: firms, individuals, rules, practices, norms, language, software, and communication and information technology. I see these combinations of structures as unique, and therefore findings must be understood in this context.

For Case 3, the units of analysis are the internal management and the employees' behaviors. The PBO is a social structure consisting of the interacting structures: organizational culture, assumptions about organizational values, employees, rules, practices, norms, language, software, and communication and information technology. As for Cases 1 and 2, the combination of structures is unique to the case study.

Even though I am specifying my research setting and my research objects, I cannot isolate them from their environment. The industry, the nature of the projects, and the organizational structures are a part of the environmental impact on my research objects. I call my research setting a partially closed system because I do not consider individuals' life histories or each firm's organizational culture involved in the design team. These contextual attributes present some possibilities that my results may not offer the full story.

In the following sections, I address the last steps in the "define and design" phase in Figure 7.1. I first present Cases 1 and 2 study design, then Case 3's design. Next, I describe the data collection methods.

7.2 Cases 1 and 2 case study design

This section explains the case study design of Cases 1 and 2. My research strategy for the singular case design was in accordance with Yin's (2017) definition of case study research: "A

social science research method, generally used to investigate a contemporary phenomenon in-depth and in its real-world context", where the case is a design team and the study is of the behavior and attitudes of team members. See Appendix A to review the case study protocol designed prior to data collection and used as a guide to governing the case studies.

7.2.1 Research objectives and questions

Four case-specific objectives and research questions, provided in Table 7.2, were formulated for the studies of Cases 1 and 2. The questions were chosen to inform those of the cross-case design presented in section 1.5.

Table 7.2: Cases 1 and 2 research questions and objectives

Objectives	Research questions
To recognize the level of psychological safety in the team.	*RQ1:* What is the experienced/observed level of psychological safety in the design team?
To point out the contextual effects on psychological safety to gain a deeper understanding of the first objective.	*RQ1a:* What contextual (multilevel) effects can explain findings in RQ1?
To recognize the level of the team's digital mindset.	*RQ2:* What is the experienced/observed level of digital mindset in the design team?
To discuss if there are characteristics of psychological safety that cultivate the team's digital mindset.	*RQ3:* Does the team's level of (negative or positive) psychological safety affect the observed digital mindsets?

7.2.2 The sampling process

The sampling process as part of the design stage in the figure in Appendix C consisted of two intertwined steps. The first step was to come in touch with a company, and the second, together with the firm, to identify a design team for the case study. This process, together with the data collection process, is visualized in Figure 7.2.

I experienced that a sensitive part of the sampling process is the establishment of contact with project actors to get access to a case object. The identification of Case 1 (Norwegian design team) was fast and uncomplicated. Through an introduction email, my main supervisor put me in contact with a Norwegian project owner. Through email, a meeting was scheduled, and in the meeting, a possible project and design team was discussed and decided upon. I was welcomed by all project actors, and all were willing to participate.

The process was challenging for Case 2 (US design team), as organizational norms differed due to culture, and bigger firms made casual connections difficult. Thus, a longer-lasting Stage 1 was needed to build trust and a common understanding of my research objective.

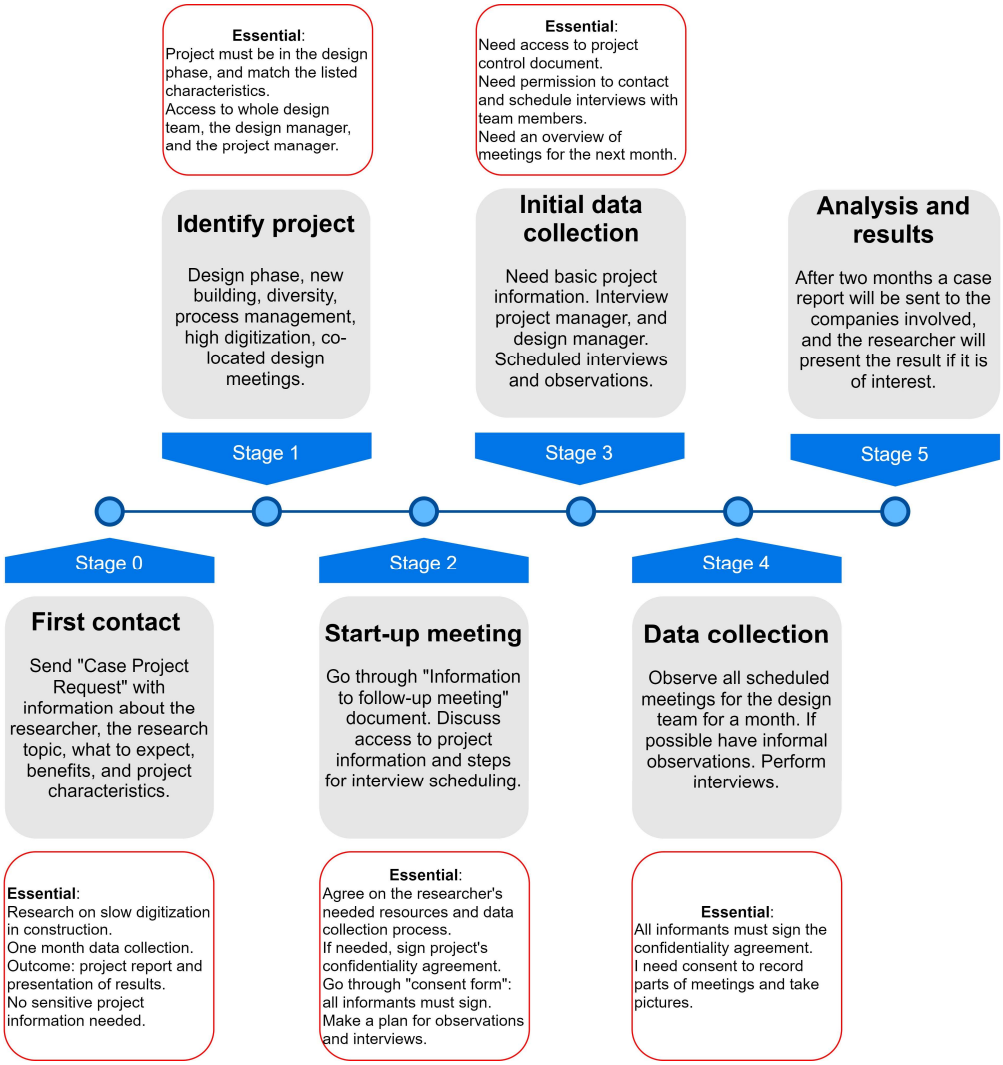

Figure 7.2: Sampling process for Cases 1 and 2

The second step of the sampling process was to collaborate with the firm on what project could serve as a case study. The process of selecting projects is designed as a set of variables determining the characteristics of the projects and the design teams, characterized as a homogeneous sampling (Preston, 2002) where the intent is to reduce the variation of external and internal contextual differences between projects and simplify the analysis.

Table 7.3 lists the necessary and preferred characteristics of the project for the proposed research. Explanation of Table 7.3:

- **Shared variables** are the characteristics that must be found in the specific project.
- **External factors** refer to characteristics of the specific overall project.
- **Internal factors** refer to the characteristics of the design phase of the specific project.
- **Gray** indicates preferred but not necessary characteristics.

Table 7.3: Variables for project characteristics

Variable category		Shared variables (project characteristics)
External factors (project organization)	Project delivery model	Cooperative work practice
	Product	New buildings (not rehabilitation)
	Project type	Construction projects (buildings)
	Project size	Medium to large (200–500 NOK mil)
	Project complexity	Complicated (medium-technological, need for diversity of knowledge)
	Private or public sector	Public sector
	Digitalization	Commitment to digital tools in the design process
	Phase of project	Developed design*
	Pace	Fast/competitive
Internal factors (design process)	Diversity of professions represented in the team	Medium to high (a team consisting of several professions; example: RIB, RIV, RIE, ARK [Norwegian])
	Diversity of represented firms	Minimum of three firms
	Team size	Minimum of seven people
	Management style	Process management (not structure management)**
	Work situation	Co-location
	Flexibility	Dynamic decision-making within the team

* Developed design is also described as detail design.

** Process management is characterized by a flexible structure and a facilitating design manager, where the process is a product of collaboration.

7.2.3 A triangulation approach for data collection

To be confident that I captured what critical realism describes as mechanisms (power of objects) (Collier, 1994), my case study evidence came from different sources, obtained by several methods using different instruments, visualized in Figure 7.3.

Figure 7.3 depicts my use of triangulation. Triangulation is defined as "the combining of methodologies in the study of the same phenomenon" (Denzin, 1970, p.291). Bowen (2009) describes it as a strategy in which the researcher consults two or more sources of qualitative data in order to find convergence or corroboration.

Triangulation is especially beneficial when aiming for deeper knowledge, as you can confirm your understanding from different sources and means. As described, I follow a retroductive reasoning that is complex and challenging to document and can end with questionable verification (Wynn & Williams, 2012). However, through triangulation of data within the case study, retroduction is verified due to several data sources confirming the findings.

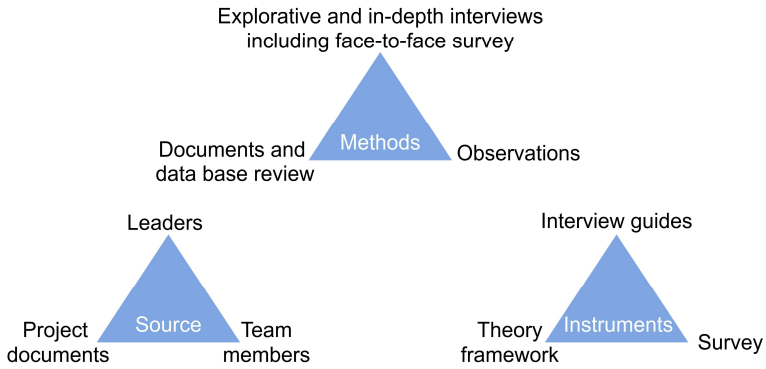

Figure 7.3: Cases 1 and 2's triangulation approach to data collection

7.2.4 Primary data collection process

The instruments for the collection of primary data are interviews, face-to-face surveys, observations, and document analysis. The steps for the data collection are explained in Table 7.4 on the next page, divided by the two studied paradoxes. The tools are further defined in section 7.4.

Table 7.4: Methods for data collection

	Interviews	Observations	Document Analysis
Psychological Safety	Interviews with the designers and the design manager will be the main sources of understanding the individual level of psychological safety within the design team (Edmondson & Lei, 2014). The researcher will look for stories regarding their experiences of taking interpersonal risks within the team through a narrative approach. To validate the findings from the interviews and observations, a face-to-face survey will be conducted (Edmondson, 1999a).	The arena for the observation will be design meetings, as this is when most of the design team members meet. The observation is designed in line with the recommendations from (Edmondson, 1999a).	It will be relevant to identify "forced" working patterns for the design process. This can be found both in the contract and in internal agreements within the team – for example, whether there is a collaboration agreement regarding physical space or how they are to communicate (Edmondson, 1999a).
Digital Mindsets	An informative interview will be conducted to garner the design manager's subjective opinion on the digitalization level of the team. This will be the basis for restructuring/guiding for observations in meetings and informal settings. Next, a narrative interview with all designers on the team will be conducted. The aim will be to look for stories regarding the use of digital tools and whether the episodes were considered rewarding versus difficult (Solberg et al., 2020). A face-to-face survey of mindset will be the main data source to gain knowledge on the digital mindset. The survey has been developed and validated by Solberg et al. (2020).	A detailed observation of digital mindset is not a part of this study, as designers do not necessarily sit together when they work. In addition, the use will differ too greatly in each case study to be comparable. However, attitudes toward digital tools will be observed.	Document analysis is not part of the data collection process. However, depending on the interview in stage 1 in Figure 7.4, an analysis of "forced" level of digitalization in the documents could be of value.

Figure 7.4 provides a visual overview of the collection strategy for the primary data based on Table 7.4. The duration of the data collection was planned to be one month, with the flexibility to conduct interviews at a later point if necessary. Due to the COVID-19 crisis, the process was longer for Case 2.

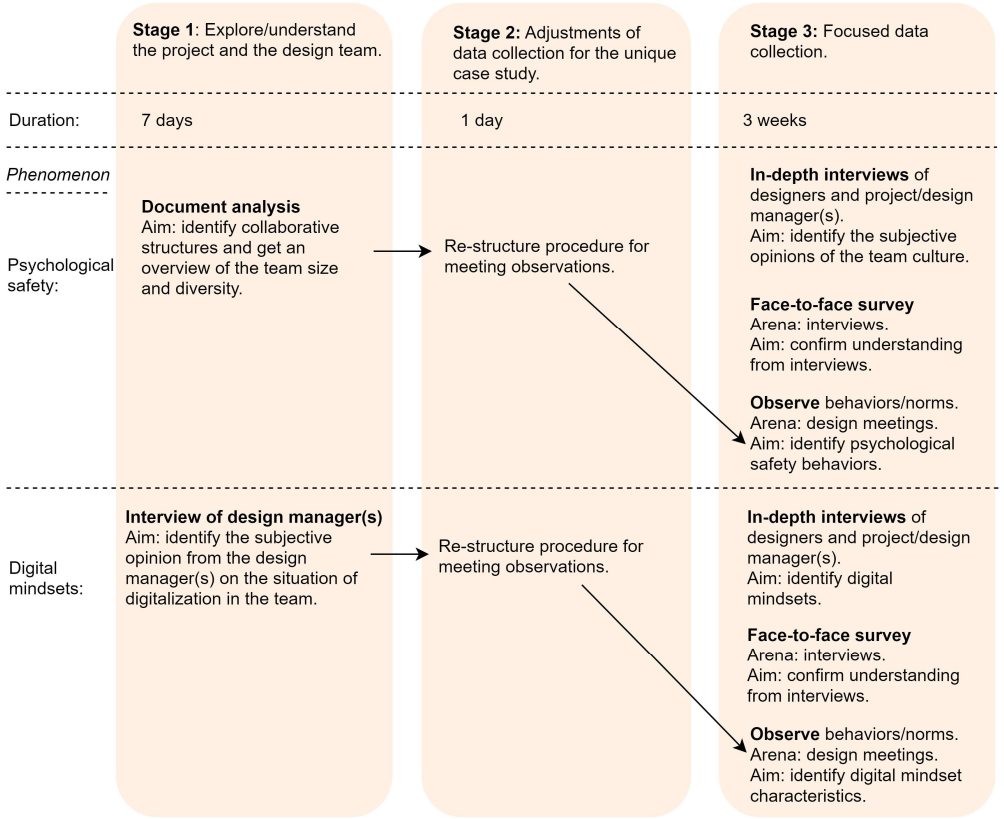

Figure 7.4: Case study strategy for data collection

7.3 Case 3 case study design

The COVID-19 pandemic erupted while I was physically present in the research setting of Case 3, as the PBO was a part of the design team of Case 2. The situation provided an opportunity to study psychological safety in a different environment, both because the case was a PBO and transformed to be all virtual.

The pandemic also provided an opportunity to observe and study resilience unfold. Thus, the case study also aimed to capture how resilience developed in the PBO as the COVID-19 pandemic served as a test for how the organization and its leaders responded to enormous pressure. Together with three co-authors, I wrote a paper based on the capability represented

in the organizational values in influencing the choice of situation-appropriate leadership styles to support employees. The paper is presented in Appendix B. The findings presented in the paper compliments those of the thesis as both emphasize the human aspect of technology change and the importance of leader and organizational support.

In this section, I will describe the research design relevant to the findings presented in the thesis. As for Cases 1 and 2, Case 3' design is in accordance with Yin (2017), where the case is a PBO, and the study is of the behaviors and attitudes of its upper management and employees. When the crisis hit, I had access to the PBO's employees, information platform, email, and meetings. The richness of the data enabled an intensive case study (Bernard, 2000) with an in-depth description of the situation (Yin, 2017).

7.3.1 Research objectives and research question

Two case-specific objectives and research questions, provided in Table 7.5, guided the study of Case 3. The questions were chosen to serve as a comparison in the cross-case research strategy to Cases 1 and 2 findings.

Table 7.5: Case 3 research questions and objectives

Objectives	Research questions
To recognize the level of psychological safety in the PBO.	*RQ1:* What is the experienced/observed level of psychological safety in the PBO?
To point out the contextual effects on psychological safety to gain a deeper understanding of the first objective.	*RQ1a:* What contextual (multilevel) effects can explain findings in RQ1?

7.3.2 A triangulation approach for data collection

To be confident that I capture what critical realism describes as mechanisms (power of objects) (Collier, 1994), my case study evidence comes from different sources, obtained by several methods using different instruments, visualized in Figure 7.5.

Triangulation was especially beneficial in Case 3 as it could confirm my understanding by different means and sources. As described, I follow a retroductive reasoning that is complex and challenging to document and can end with questionable verification (Wynn & Williams, 2012). However, through triangulation of data within the case study, retroduction is verified due to several data sources confirming the findings.

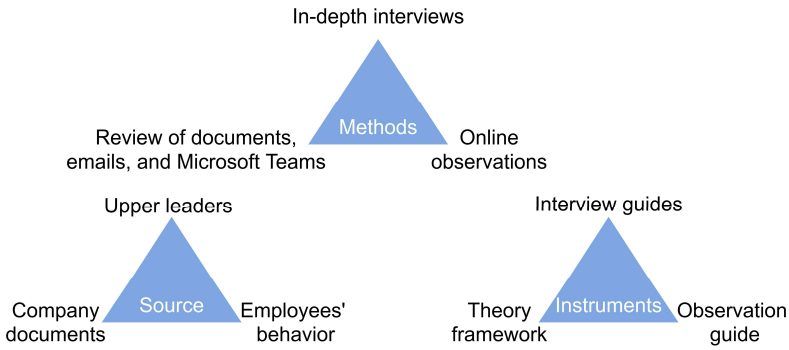

Figure 7.5: Case 3's triangulation approach to data collection

7.3.3 Primary data collection process

The instruments for the collection of primary data were interviews, observations, and document analysis, including reviews of emails and activity in Microsoft Teams. The tools are further defined and described in section 7.4.

The data collection took place over five months, from mid-February until July 2020. All office-wide meetings and management communication in this period were observed or collected by me. Due to the crisis, all communication with leaders and empirical data collection proceeded online through Skype for Business or Zoom.

The data collection strategy was developed prior to the data gathering; thus, protocols were developed based on the objective of understanding how leaders and employees perceived psychological safety during the first months of working in a virtual environment. The protocols were based on those used for Cases 1 and 2's design.

Still, the events that were studied were non-linear, as is typical for process data (Langley, 1999). When a crisis hits, there are many sequences of events on multiple levels, ambiguous boundaries, and changing feelings and thoughts. Thus, the case study design took on a process perspective, trying to understand how and why psychological safety developed during the first months with home offices. The motivation for the data collected was to provide a deeper understanding rather than empirical generalization.

7.4 Data collection methods

Data collected in the *defining stage* of the research design in the research process model in Appendix C was gathered in a literature search and is described in the following before elaborating on the primary data collection methods that happened in the *prepare, collect and analyze* stage of the model.

7.4.1 Literature search

At the very start of the Ph.D. process, my aim was to identify the most relevant and appropriate theoretical framework(s) to guide the research. I did a broad search, going beyond the project management field, to grasp the direction the conversations about digital human behavior were going and identified the two theories of psychological safety (Edmondson, 1999a) and digital mindsets (Solberg et al., 2020).

I argue that a systematic literature search is not appropriate for the scope of this thesis, which broadly explores the relationship between humans and technology in larger transformation processes. This topic is multi-faceted and encompasses several sub-topics such as human aspects, processes, technology effectiveness, efficiency, etc. Therefore, posing a clearly formulated question for a systematic search was not fruitful. The topic also cuts across multiple disciplines, each with its own definitions and perspectives. Therefore, instead of using a structured and formal approach, as with a systematic literature review (Khan et al., 2003), I focused on providing an overview of the current state of knowledge based on my selected theories. Thus, my focus was finding and identifying relevant materials rather than evaluating or synthesizing the information contained within them, as with a literature review (Khan et al., 2003). The approach is similar to a scoping review, where one manually searches through relevant journals or references of identified articles (Arksey & O'Malley, 2005). However, scoping reviews often cover broader topics.

The process of creating the theoretical framework may be described as snowballing. This approach involves both backward snowballing from reference lists and forward snowballing through citation tracking (Jalali & Wohlin, 2012; Webster and Watson, 2002). The key to successful snowballing is identifying a starting set of papers from leading journals in the field (Wohlin, 2014). I have labeled these key sources, some of which are listed in Table 7.6. Some of the key sources were systematic review papers, for example, Edmondson and Lei (2014) and Frazier et al. (2017), which were valuable for getting an overview of research on psychological safety. Furthermore, during my analysis, I noticed certain patterns in the data and needed to find theories to discuss them. To achieve this, I went back to the key sources and conducted a more thorough search for relevant sources that addressed these specific topics.

To give an example of how I have approached the literature search with snowballing, I will describe how I developed the theoretical chapter concerning digital mindset. Digital mindset, as defined by Solberg et al. (2020), is still a new and relatively unexplored concept. Also, there exists a vast number of other conceptualizations of the term. Therefore, searching databases, such as Scopus, was ineffective. Because the paper is newly published, forward snowballing had little effect. Therefore, I had to start with the reference list to gain a better understanding of the arguments of the concept. After reading several papers, I noticed keywords that I could further use to search within databases.

Table 7.6: Examples of key sources

Focus of study	Citation	Publication type	Method	Field
Psychological safety and learning behavior	Edmondson, 1999a	Journal article	Qualitative and quantitative	Organizational behavior
Survey of team psychological safety	Edmondson, 1999b	Verified survey	Survey	Organizational behavior
Digital mindset	Solberg et al., 2020	Journal article	Quantitative and theoretical	Organizational behavior
Growth and fixed mindsets	Dweck, 2007	Book	Theoretical	Organizational behavior
Projects as temporary organizations	Packendorff, 1995	Journal article	Theoretical	Project management

7.4.2 Document studies

Project documents are commonly used as a source in qualitative research and are often a part of case study research (Bowen, 2009). Bowen defines document analysis as "a systematic procedure for reviewing or evaluating documents – both printed and electronic material." Documents can be text in various forms, pictures, or art. They have in common that they are most often not made for research purposes. Therefore, when choosing the documents, in order to avoid using the information wrongly, a researcher must be conscious of what the document can provide to the research, whom it is written for, and in what context it was made.

In some fields, document studies aim to view how words and structures are used to portray an argument or a class in society (Ryghaug, 2002). In project management studies, where my research belongs, document studies typically aim for contextual information and facts through naïve reading. Bowen (2009) highlights that documents are especially useful for contextualizing data collected through other methods, such as interviews and observations. Another use of documents in management studies is discussed by Callon (2002), who explores the effect of the role of the guidance provided in written management tools. Callon writes that written tools "make the complexity of systems of action manageable and controllable without eliminating it", including that the documents construct and objectify services, the consumers, and the actions that make delivery possible.

In the design phase of construction projects, there is typically a project control document with information on project details, the PDM, stakeholders, costs, and plans and deliveries. These documents are what Callon (2002) defines as "writing devices that put organization-in-actions

into words" and are products of collective efforts that are rewritten, building on achievements and experiences. The author of the documents is typically the project manager or superior, and the readers are existing or new team members and the client. Details are hard to remember precisely over time. Also, actors are often brought into projects at different times and do not have first-hand knowledge of the project's details. Therefore, the information on project details is difficult to gain from interviews.

Thus, in Case 1, I used the project control document to familiarize myself with the project. In addition, there was a digital work platform with information about the design team, including roles, size, and diversity. This project also had posters in the meeting facility stating how the team should behave, providing information on the team's attitude and collaborative goals.

Case 2 did not operate with a project control document but used internal digital platforms where they uploaded past and in-progress deliveries to the project owner with detailed project information. Due to security protocols, this information and team contact information were gained through conversations with the design manager. However, the project was governmentally owned, and therefore much information was public and found online. For both Cases 1 and 2, agendas and minutes were analyzed to identify how the team was managed and the team's dynamic.

The emergent Case 3 study followed a different case study design; thus, the information of interest was different from Cases 1 and 2, requiring other types of documents, as described by Bowen (2009). Like the project control document, office presentations designed for new employees provided me with background information about the office and the firm. The situation of COVID-19 was emergent, and the management created dynamic protocols as a tool to inform and control the situation. Information channeled through Teams and by email revealed what kind of information increased and what became more critical to support the office through the crisis. Thus, these documents were analyzed to understand what guidance the information provided, as described by Callon (2002). Table 7.7 provides an overview of the different sources treated as documents for the three within-case analyses and what information was of value.

Another important use of the document information was to go beyond the words and see the informants' stories through their expert jargon, as Gudmundsdottir (1996) described. Understanding the research objects' industry-specific slang was especially important when studying a culture using a language other than my native. For example, despite being an engineer, I did not have a broad engineer-specific English vocabulary.

Table 7.7: Documents from case studies

Project	Type of document	Information
Case 1- Norwegian design team	Project control document	Project information (size, location, plans, project delivery model, stakeholder map)
	Database	Team members, roles, firms
	Posters	Cultural and collaborative goals
	Agenda and minutes	Leadership, distribution of responsibility, plans, team dynamic
Case 2- US design team	Deliveries	Project information (plans, responsibilities)
	Received documents from database	Delivery schedules, team members, roles, firms
	Agendas and minutes	Leadership, distribution of responsibility, plans, team dynamic
	Webpage	Project information (size, location, project progress)
Case 3- COVID-19 case study	Dynamic protocols	Leadership styles, work processes
	Office presentation	Organizational information (size, history, values, goals)
	Microsoft Teams activity	Change of work processes and employee and leader support
	Emails	Change in information and leadership support
	Agendas and minutes	Change in work processes and leadership support

7.4.3 Semi-structured interviews

A research interview is a tool that gives access to a specific type of information and is characterized as being a social situation (Gudmundsdottir, 1996; Rapley, 2004). Interviews are used when the needed information can only or in the best way be conveyed through words and stories, and as with documents, interviews are often used in combination with other research methods (Yin, 2017). Interviews can take many forms, from structured to non-structured conversations, and as a group or two-way dialogue. The choices are often associated with how the interviewer views knowledge development, if the answers are seen as true knowledge about the world, or if the interview itself is developing reality (Rapley, 2004).

As a critical realist, I believe that the interview questions and the relationship between the interviewer and the informant create a unique context that can alter knowledge, despite there

being an objective reality. Thus, getting the same answers in a different setting will not be possible (Holstein & Gubrium, 1995). Therefore, I have to be conscious of the questions I ask and how I frame the interview before starting the conversation (Rapley, 2004). In my research, I aim for information but also views and reflections (subjectivity). Semi-structured interviews with direct and open-ended questions provide the possibility for both. What characterizes these interviews is that they often are guided by a set of questions (Bogner & Menz, 2009). Based on the theory described in subsection 7.4.1, I created themes and questions that served as an order to the conversation and were flexible to follow the interview flow (Rapley, 2004). The interview guides are attached in Appendix E and Appendix F.

Expert interviews are often associated with project management research, as the objective is to get access to the interviewees' knowledge (Bogner & Menz, 2009). Experts in Cases 1 and 2 are team members that have been involved in the design team for a long enough period to have developed an opinion about the team climate. To identify these experts, in Cases 1 and 2, I started each case study with exploratory expert interviews of project and design managers possessing contextual knowledge (see Appendix F). Bogner and Menz (2009) define exploratory interviews as a tool to gain information about research objects, constructing the research's next steps. Case 2 did not use a project control document. Thus, the exploratory interviews were also essential to establish trust and attaining relevant documents and information. In Case 3, informants were experts in that they had first-hand knowledge of how the office technically and psychologically handled the crisis. The interviews followed the same semi-structured format (see Appendix E) but also had themes focusing on the crisis.

My main topic, psychological safety, is a more personal matter than asking about plans and deliveries (Edmondson, 2018). It is often an unspoken theme and hard to describe. In my interviews, it is these silenced voices that I want to hear. When speaking about being accepted, heard, and feeling safe at work, the interviewee can speak as a team member, an employee, or an individual, depending on how they experience the interview setting (Holstein & Gubrium, 1995). As an interviewer, I have focused on being an active listener and asking questions to shift the informants' narrative roles, thereby getting different perspectives on an event.

Table 7.8 shows an overview of the informants I interviewed. There were 29 interviewees from 14 different companies for Cases 1 and 2, and for Case 3, there were six interviews. All interviews lasted between 40 and 60 minutes.

Table 7.8: Informants per case study

Case	Type of consultant	Role
Case 1 – Norwegian design team	Project owner	Project manager
	Constructer	Design manager
		Former design manager
		BIM-coordinator
	Architect	BIM-coordinator
		2 Architects
		Landscape architect
		Former design manager
		2 Structural design engineers
	Structural design consultant	Structural design engineer
	Electrical engineering consultant	Engineer
	Consultant for precast concrete	Engineer
Case 2 – US design team	Architect	Project manager
		Design manager
		Architect/ Associate principal
		Architect
	Structural design consultant	Structural design engineer
		Engineer
	Architect consultant	2 Architects
	Civil engineering consultant	Engineer
	Mechanical engineering	Engineer
	Landscape engineering consultant	Principal in charge
		Landscape architect
	Urban design engineering consultant	2 Engineers
	Electrical engineering consultant	Engineer
Case 3 – COVID-19 case study	Structural engineering office	Office manager IT manager 4 Principals

7.4.4 Face-to-face survey

As with the explained research methods, surveys are used in numerous ways. Most often, surveys are associated with quantification and generalization. There are also qualitative surveys with open-ended questions aiming to capture the diversity of perspectives on the topic of interest while still keeping the values of qualitative research (Braun et al., 2020). Mixed-method provides the possibility of surveys where the qualitative or the quantitative part is dominant through sequential logic or weighted equally and analyzed concurrently (Borrego et al., 2009).

I chose to use a face-to-face survey as part of the expert interviews in Cases 1 and 2. This approach must not be misunderstood as a sequential mixed-method, as the survey is not designed nor analyzed as a quantitative tool. As the survey is intended to help to answer my research questions concerning the design team I am studying, there were no gains from designing a more extensive quantitative study. Responders outside my research setting would not have brought me closer to understanding the mechanisms behind events, as Sayer (2000) describes when explaining CR. The survey is used as a technique within the interview, not a self-report questionnaire, and the data must be understood in this context.

A survey was used in addition to interviews because of the phenomena of interest. Psychological safety and mindsets are hard to identify. Thus, I wanted to limit my subjective interpretations of the interviews to grasp the interviewees' experiences. In research, psychological safety has dominantly been studied quantitatively, and I chose to use the verified survey by Edmondson (1999b). Similarly, the survey used to map the team's digital mindset was obtained through a request to the authors of the article "Digital mindsets: recognizing and leveraging individual beliefs for digital transformation", by Solberg et al. (2020). The survey handed to participants during interviews is attached in Appendix G.

Edmondson (1999a) explained that psychological safety is a group construct that characterizes the team as they share the same set of influences and experiences. Thus, the survey will give an impression of the team members' perception of psychological safety and to what extent they shared the perception, but not an explanation of why. To understand the mechanisms behind the survey results, I went deeper into the qualitative data.

Most studies using Edmondson's survey and exploring mindsets have a larger response group (n) to capture differences among teams to generalize an effect of the phenomena. It would be relevant to evaluate the scale reliability in these cases, such as Cronbach's alpha coefficient. However, the general assumption is that reliability analysis should not be attempted for sample sizes under 30 (Samuels, 2015). Therefore, I have not considered the scale reliability for psychological safety or digital mindsets due to a small respondent group.

7.4.5 Observations

Observations as a research method can be active or passive. Two active observation techniques are to become a part of the research setting (Almklov, 2008; Czarniawska-Joerges, 2007) or change practices in collaboration with practitioners (Costello, 2003). The aim of passive observation is often to observe the extent to which causal knowledge about a phenomenon appears (Boumans, 2010).

I have been a passive observer, as I have not engaged in activities or actively changed processes. In addition to observing behavior, the method helped identify the events to discuss and the on-the-spot question for interviews. I developed a meeting observation guide, found in Appendix H, to focus the observations.

It was especially important to be a passive observer for two reasons. Firstly, my research topics, psychological safety and mindsets, can change instantly. By adding myself to the group, I could have changed their dynamic in ways that I could not identify. Secondly, time is often problematic in organizational studies (Czarniawska-Joerges, 2007), as it was for me. As I observed for a month for Cases 1 and 2, participation was not feasible. Also, for Case 3, the delicate situation due to the COVID-19 pandemic made participation risky for the organization.

Despite not becoming a part of the research setting, I have adapted some observation philosophies from anthropology. The following explains how I interpreted the active role of collecting observation data (Almklov, 2008).

There are great advantages to observing and paying attention to what people are trying to say, going beyond words (Wikan, 1992). In my observations, I used a lot of time to train myself not to listen to the technical details being discussed but look for signs of how individuals used their words and the tone of their voice. Having an observation guide (Appendix H) aided this process. Thus, when I retell a situation, I have had to use both feelings and thoughts. Wikan (1992) describes the process of applying life experiences as a resource to understand phenomena as resonance. The aim of resonance is to find a shared understanding but, at the same time, accept that groups are different. This entails that my translation of an event will not be accurate but be shared intelligibility to me and the observed. Similarly, as a critical realist, I accept that the "I", a synonym for my knowledge and intuition, affects my research. However, when going into the analysis, I must be careful not to put a deeper meaning to what I observe but "to attend to the concerns and intentions from which they emanate" (Wikan, 1992).

The majority of my observations were of meetings, and Table 7.9 on the next page provides an overview of what kind of observations were made in the different studies. In Case 1, they had meeting days where team members came and went, and this allowed me to observe the informal conversations, for example, at lunchtime. Due to the COVID-19 situation, all observations were digital in Case 2, making it harder to gain an overview of the team and its dynamic. The

active role of an observer described by Almklov (2008) changed, as the informal situations of contact were not there. Also, getting invitations to meetings and information rested heavily on my contact person in the project, and gaining trust from the observed was challenging. The situation was similar in Case 3. However, a significant difference was that I was physically present at the office for two weeks before they went digital, giving me the time to establish relations with employees in Case 3, resulting in them being more comfortable seeing me in digital meetings.

Table 7.9: Observation types per case study

Project	Type of observations	Nr. observ.	Meeting duration	Description
Case 1 – Norwegian design team	Design meeting	1	3 hours	Discuss solutions for the building project
	BIM-coordination meetings	2	2 hours	Discuss and solve collisions in the BIM-model with the whole team
	Specialty meetings	2	1,5-2,5 hour	Discuss smaller issues/ solutions with fewer team members
	Collaborative planning	1	7 hours	The whole team met to discuss critical points in the project plan
	Informal settings	7	5-60 minutes	Breaks between meetings, lunch breaks
	Different management meetings	3	1,5-3 hours	Discuss the economy and strategic steps for the project
Case 2 – US design team	Design meetings (focused meetings)	3	1 hour	Discuss solutions for the building project, deliveries
	Specialty meetings	1	1 hour	Discuss smaller issues/ solutions with fewer team members
	Collaborative planning	6	1-2 hours	Discuss interdisciplinary solutions for the next delivery
Case 3 – COVID-19 case study	Daily morning check-in	16	6-15 minutes	Short voluntary morning meetings due to the home office situation
	Weekly client management meeting	5	30 minutes	Discuss project opportunities and industry relations
	Monday scheduling meeting	5	48-60 minutes	Weekly planning of workload
	Monthly management meeting	2	1 hour	Discuss financials, billing, the market, returning to the office
	Monthly office lunch meeting	2	1-1,5 hour	Arena for social activities and informal information

7.4.6 The benefits of triangulation

Despite the fact that the data sources were slightly different for Cases 1 and 2 compared to Case 3, as presented in the previous sections, the challenges and benefits of triangulation were the same. Therefore, the following discussion will not separate the case studies.

Early on in this chapter, I stated that research philosophy would decide *if* and *how* methods can be used, based on Ragin (1987), Kuhn (1996), and Chilisa and Kawulich (2012). In the quest to understand my industry problem, CR was the right choice for me. Flick (2007) explains triangulation as an alternative to validation, which, as Wynn and Williams (2012) mentioned, is a problem with retroductive reasoning associated with CR. Through several methods, one confirms and deepens the knowledge about the phenomena of interest and reduces the many unavoidable biases (Bowen, 2009). Thus, it can help overcome the issue of trusting the observed data, which is a challenge for critical realists (Sayer, 2000). How the discussed data sources uniquely contribute to the triangulation is shown in Table 7.10.

Table 7.10: Information by data sources for triangulation

	Documents	**Observations**	**Interviews**	**Face-to-face survey**
Contextual information	x	x		
Role and actor information	x	x		
Subjective experiences	x		x	x
Behavior	x	x	x	

Contextual information in my studies is knowledge about the research settings and the objects. As Bowen (2009) describes, document studies have been especially useful for contextualizing more subjective data from observations and interviews. What I found challenging was that information about rules and norms in construction projects does not necessarily give an accurate picture of the setting. Much information is there due to formalities. Also, the context changed faster than the information was updated. I cannot say that, for example, the project control document did not provide the needed guidance for the project team, as this is not a part of my studies, but I do claim that the document alone is not sufficient to describe the context. It was essential to also go into project databases and observe what actually happened in practice.

Role and actor information was also gained through document analysis. However, as with contextual information, it was impossible to lean on documents alone. I noticed that roles were played out rather differently from what was described in documents. In meetings, I observed

how different team members and employees behaved in accordance with their assigned roles (see Appendix H). These observations of roles were crucial to understanding the team dynamic and what leadership style was dominant. I could then compare contextual information with actor information to identify the *why* of the situation.

Subjective experiences concern what people think about a situation or an event. They are the views and the reflections that only the informants themselves can tell. Interviews were the primary source to understand if and why my research subjects were psychologically safe and how they felt about digitalization. The absence of psychological safety is hard to prove, as it could be present even though a person is not active in a setting (Edmondson, 2018). Also, it is challenging to ask the correct open-ended questions to grasp such delicate states, as there are no yes/no questions. Thus, the face-to-face survey helped to verify my understanding of the informants' answers (see Appendix G). The document studies served as an indirect source to understand subjective experiences, as they helped me understand the vocabulary of my research objectives, as explained by Gudmundsdottir (1996). Without having a shared understanding of terms during interviews, the interpretation of the interview answers could have given false meaning.

Behavior provides information on how actors cope with a situation. The benefit of passive observation is identifying *what actually* happens, not what *might* happen or what people *think* happens (Haavelmo, 1944). As Boumans (2010) stated, passive observation alone would be problematic, as I do not get the intimate knowledge of the *why* of a situation, also called structural relationships. For that to happen, all possible variables in the system (research setting) must be simultaneously present several times for comparison. From the CR perspective, it would not be possible to say for sure that all layers of reality at that moment are observable or active (Sayer, 2000). Thus, observing alone would challenge the process of analysis. To identify the mechanisms of a phenomenon, I need to gain knowledge of structural relationships, requiring another dataset. Interviews help to gain information on the *why* of behavior (see Appendices D and E). As mentioned, by first categorizing the behavior, interviews provide the arena to identify the structural relationships. Written information provided in the document studies also revealed leadership behavior. The change in written information was significant for the study of Case 3, as it shed light on the change of leadership styles. In this case, I studied the guidance provided in documents (Callon, 2002).

7.5 Data analysis

The analyses of the three case studies were done separately as within-case analyses and then compared through a matrix-based cross-case analysis as defined by Cruzes et al. (2015) and shown in the *analyze and conclude* step in the research process model in Appendix C. Both the

within-case analyses and the cross-case analysis processes are similar to a retroductive reasoning. I explain my approach in the following.

Step 1: Abstraction.

The first step was to abstract observed experiences perceived by me as a researcher through interviews, observations, documents, and the face-to-face survey to describe the events that I believe have occurred. As mentioned, the use of methodological triangulation verifies the retroduction of experiences, as I interpret the observation based on different sources (Wynn & Williams, 2012; Yin, 2017). The action of abstraction means to impose some order on the experiences so that the causally relevant elements become apparent. As I started with existing theory, I reframed what happened through the lens of the literature.

The within-analysis of each case study happened in multiple stages using NVivo, a software that supports qualitative and mixed-methods research. Examples of how the coding was structured are illustrated in Table 7.11 on the next page. I analyzed theoretical sources to identify broad themes (macrocodes) in the first stage. In the second stage, through a thorough understanding of the primary data, the macrocodes were grouped into intermediate codes, and additional microcodes were added.

Step 2: Theorizing.

The next step was to theorize about the causes of the events. Sayer (1992) describes that the linkages between structures and events can be found by asking: "What does the existence of this object (in this form) presuppose? Can it exist on its own as such? If not, what else must be present? What is it about the object that makes it do such and such?" In the abstraction, the fundamental properties of structures and their connection are redescribed in terms of the theories. Relevant structures, in my case, would be the design team (the combination of disciplines), the design manager, individuals' digital mindsets, digital use, and the team culture. In the theorizing, I discuss how these structures do certain things and how their combination produces events as a whole. Thus, I went back and forth between empirical data and theory until the most probable explanation was found. These events, or experiences put in order, are not the proposed theory but the tools to develop it (Wynn & Williams, 2012). I ask questions about causal relations, creating what Yin (2017) explains as explanatory case research.

Table 7.11: Coding strategy, managed in NVivo

Macrocodes	Intermediate codes	Microcodes (examples)	Data from interviews and observations (examples)
Psychological safety	Interdependence	Accountability	"We know that the decided solutions are well worked out and that several actors have voiced their opinions and concerns." (Team member)
	Interpersonal risk	Speaking up	Comments from meeting observation: "Just a stupid question, should there not be lightening there?"
Contextual effect on psychological safety	Organizational dynamic	Project delivery model	"I believe that a collaborative delivery process is a good way to do building design, but the contractor needs to get habits in the predesign phase." (Team member)
	Leader behavior	Modeling for openness and weakness	It was observed that the design manager was open about his limits when it came to technical details and trusted the team members to fill this gap.
	Team dynamic	Respect	"It is respect for others' specialties. This has been very good in [the project], especially the architects. They do not present a picture and say, 'this is how it shall look', they present it like 'this is how I prefer it, what can we do?'. Then they benefit greatly from my knowledge." (Team member)

Step 3: Thematic synthesis and matrix-based comparison.

Since I aimed to compare cases, I chose a matrix-based cross-case comparison (Cruzes et al., 2015), similar to a thematic synthesis, where I compared themes that initially emerged from the individual cases (Nicholson et al., 2016). By intensively examining the cases individually through thematic analysis and systematically comparing the themes, I limited the chance of losing each case's uniqueness, as West and Oldfather (1995) expressed. Table 7.12 shows an example of the matrix-based comparison to answer RQ2 concerning effects on psychological safety.

Table 7.12: Example of matrix-based cross-case comparison

Mechanism	Sub-mec.	Case 1	Case 2	Case 3
Leader behavior	Inclusive decision making	Invited team members to decision-making. Meetings included all that were needed to make decisions.	Team members were included in needed meetings. However, it was mostly the project owner who had the last word. Leaders created systems for reporting progress.	Employees were included in deciding changes that were needed. Also, the effort to understand the new changes in the market was presented as a collaborative effort.

Step 4: Narrative representation.

After the construction of interpretations of the thematic synthesis, I followed a narrative synthesis, bridging summaries of perceptions (Cruzes et al., 2015). The approach assumes that one can construct meaning by telling stories, incorporating epistemological and ontological assumptions. The thematic synthesis found interesting themes, which narrowed the narrative exploration, which is the foundation to the conclusion.

7.6 Ethics, quality, and trustworthiness

This section begins by addressing the ethical considerations taken into account in designing and following the proposed research strategy. I then outline the steps taken to ensure quality and establish trustworthiness, all of which are anchored in the adoption of a critical realism research philosophy.

7.6.1 Ethics

Ethics in research is a skill that requires training and supervision. Muthanna and Alduais (2020) found that there is a strong correlation between effective supervision and research integrity and that much responsibility rests on the shoulders of the supervisor. I have had a close dialogue with the main supervisor about my work, who, being both knowledgeable and engaged, has provided me with the needed conscientious feedback on the question of ethics and process. In my experience, I have been fortunate to have had the needed support from supervisors and an academic network to learn to have integrity in my work. Also, in the Case 3 research project, I further developed my ethical behavior while learning from the research team consisting of doctors and professors.

Ethics as a researcher is about responsibility. Therefore, I have considered my research's and action's effects on others. In the following, I'll describe how several ethical issues were addressed during the research strategy's different stages.

The defining stage (see Figure 7.1) of the research design is based on existing research, and I have not interfered with the real world, so there are no ethical issues. The discussion of ethics becomes relevant for the output (Drevland, 2019), which is the theoretical framework I have used for data collection and for analysis. The question will be if I have inserted bias towards any of the actors that I observe, for example, the leader, in disrupting psychological safety. The framework I have used does not state wrong or right, and therefore from my knowledge, I have been as unbiased as I can. Research, however, is seldom neutral, and all research, no matter type, will be influenced by the person conducting it.

The three case studies rely on empirical data, where ethics is more problematic. Informed consent is an important part of qualitative research and requires that informants are informed about the research, processes, possible risks, and benefits (*Code of Ethics*, 2022). The interview protocol (see Appendix D), which was sent to interviewees to review and decide if they wanted to participate, contained this information. Additionally, I had follow-up meetings and dialogues throughout the data collection process. There were no benefits for case participation. However, although the topics discussed in the interviews do not touch upon personal matters, they concern opinions of the team climate, colleagues, and managers. This could be a potential risk for informants to their work relations. Therefore, an agreement of confidentiality was signed before the interviews to protect informants. Informed consent also embraces free consent - in which informants should not feel pressured to participate. The managers who assisted me in scheduling interviews may have applied social pressure to participate, violating ethical concerns about free consent. To accommodate, I informed participants that they could withdraw their interviews at any time. Some wanted to review their answers, and I sent them the transcribed interviews for them to comment on.

B. Saunders et al. (2015) defined confidentiality as all information that is kept hidden from others than the researchers. In the case studies, I have been given access to information and listened in on conversations about projects and company secrets. This information has not been of relevance to my research, but I have still taken care to ensure that the information has not been included in the thesis. When in doubt, I consulted with case participants.

Anonymity is a form of confidentiality and means keeping informants' identity secret (B. Saunders et al., 2015). I took the following steps to anonymize and store the data. Each informant was given a number, and the list of informants and their associated numbers was kept on an encrypted memory stick list. After an interview, I transferred the recording file to my computer and deleted it on the recording device. I then anonymized the files by naming

them by their number. By removing names and other identifying information, the transcriptions were further anonymized.

Yet, some narratives may be identified by the participant or by others in their network of fellow professionals. Because CR research is context-dependent, I have made the conscious decision to name and describe the case study settings. Knowledge of the research settings was necessary for the contingent validity (explained in subsection 7.6.2) of the cross-case comparison. According to B. Saunders et al. (2020), naming the setting poses a threat to "external confidentiality" because industry actors might be able to identify participants. Also, the small group sizes may compromise "internal confidentiality". Especially in Case 3, participants might be identified by other employees in the firm due to few informants and them all being in the management group. To minimize this, I labeled them "Principal x". However, I specified the comments made by the IT Manager (ITM) and the Managing Principal (MP) as they provided relevant context for the statements they made. Also, quotes might be recognized in Cases 1 and 2 due to participants' trade and position in the design teams. I have carefully considered the trade-off between details and the possibility of harm to participants, which is one of the guiding principles in social science research (*Code of Ethics*, 2022). The topics covered in this thesis are not sensitive; however, in some instances when the narrative was unusual, I left out the details to protect the participants' job situations. It was challenging to find the right balance between preserving the data's richness and avoiding presenting it in a way that would compromise anonymity.

Qualitative research, such as interviews, implies a relationship between the researcher and the interviewee. This relationship is often unbalanced, and it is vital to safeguard integrity and dignity. One strategy I used was to ask open-ended questions and give informants the freedom to provide as much detail as they desired (see Appendix E and Appendix F). Following that, I was careful to avoid delving further into conversations where informants discussed personal concerns, particularly with their leaders. I have strived to treat interviewees with respect and present their stories fairly.

Misconduct in research is an issue of ethics and trustworthiness and is discussed as a serious problem in academia (Martinson et al., 2005). Kuroki (2018) describes the importance of reflecting the core values of truth (fabrication, falsification), trust (plagiarism, irreproducibility, inadequate research practice), and risk (industrial products). In my research, I do not interfere with the real world or change any processes; therefore, there are no safety or health risks for the industry associated with this research. The question of truth and trust discussed in this chapter will be further discussed in the context of trustworthiness.

7.6.2 Quality and trustworthiness

Several concepts are used to assess qualitative research, and the most common are reliability and validity. Reliability is concerned with the consistency or stability of a measure, which in practical terms, is if the research may be tested or repeated. The validity of the results is determined by how well they measure what they are designed to measure. The research I conducted is, first and foremost, qualitative, and measurement logic is not applicable.

Furthermore, the assessment of a study is dependent on what constitutes good and valid research, which is not necessarily the same across philosophical positions (Bøllingtoft, 2007). For example, reliability and validity come from positivism (Elo et al., 2014). Because I adhere to the CR philosophy, I have applied different criteria, as suggested by Healy and Perry (2000), for ensuring rigorous and meaningful results: ontological and epistemological criteria and methodological trustworthiness.

Ontological criteria.

Healy and Perry (2000) described two ontological concerns when judging CR research. The first is ontological appropriateness, which is an assessment of the research's suitability to the philosophical viewpoint. To ensure that I have not only tactically acknowledged my ontological position, I have also thickly described and discussed how CR is well suited to the case study strategy in chapter 7. Also, I describe how my research questions deal with complex social phenomena involving reflective people in section 1.5.

The second is contingent validity, which is the validity of generative mechanisms and the context that makes them contingent (Healy & Perry, 2000). As described in subsection 6.2.2, as a critical realist, I see society as an open system, and the effect of casual mechanisms cannot be created in an isolated environment. Casual impacts are not fixed and vary depending on the context. To ensure that I met this criterion, I used in-depth interviews and observation to analyze *why* things happened rather than simply describing events. To strengthen the credibility of the analysis, I also provided detailed descriptions of contexts and information about case participants (see chapter 8).

Epistemological criteria.

When evaluating the quality of research, the process through which knowledge is created is also considered. Because CR acknowledges that obtaining knowledge of the real world can be problematic due to the different interpretations of it, CR research relies on multiple perspectives (Healy & Perry, 2000). In my case studies, I used triangulation of multiple data sources. I also discussed my interpretations of data triangulation with research participants to ensure my interpretations. In addition, by detailing how I handled ethical difficulties in the former section, I demonstrated that I was conscious of my own values and perceptions as well.

Methodological trustworthiness.

The four last criteria have to do with methodology. Methodological trustworthiness is a term comparable to reliability in CR research, where trustworthy entails that the research can be audited by a third person (Bøllingtoft, 2007). I have assured methodological trustworthiness in the study by considering the credibility, transferability, dependability, and confirmability of the study, as described by Elo et al. (2014).

Credibility in qualitative research refers to confidence in the truth of the study's findings. To establish credibility, I have provided thick theoretical descriptions of the phenomena I have studied and described how they were studied using triangulation of well-established research methods. Also, all data collection steps in the specific cases were discussed and reevaluated with the contact person in the specific study. Credibility also entails whether the results are accurate interpretations of the setting and participants' meanings (Elo et al., 2014). For the analysis, I have outlined the iteration between the data and theory before reaching the findings. I ensured that those participating in the research were identified by anonymous numbering and that the research setting was described accurately.

Transferability in qualitative research ensures that findings can be transferred to other settings or groups (Elo et al., 2014). To ensure that readers may evaluate transferability, I have clearly described assumptions and interpretations of the research settings and the participants. Still, transferability from a CR viewpoint is complicated due to findings being context-dependent, both in time and place. Therefore, replication would not produce conclusive verification of the identified mechanisms.

Dependability in qualitative research refers to whether or not the data is stable over time and under different conditions (Elo et al., 2014). To ensure this, I developed and followed a case study protocol (see Appendix A) throughout the data collection phase for all case studies. Also, I have described the entire research process in detail, provided in chapter 7 and in the appendices. These descriptions have the necessary details for a third person to be able to follow the steps of the case studies.

Confirmability has to do with the insurance of the findings being based on participants' narratives and not potentially my biases (Elo et al., 2014). To ensure this, I coded raw data and clustered them into themes in NVivo to ensure that the findings portray the participants' responses. I have used quotations from interviews and described observations to show the connection between the data and the results. Also, by numbering the informants when presenting findings, I show that all participants have been heard and exhibit the richness of the data. For the findings, the main concepts have been connected to the results through quotations to show the connection between the data and the results.

7.7 Chapter summary

In this chapter, I presented my research paradigm, which is the sum of research philosophy and the research strategy. Before developing my research strategy, I decided on critical realism as my philosophical position. In short, critical realism sees the world as external to our thoughts but susceptible to misinterpretation. Ontologically, I seek a deeper understanding, concentrating on necessity and contingency. Knowledge, from an epistemological stance, is limited to our understanding at a certain time and a method of functioning in the world rather than expressing truth. I recognize that my study is value-laden for axiology, and as such, I must be transparent about my process and my writing.

Case-study research, which is the research strategy I chose, is well suited to critical realism. The COVID-19 pandemic impacted the original research strategy, where three case studies were to have the same design and be compared. It resulted in Cases 1 and 2 having the original, similar research design, and Case 3 emerged during the COVID19-pandemic and hence followed a different design.

Cases 1 and 2 are limited to the design phase of the building project, and I focused on the interactions and the work climate within design teams. In Case 3, I focused on leaders, employees, and their work climate in a PBO during the first months of the COVID-19 pandemic. The methods for data collection in the three case studies were interviews, observations, document analysis, and a face-to-face survey.

Each case study was handled and analyzed separately before being compared in a cross-case analysis. I followed a retroductive reasoning, where I went back and forth between theory and empirical data until the most probable explanations for my research question were found. In the cross-case analysis, I aimed to find demi-regularities through comparison, where I used a thematic matrix-based approach and a narrative representation of the results.

Part 3
Within-Case Analyses

Notes

This third part of the thesis lays out the three independent case analyses. As outlined in section 7.1, my research strategy emphasizes the importance of considering each case as a complex unit with independent within-case analyses before comparing similarities or differences. The goal of the within-case analyses is to uncover the complexities and nuances of the data and to gain a deep understanding of the cases being studied.

It starts with chapter 8, where the case studies are introduced. Chapters 9 present results and discussions of Case 1, and chapter 10 present results and discussions of Case 2. The chapters are divided into sections, following the structure of the case-specific research questions outlined in subsection 7.2.1:

Empirical results:	Evidence of psychological safety:	*RQ1:* What is the experienced/observed level of psychological safety in the design team?
	Contextual effects on psychological safety:	*RQ1a:* What contextual (multilevel) effects can explain findings in RQ1?
	Evidence of digital mindsets:	*RQ2:* What is the experienced/observed level of digital mindset in the design team?
Discussion:	Psychological safety antecedent to digital mindset:	*RQ3:* Does the team's level of (negative or positive) psychological safety affect the observed digital mindsets?

Chapter 11 presents the results of Case 3, which, as explained in subsection 7.3.1, focuses solely on exploring RQ1 and RQ1a. This chapter does not include a discussion of the results as it serves as a comparison to Cases 1 and 2 by providing a different perspective on the development of psychological safety in being a PBO compared to the two TPOs. The coverage of Case 3 is smaller compared to Cases 1 and 2. This is primary due to fewer informants and, thereby, a smaller sample size, not including the face-to-face survey, and the study only addressing two of the case-specific research questions.

Chapter 8
Introduction to Case Studies

> "The description is not the described; I can describe the mountain, but the description is not the mountain, and if you are caught up in the description, as most people are, then you will never see the mountain."
>
> Jiddu Krishnamurti
>
> Indian philosopher

8.1 Introduction

The purpose of this chapter is to present empirical descriptions of the three cases for which I gathered data. Having some notion of how the cases are formally described can help me distinguish between what *can* be true from what *must* be true in the broader term of contribution, as it provides a context for my findings. According to CR, the descriptions in this chapter fall within the empirical domain of the ontological layers (Sayer, 2000) and are susceptible to misinterpretation. Thus, I attempted to describe rather than explain the facts I gathered. I primarily used document analysis for the descriptions. When facts were absent, I supplemented interview responses or informal conversations with individuals.

Table 7.1 in section 7.1 provides an overview of the cases, their research designs, and their purpose. As described in section 7.1, the first two cases had a similar research design, whereas the third was an emergent study with research objectives separate from that of this thesis. Still, Case 3 was designed to inform the overreaching research questions provided in section 1.5 concerning psychological safety.

In the following sections, I first compare the key selection characteristics of Cases 1 and 2, followed by a more detailed description of each research setting divided into external and internal factors. Lastly, the PBO of Case 3 is presented.

8.2 Project characteristics

In this section, I will discuss some of Cases 1 and 2's commonalities and contrasts, which are my theory-laden interpretations. In the method chapter, I stated that I intend to identify demi-regularities between Cases 1 and 2, as advised by Wynn and Williams (2012). That is, they must be similar to some extent in order for comparable occurrences. Table 8.1 shows Cases 1 and 2's characteristics based on the chosen selection criteria from Table 7.3 (p.80).

Table 8.1: Comparison of project characteristics of Cases 1 and 2

Variables		Case 1	Case 2
	Location	Oslo, Norway	San Francisco, USA
External factors (project organization)	Project delivery model	Collaborative delivery model	Similar to a Design-Bid-Build model
	Product	Swimming facility and cultural school	Public housing project
	Project type	Construction project	Construction project
	Project size	Medium, 300–500 mil. NOK	Medium, 300-400 mil. NOK
	Project complexity	Medium-technological, need for diversity of knowledge	Medium-technological, need for diversity of knowledge
	Private or public sector	Public sector	Public sector
	Digitalization	Use of BIM for project planning and collaboration	Digital pilot project for San Francisco city for document handling
	Phase of project	Design development	Design development
	Pace	Competitive	Competitive
Internal factors (design process)	Diversity of professions	High	High
	Diversity of represented firms	23, three main actors	20, two main actors
	Team size	Large: 88 registered, 24 highly active	Moderate: 47 registered, 31 highly active
	Management style	Process management	Combination of process and structure management
	Work situation	Co-location once a week	Traditional meeting structure, all-digital planning
	Flexibility	Dynamic decision-making within the team	Semi-structured decision-making led by managers

At first look, Cases 1 and 2 appear to be comparable in terms of being in the public sector, the economic and team size, complexity, the requirement for knowledge diversity, and the goal of digitalization. These attributes will influence the intensity with which the team collaborates, and the parallels signal that similar events are likely to occur.

The project delivery model/system (PDM) is the most significant distinction between Cases 1 and 2. Case 1 employs a cooperative delivery model, emphasizing shared risk and trust between actors. In Case 2, they classify themselves as being closer to a design-bid-build model, which is more competitive and hierarchical. The work situation differs as well. COVID-19 caused Case 2 to be fully digital, as face-to-face meetings were no longer possible. These meso-leveled characteristics provide expectations of different types of leadership styles and collaboration insensitivity. Knowing the observable difference in structure will allow me to identify the true mechanisms, which I see as a benefit.

8.3 Case 1 – Manglerud bad

Figure 8.1: Illustration of the project Manglerud bad, illustrated by Asplan Viak

Case 1 was identified through a discussion with the company Undervisningsbygg Oslo, a Norwegian public sector client. Undervisningsbygg is the largest property manager in Oslo that develops, builds, and distributes public buildings. After I discussed Table 7.3 with leaders of Undervisningsbygg, Manglerud bad was found fit for the proposed case study. As the project owner, they had the authority to grant me access to the project.

8.3.1 External factors

Manglerud bad is a swimming facility, including a cultural school, a youth center, and a skate park. The project is located at Manglerud in Oslo, Norway. The total area is 6 513 m^2 (70 105 square feet), assessed as a medium/large project (300–500 mil NOK). In 2016, the pre-phase started, and the project was estimated to be finalized in June 2021. The architectural expression by the project architect, Asplan Viak, is depicted in Figure 8.1. The project's goal is to provide a district gathering space for people of all ages.

The project was in the second phase of the detail design phase when this study was documented. The PDM is referred to as a "samspillsentreprise" in Norwegian, which translates to "partnering project" or "collaborative delivery model" in English. Table 8.2 lists the three major firms.

Table 8.2: Main actors, Case 1

Firm	Actor	Team actors
Undervisningsbygg	Project owner	Project manager
Asplan Viak	Consultant group	Architects (building, interior, landscape), BIM coordinator, engineers in structural design, water and drainage, outdoor environment, energy, ventilation, and sanitation.
NCC	Contractor	Design manager, BIM coordinator, performing consultants. Also in charge of the sub-contractors, for example, precast concrete and electrical engineering.

Despite the fact that it was a collaborative delivery model with shared responsibilities, there was some hierarchy, as illustrated by the project organization map in Figure 8.2. Undervisningsbygg led the project, and their project manager was in charge of the progress and regularly monitored project operations. Asplan Viak was brought in during the conceptual phase, and when NCC was brought in as the contractor early on, Asplan Viak remained as a subcontractor under NCC. When the design development phase began, there were two designer managers, one from Asplan Viak and one from NCC. However, disagreements necessitated adjustments, and NCC recruited a sole design manager.

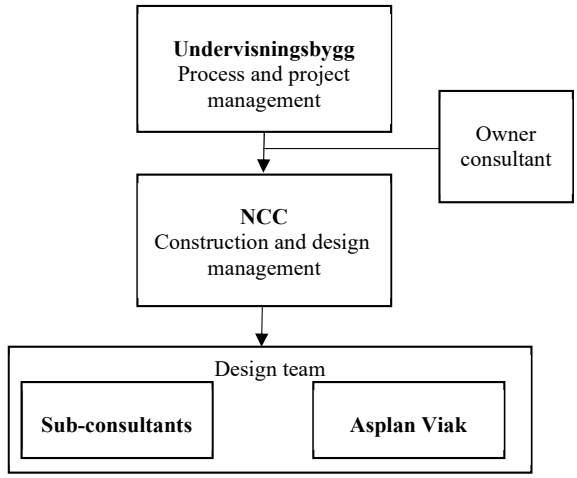

Figure 8.2: Project organization map, Case 1

During the interview, the project manager characterized the project's design phase goal as follows: "[...] to complete the digital model before we begin the production phase. The goal is for the digital model to be as accurate and exact as possible." He further described that a project goal was to be highly digital by using BIM as a collaborative tool rather than merely a visualization tool. Two BIM technicians from NCC and Asplan Viak were recruited to supervise the project model synchronization. NCC also managed a digital portal for storing and sharing papers to which all team members had access. When not being co-located, the information flow went through emails and phone calls.

8.3.2 Internal factors

With 23 firms and 88 professionals registered to participate, the diversity of represented firms and team size is considered high. During data collecting, 24 individuals were directly involved in design development.

There was a meeting day on the construction site once a week, switching between design meetings and BIM-coordination sessions. The co-location was intended to facilitate dynamic decision-making. Accordingly, decisions about processes and solutions were made together as a team, and then they either planned smaller specialty meetings or worked at their home base. Figure 8.3 is a picture from the co-location space of words that the designers wanted to represent the project. The words selected reflect the design team's collaborative mood.

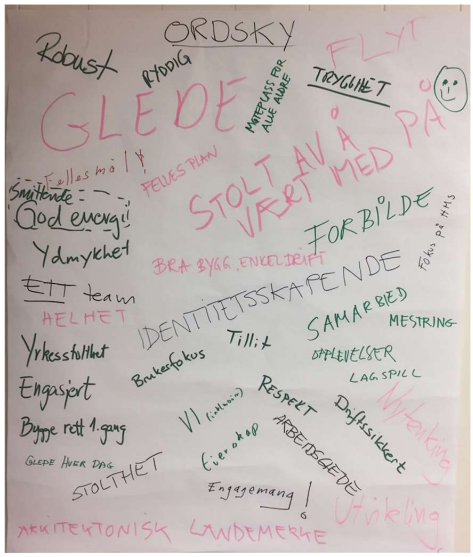

Figure 8.3: Word cloud* from the co-location space of Case 1

* Translation: joy, robust, tidy, safety, flow, meeting place for all ages, proud to be a part of, focus on HMS, trust, collaboration, engagement, one team, humility, identity-creating, professional pride, common goals, whole, development, role model, team-play, mastery, experiences, job satisfaction, architectural landmark.

8.4 Case 2 – Francis Scott Key Educator Housing

Figure 8.4: Illustration of the FSK project, illustrated by BAR Architects

Case 2 was identified through discussion with KPFF San Francisco Office (SFO), an American structural engineering office located in the Bay Area in California. After identifying a project based on Table 7.3, KPFF SFO put me in contact with the actor responsible for the project

management, BAR Architects, an architectural interior design and planning firm located in San Francisco. KPFF SFO was a part of the design team providing structural engineering services.

8.4.1 External factors

Francis Scott Key Educator Housing (FSK) is a San Francisco Unified School District (SFUSD) project led by MidPen Housing. The FSK is a housing project with 135 units of studios, 1-bedrooms, 2-bedrooms, and 3-bedrooms. The total site area is 60 000 square feet (approximately 5 600 m^2), evaluated as a medium/large project (300–400 mil NOK). In 2018, the pre-phase started, and the project is estimated to be finalized in 2024. BAR Architects illustrate the architectural expression in Figure 8.4. The project aims to create affordable housing opportunities for teachers, para-educators, and their families and a neighborhood that encourages community interaction.

The project was in the middle of the design development phase when this study was documented, intending to deliver 50% design development documentation. The PDM has similarities to that of a design-bid-build and a construction manager/general contractor (CM/GC), with two major actors listed in Table 8.3. The project's concept originated in 2014 as a collaboration between the San Francisco Unified School District (SFUD) and the Mayor's Office of Housing and Community Development (MOHCD). In 2018 the architectural firm was contracted, and MidPen Housing was selected as the project developer, referred to by team members as "owner" or "owner representative." The contractor was engaged later in 2019 as the general contractor but was not yet fully integrated into the project at the time of the study.

Table 8.3: Main actors, Case 2

Firm	Project actor	Team actors
MidPen Housing Corp.	Project owner	Project developer on behalf of San Francisco City.
BAR Architects	Architect and project management	Project manager, design manager, architects (building, interior). Also in charge of the design team with several consultants, including KPFF SFO.

In Case 2, the project owner representative handled the economic aspects of the project on behalf of San Francisco City, which owns the project financially. BAR Architects, handled design management. As a result, the project owner was removed from day-to-day activity but was to be involved in change decisions and kept up to date on progress. Because BAR Architects is an architectural firm rather than an engineering consultant, most specialists were employed as sub-consultants, as shown in Figure 8.5's project organization chart.

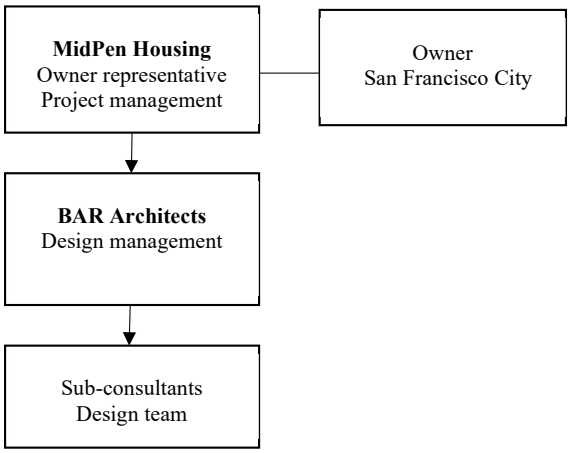

Figure 8.5: Project organization map, Case 2

The FSK project began as a test project in which all document handling in regard to San Francisco City was to be done digitally. Digital documentation had the greatest impact on project management rather than the day-to-day work of the design team. Furthermore, when I began collecting data, COVID-19 necessitated the entire work process to be done digitally, with no physical meetings. The project proceeded as estimated, but all design team communication and cooperation took place digitally. The usage of Bluebeam, in particular, was cited by informants as a feature that distinguished the project digitally from others and was a significant help during the crisis. Bluebeam is a PDF solution fine-tuned for the construction industry, where teams can markup and edit 2D and 3D drawings PDFs for a paperless workflow.

8.4.2 Internal factors

The team size and diversity of represented firms are regarded as high, with 20 firms and 47 persons registered to participate. Twenty individuals were actively involved in the design process at the time of data collection.

During the data-collecting period, all meetings were held once a week digitally via Zoom. Emails and video conversations were used for communication, in addition to digital models and Bluebeam checklists. Because the project and design managers for the design phase were both engaged by BAR Architects, they worked together to oversee meetings and provide information. The management approach was majorly structured with agendas and minutes, just as the decision-making process was.

8.5 Case 3 – KPFF San Francisco Office

Figure 8.6: The KPFF San Francisco office, received from KPFF San Francisco

In March 2021, when COVID-19 forced San Francisco to shelter in place, I was sitting at the KPFF San Francisco office (SFO) as they were assisting me in identifying a construction project design team to follow for the planned Case 2. Therefore, when the crisis hit, I had access to the firm's employees, information platform, email, and meetings. The richness of the data enabled an intensive case study with an in-depth description of the situation.

8.5.1 External factors

The SFO is a part of KPFF, which is a consulting engineering firm that provides structural and civil engineering services. The corporate structure of KPFF is based on a decentralized, supportive business organizational model (Tawresey and Asher, 2001), with regional offices located throughout the United States and internationally. Each regional office operates autonomously, with its own management team responsible for local operations and business development. The regional offices are supported by a centralized corporate office, which provides strategic direction, support services, and resources to the regional offices. KPFF's decentralized structure allows for greater flexibility and responsiveness to local market conditions, while centralized support provides the resources and consistency.

The supportive business organization recognizes a distinction between the firm's project structure and the business administrative structure (Tvedt et al., 2023). The project structure is focused on providing clients with the appropriate level of consulting engineering service. The administrative structure exists for the purpose of supporting project-focused activities.

The organizational structure of the business administration is grounded in the principle of prioritizing profession before commerce, and its efficacy is contingent on the preservation of values throughout the organization. Approximately two decades ago, a group of owners representing the next generation of leadership devised the "core values" to address the difficulties of building relationships among employees as the company grew in size and reach (Tvedt et al., 2023). These core values were established to strengthen relationships, not just during prosperous times but also during trying moments. After ten years, these management principles were distilled into five fundamental values, namely stability, excellence, passion, relationships, and trust. The values reflect what KPFF had already been doing and facilitate communication and perpetuation throughout the firm, which is the organization's goal. The core values embody KPFF's established practices and enable effective communication and sustained adherence throughout the firm, aligned with the organization's objective.

8.5.2 Internal factors

The SFO provides structural and civil engineering services to clients in the Bay Area. They have a staff size of approximately 75 professionals, including about 55 in structural engineering, ten in civil engineering, five in protective design, and five in administration. The structural engineering group is organized into five engineering groups and one computer-based modeling group.

The office specializes in building design and construction support for projects ranging from small renovations to large, complex structures. Their services include feasibility studies, site analysis, design development, construction documents, and construction administration. They work with clients in a variety of industries, including education, healthcare, hospitality, multi-family residential, and commercial development.

Since KPFF's corporate structure is based on a decentralized business organizational model (Tawresey and Asher, 2001), the SFO has considerable independence in making decisions from KPFF offices in other locations. The SFO is a version of a PBO that has followed the distinction between the project structure and the business administrative structure of the office. The project structure focuses on providing clients with the appropriate level of consulting engineering service. The administrative structure exists to support project-focused activities. Case 3 focuses on changes to the administrative structure of the SFO during the early COVID-19 pandemic.

Under normal circumstances, the office values having a strong office culture, where employees come in daily at the office. They have weekly newsletters and Friday lunches and put effort into the social side of the office. The work situation changed in a matter of days when the COVID-19 pandemic effects forced shelter in place for all of San Francisco. To communicate through the crisis, the SFO mostly used emails and office meetings at the start. Daily check-in was a measure initiated by the Managing Principal to give the employees an informal platform

to speak up about the sudden digital work situation. However, as they learned and saw the need to expand their collaboration, they started to actively use Microsoft Teams for both office and project-related information.

8.6 Chapter summary

I began this chapter with a quote from Krishnamurti: “the description is not the described.” In this thesis, I primarily use qualitative approaches with CR glasses on. Therefore, the quote is relevant to my experiences. The data used to describe the cases reveals something about the objective world. For example, the research settings in Cases 1 and 2 are design teams, but with different team sizes and work settings. However, several internal factors, such as the management style, are transferable knowledge. Similarly, Case 3 is a project-based organization, but knowledge of their office culture is transferable. The next phase in my retroductive reasoning will be to present the findings from the within-case studies.

Chapter 9
Case 1 Results and Discussion

An investigation of psychological safety in a digitally advanced design team working on a Norwegian construction project.

9.1 Introduction

The Case 1 results and discussions of the case-specific research questions are presented in this chapter. This introduction presents a brief summary as to why the case is interesting. The findings are then presented by each research question, one for each section. Finally, in the last section concerning the relationship between psychological safety and digital mindsets, I discuss the within-case findings against the literature.

Case 1 had several characteristics that made it unique from a psychological safety and digital mindset perspective. First, the project had a collaborative structured delivery model, where the project manager's vision was a project with shared responsibility, risk, incentives, and gain.

A part of this vision was being co-located. I observed that the Project Manager (PM) valued that the team members were sitting together and made an effort to facilitate face-to-face meetings. The contractor was sitting at the site permanently, and once a week, the whole team gathered for a day dedicated to design and specialty meetings. A team member felt that this working structure helped them to form efficient solutions:

> "We that are working on the project site are sitting physically together. It is a big advantage. You have the possibility to work concentrated by yourself at your desk, or work with others." (Team member 1)

A second objective was to have a complete digital detail design before starting the construction phase. During my observations, I saw ample data confirming that having a digital model was something the team actively worked for. The different disciplines continuously added their elements to the model, and every second week, they had "collision control" meetings, where they went through the model and solved interdisciplinary issues. Also, the project engaged BIM managers from both the contractor's and the consultant's sides.

> "Many projects claim that they are a BIM project because it looks good, but not all of them are actually BIM projects. But here, it is clear that an effort has been made. They

> are so devoted that they have a man of their own who follows the model. He knows what is happening and follows crashes and such. So I think it works very well. We also get those reports afterward, which is very useful." (Team member 10)

Finishing the project before building it required a high level of collaboration among several disciplines. I find this interview excerpt to describe the interdependence of the team's work:

> "We have a very limited area to build on and a large program to be molded together in a kind of Tetris package. It is extremely complex to fit everything. And the fact that we have managed to pull this together with all disciplines has been a very successful process." (Team member 3)

Another team member described how good it felt when the interdependence of tasks led to productive collaboration:

> "What was great about working with this specific solution was that we were working very closely, and we delivered together. It feels very good when you deliver something with others and get a positive response on the other end." (Team member 1)

Still, collaboration was proven not to be easy when two design managers from different firms were let go from the project some months before I started my case study. In the interview, the PM told me that the problem occurred when they entered a new phase of the project and the contractor was hired, and the project then had two design managers. The Design Manager from the contractor side did not cope with the merge, and the Design Manager from the consultant group sat with his arms crossed. As a result, the project had one design manager on each side of the interaction that did not cooperate. Finally, the PM decided that a new start was needed, and the two design managers were let go. Yet, the project learned from the event, and the current Design Manager (DM) said that they had continued in a more collaborative manner:

> "I also think that when you start out badly, pressure is put on everyone to show a willingness to cooperate and positivity. […] Maybe I entered the project as a breath of fresh air. We had to eliminate the noise, and then it became a new setting. I have deliberately used my type of humor instead of stabbing people in the back and publicly humiliating them." (Design manager)

I observed that the team had supportive structures that indicated that psychological safety could be present and digital goals that could potentially challenge team members' digital mindsets. If psychological safety was present, and to what extent will be discussed in the following.

9.2 Evidence of psychological safety

The first step in the analysis process was to provide evidence for psychological safety. Thus, in this section, I present results to answer RQ1: *What is the experienced/observed level of psychological safety in the design team?*

I rely on descriptive statistics from the psychological safety face-to-face survey and norms and attitudes uncovered through observations and interviews to analyze and describe team members' perceptions of psychological safety.

9.2.1 Descriptive statistics of psychological safety

The means and standard deviation for the quantitative psychological safety survey are displayed in Table 9.1. Theoretically, the measure of psychological safety could vary from 1 to 5. The overall mean of 4,07 is well above the theoretical midpoint of 3. Thus, the results shown in Table 9.1 suggest that respondents reported a relatively high level of psychological safety. Also, the standard deviation (St.D) of 0,74 shows that the individuals shared that perception.

Table 9.1: Results of psychological safety items (N=13, scale 1 to 5), Case 1

Likert scale questionnaire – psychological safety team 1							
Item	SD	D	N	A	SD	Mean	St. D.
1. When someone makes a mistake in this team, it is often held against him or her.	1	10	2			3,92	0,49
2. In this team, it is easy to discuss difficult issues and problems.		1	2	6	4	4,00	0,91
3. In this team, people are sometimes rejected for being different.	9	3	1			4,62	0,65
4. It is completely safe to take a risk on this team.		2	3	6	2	3,62	0,96
5. It is difficult to ask other members of this team for help.	4	7	1	1		4,08	0,86
6. Members of this team value and respect each other's contributions.			1	9	3	4,15	0,55
Total level and variation:						4,07	0,74

* SD = strongly disagree, D = disagree, N = neutral, A= agree, SD = strongly agree, St.D. = standard deviation

Despite the results showing a low total SD, there were differences in perception among the team members when looking at the results per item in Table 9.1.

The high level of psychological safety is most evident in response to one of the items. To *"In this team, people are sometimes rejected for being different,"* nine respondents strongly disagreed, and three disagreed. Next are the responses to *"It is difficult to ask other members of this team for help,"* where four respondents strongly disagreed, seven disagreed, while three respondents strongly agreed, and nine agreed to *"Members of this team value and respect each other's contributions."* Also, the most unanimous responses are to the statement: *"When*

someone makes a mistake in this team, it is often held against him or her", where the majority of 10 disagree, and one respondent strongly disagrees.

Table 9.1 items 2, 4, and 5 elicited negative responses from some respondents. The team member who responded negatively to *"In this team, it is easy to discuss difficult issues and problems"* came from a smaller firm and was hired by the contractor later than the rest of the team. The first respondent to respond negatively to *"It is completely safe to take a risk on this team"* was the only representative from that particular firm and had been on the project for a brief time. The other respondent answering negatively, was let go from the team because of collaborative difficulties at the start of the design phase. Surprisingly, the negative reaction to *"It is difficult to ask other members of this team for help"* was an active and central member of the design team who had followed the project from the start.

Overall, the descriptive analysis reveals a strong consensus on a high level of psychological safety. Nonetheless, some of the items measuring interpersonal risk were weaker than others, and a negative reaction from a key team member speaks to internal team dynamics that are not supportive of the development of psychological safety. This will be further elaborated on in the following description of the qualitative findings.

9.2.2 Qualitative assessment of psychological safety

During the interviews, I asked team members to tell me about a successful work process they've had and instances when they've presented new ideas to the team or spoken up. I also asked them to elaborate on their impressions of the setting and their involvement. Beyond the descriptive statistics, these general questions allowed me to listen for examples of team members' perceptions of the interpersonal climate.

Item four from Table 9.1 concerning feeling safe to take risks got the lowest score of the psychological safety items. As described in section 2.1, interpersonal risks are behaviors such as speaking up, proposing an idea, or reporting a mistake. During my observation, there were no notable situations where members admitted or were challenged with a mistake, and taking risks seemed to be the norm. In the interviews, it was mostly the act of expressing one's viewpoint that was cited as not being problematic:

> "It is easy to know beforehand how things will be understood, and it is absolutely possible to come up with suggestions. […] Everyone has felt that they are allowed to contribute and that their needs get covered along with the progress of the project." (Team member 2)

I observed in the meetings that the project's progress depended on presenting ideas and thereby discussing them. Team member 3 described that these situations were processes with "no wrong answers", even though their ideas could be criticized or rejected. Similarly, another designer said that even though his idea was "torn down," it did not matter because the team

behaved professionally. Thus, discussing difficult issues was a common thing for the team members:

> "I had a bad hunch. But we still presented the idea. […] It had to be redone." (Team member 8)

I observed that asking for feedback was more common than requesting help. When people face an issue they cannot solve, they ask for help, whereas when they seek feedback, they ask for an opinion. Because this interaction is beyond the study's scope, I cannot say whether seeking help was more prevalent internally within the various firms. In most meetings, I saw that team members presented a concept and asked for feedback on how their solution would influence other disciplines. The threshold for asking for feedback was low at first glance, as the dialogue and decision-making seemed to flow well. "Just as a silly question..." or "this is my suggestion if you can agree on that?" are instances of how team members communicated throughout these meetings. A team member detailed an incident in which she shared an idea with the team in an interview:

> "In the last design meeting, we discussed the cover of the main entrance. I had an idea or a thought, and I had to test it in that meeting. […] I did not have the knowledge about the question I asked. It was directed to [a consultant], and when they answered no, it was ok. I felt that was very comfortable." (Team member 1)

Similarly, a less experienced team member expressed that it felt safe to admit that he did not know everything:

> "Not everyone respects that you are new and don't know everything. But it's pretty easy in this group, I think." (Team member 10)

Even so, because the meeting structure was informal and the more dominating personalities frequently spoke up, it was difficult to tell if people felt safe asking for help in the larger design meetings. In an interview, a team member stated that the framework of the team's collaboration did not always promote the safety of asking for feedback. When the contractor took over the design manager role, he said, the designers did not have their own forum to discuss the BIM model, which created a barrier to asking for input, according to one designer:

> "Today, the contractor checks the issues they have discovered in the model. In other projects, we see that if we have a low-threshold forum for only the designers and preferably those who are drawing and not discipline managers who do not know the projects as well, then designers get solved a lot and collaborate a lot better." (Team member 9)

The interviews revealed that the team members were aware of the type of working environment required for the project to benefit from their knowledge and experience. For example, one team member stated that his coworkers needed to be polite to invest in cooperation completely. Another team member stressed the need for a culture in which all inquiries were accepted rather than disregarded or ridiculed. Discussion should be an open process with no wrong

answers. He was honest about not always having the time to pursue this pedagogical approach while describing the current team:

> "I know that when it is very intense and a lot of pressure on progress, there is not always time for it. There is room for improvement, as it is called. But something I'm aware of is that I think it's sad when you have not had the opportunity to do so. […]. Sometimes you have to make quick decisions and be tough, while at times you have more room to open up for larger discussions that can take time." (Team member 3)

As a result, the perceived threshold for asking for feedback varied, as evidenced by my observations and conversations with team members. Despite this, only one team member responded negatively to the help-seeking item, as seen in Table 9.1. When I delved deeper into the individual interview, I recognized that the team member was focused on the challenge with the many distinct discipline-specific objectives. When the contractor came on the project, for example, he had other demands regarding designing the ventilated ceiling of the bath facility. A group of designers had worked out their "perfect" design, and when having to go back and change the architectural expression, it was similar to a grief process:

> "There were many discussions with the client and [the contractor] about what they would lose. So, it was a big job and a theoretical discussion, almost without physical studies. […]. It is a process that you do not own right away, but a process that goes on for several months, and then one cannot work alone in isolation. We had to work towards the client and [the contractor]. So we went through a complex process that did not have a quick solution, as we saw it anyway." (Team member 1)

The collaborative delivery model required them to find a shared solution, which he described as a set of compromises. The designer claimed that other actors did not fully comprehend the work process, despite the fact that he explained to them that the new solutions had to mature into the final design. Despite his negative response to the item about asking for help, his experiences show that he did have moments of interaction and testing ideas.

A positive perception of psychological safety includes feeling that team members respect and value each other's contributions. In being an interdisciplinary team producing a complex product, none of the team members or leaders understood the full scope of all the details going into the project. Thus, there was no choice but to trust others to be liable. Accordingly, the situations where team members expressed that they felt productive or successful were characterized by respect and accountability. For example, a central designer expressed that the contractor had individuals with high competence, and another commented:

> "I feel that there is mutual respect. People say what they need to say, and then it is discussed further." (Team member 2)

A team member described a successful event in which the focus was on how to combine ultimatums rather than desires. Ultimatums, according to my interpretation of the interview, are discipline-specific details that cannot be negotiated. Every discipline has its own needs that

need to be examined to arrive at a workable solution. Respect, according to the team member in this situation, means working with each other to develop solutions:

> "It has been a very good dialogue because everyone tries to accommodate one another. No one says, 'this is how it will be, I do not want any more discussion'." (Team member 1)

Still, not all team members felt that their knowledge was understood or respected. Some team members tended to over-explain details and not consider that most of the team had been working within the design phase before:

> "Sometimes you have people who talk down to you because they believe that it is important that everyone understands the scope of the topic they are talking about. Thus, it becomes a bit like a teacher who wants to compress a lot of knowledge in a short time before getting to the point. But one must have a general understanding that most people have encountered this before, have a certain knowledge of it, and keep the explanations to the overall level of detailed information. Then I think that all sharing of knowledge is important and positive." (Team member 2)

Similarly, respect and trust were tightly connected:

> "The way we appear at the meeting shows that we have trust in each other, we know where we have each other." (Team member 7)

In contrast, this comment by a team member indicates that he did not trust the knowledge of the younger, less experienced BIM managers:

> "They are skilled in the BIM tool but do not have the necessary experience from the construction site and do not have enough authority as a meeting leader. So, they do not have the skills to run meetings efficiently." (Team member 4)

The comment could be due to a lack of awareness of the responsibilities of the BIM manager's work, or it could be that the team member underestimated the abilities of the team members he was describing.

As I presented in the theoretical framework, psychological safety can also be observed and understood by identifying behaviors. The open interview questions allowed me to listen for learning and innovative behavior. In the observed meetings, I listened for examples of seeking and giving feedback and help, speaking up, language, respect, and informal dynamics. Examples of characteristics that suggest the presence/absence of the team's psychological safety are listed in Table 9.2 on the following pages. In the process of creating the table, I used the theoretical framework (Table 2.2, p.26) and inductively created and deleted nodes when going through the qualitative data.

Table 9.2: Indications of characteristics of psychological safety, Case 1

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Speaking up	[Interview, team member 8] "I believe that the mood is pretty good, light atmosphere, and people can easily talk freely. And then some personalities are more notable than others." [Interview, team member 2] "I have been on the sideline and contributed with some suggestions even though my thoughts were not necessarily emphasized. But there has been an openness for everyone to come with their opinions." [Observation] Comments from meetings: "Just to make it clear.", "Just from experience.", and "Just a stupid question, should there not be lightening there?"	[Interview, team member 8] "We drew the solution to detailed, even in 3D. But then it turned out that in terms of shape, it might not fit so well anymore. So we should have said, 'wait a minute, we have to talk about this' and take those meetings before it goes too far." [Observation] Situation from a meeting where the team identified uncertainty drivers in the project, and everyone was forced to participate. The meeting facilitator asked the group: "What do you expect? What is important to you?"
Seeking feedback/help	[Interview, team member 1] "I need to be included in the discussions where my discipline is asked questions. I think this works very well in this project." [Observation] Comments from meetings: "I did not fully understand that" and "We are struggling with this."	[Observation] A meeting participant was observed as annoyed when asked to explain an argument. In addition, the response from the participant was perceived as negative toward the team member seeking feedback.

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Collaboration	[Interview, team member 8] "Their attitude is 'yes we can do this' and 'we will do this', that helps." [Interview, team member 4] "So in relation to the big meeting we had there, [the topic] was too substantial for most of those present to discuss. So three or four people who had something to contribute to that discussion walked across the street after the meeting and sat down there for a lunch meeting. We figured how we could do this, who does what, and how we distribute this information." [Observation] Comments from meeting: "Boys, how can we do is.."	[Interview, design manager] "It is ok that [the person] cannot make it in time, but then tell me. If I know beforehand that [the person] will not do it, then I can restructure the plan. If not, [the person] destroys the day." [Observation] Project manager: "Now you can go home and think about whether you will get to finish until next time. I am not getting an answer, so it is difficult to lead. We need everyone with us otherwise, we start to limp."
Flexibility	[Interview, team member 3] "The final solution was a process of compromises between many disciplines and decision-makers." [Interview, team member 7] "There has been flexibility concerning the fact that even though [the contractor] opinions which are the cheapest and easiest way for them, they also let us evaluate if this is the way to do it." [Observation] In meetings, it seemed like team members were flexible in accommodating requests to alter solutions. Still, time pressure limited the possibility of flexibility.	

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Experimenting /creativity	[Interview, team member 2] "It has been a new way of doing things than what has not been done before." [Interview, design manager] "When we sit on a grandstand in a swimming hall, it is very hot. Therefore, we wondered if we could get some fresh air in. And again, he who is going to perform ventilation says, 'yes, maybe we can use the grandstand and insert a pipe to get air'. So now, when you sit with your legs on the stairs, there is a valve under which cold air comes up. So we had a creative process and ended up getting a good, quite new solution."	[Interview, team member 6] "They have their concept that they have been true to. And that means that the various designers do not necessarily have the degree of freedom that they would have had in another swimming pool project with a different contractor."
Improvement is a collaborative commitment	[Interview, team member 2] "It has been a process with different understandings and some presumptions. But through the process, there have been inputs from both sides. Not one of the actors has been 'standing put'. Instead, everyone has participated in the process and contributed." [Interview, team member 3] "I did not do that alone. It was created through maturation, together as a group."	[Interview, team member 4] "It remains to be seen if everyone follows the plan. Yesterday, there was an input from the architect, who did not follow the agreed work process." [Observation] Comment from a meeting: "Things were not finished, and [the person] did not know where we were in the model. It is just not good enough."
Knowledge sharing	[Interview, design manager] "It is many inputs from different actors that contribute to safeguarding these things." [Interview, team member 6] "It was a result of me being active in the meeting and contributing with views that stood out as interesting and solution-oriented."	[Observation] Even though the project has an 'open book policy', I observed that [an actor] had to dig for information in a meeting. For example, [an actor] was asked to justify their presented work, and it was perceived by the meeting participants that information was held back.

Importantly, the qualitative analysis indicates more variance in individual perceptions of psychological safety than the descriptive statistics. Nevertheless, there are signs of psychological safety, especially team members' feelings of being able to propose ideas, respectfully discuss issues, and respect decisions different from their own.

9.3 Contextual effects on psychological safety

The second step in the analysis was to identify contextual mechanisms affecting the team's psychological safety to provide insight into the results from RQ1. Thus, in this section, I present findings to answer RQ1a: *What contextual (multilevel) effects can explain findings in RQ1?*

To answer the research question, I used the description in section 2.2, as guidance for data collection and analysis, which specifies what contextual elements influence psychological safety. Because I conducted my research for a short period, I observed the consequences of contextual effects in the form of individuals' perceptions of psychological safety. Team members answered questions about work processes and how team characteristics and settings affected the discussions and collaboration. In my observations and the document study, I also recognized structures that explained some of my conversations with the team members. In the observed meetings, I listened for examples of, for example, informal dynamics, group identification, structure creation, task orientation, and time management.

During the analysis, I identified four main categories affecting psychological safety: team diversity, team dynamic, leadership behavior, and organizational dynamic. Each category has been divided into sub-categories, and the significant findings are presented in the following.

9.3.1 Team diversity

I observed that the design team of Case 1, being a construction project, had diversities in different forms. At the start of the case study, I got access to the contractor's electronic database to identify possible interviewees. The database revealed that the design team was a multidisciplinary group of various types of consultants and architects, including sub-contractors and external and internal facilitators and leaders.

Role diversity.

In building such a complex project, the team members expressed the value of having a bigger group of diverse specialties, as it provided different perspectives. Still, the PM expressed that it was challenging for some to understand all the roles, including their needs and the coordination, much due to the technically demanding project.

In addition, the different roles had function-specific objectives, which seemed to challenge their interaction and knowledge sharing. I noticed that team members struggled with the many roles that tended to have overlapping responsibilities since each firm decided what kind of roles and how many roles were needed to cover their field:

> "There are very many specialties in this team. Traditionally some of these specialties are one consultant. For example, normally, the water and drainage engineer is responsible for both the inside and outside of the building. But in this project, the responsibility is divided into several people." (Team member 5)

Firm diversity.

I also saw that the diversity of firms challenged their collaboration, especially as the team struggled to understand the work process of others. The document analysis showed that there were three main firms in the design team: one representing the project owner, one representing architects and consultants, and one the contractor. The firms' internal cultures and work processes were quite different.

> "It is often the case that the architect is one of the most important people in a project. It is about design and expressions that cannot be written down; they must be visualized. Often, their ideas come in as a disruptive element that can ruin productivity. The engineer is productive, whereas the architect is often like, 'no, we cannot do it like that'. It can take time if we go too many rounds about what to do and only encounter challenges." (Design manager)

Another aspect of diversity was that groups from the same firm created internal groups within the team. The PM noted that having a group from the same firm was not always advantageous, as people tended to drift away from the project priorities. I observed that there were occasions where information stayed within these smaller groups:

> "We have weekly internal status meetings at [firm], which is not that much about the design but to coordinate among us since we are a firm. If there are common messages, it is supposed to go through that platform." (Team member 12)

Personalities.

Also, within each firm, there was a diversity of personalities. Especially in the meetings, I noticed the consequence of various characters. Some team members were more visible and proactive, indicating a low threshold for interpersonal risks. It could be that a particular type of people gets drawn to a type of profession and that the combination of firms and the personalities these firms attracted made the differences in personalities extra challenging. Still, the design manager described the challenges of including certain personalities:

> "We do have people that do not fit in in such a model. […] It is a challenge in this setting that the introverts may not be the personalities that fit the best." (Design manager)

Similarly, a team member expressed that being shy complicated behaviors such as speaking up and collaborating across role boundaries in the design team.

Table 9.3 lists direct quotations and my observations from meetings that are indications of the role team diversity played in the team's level of psychological safety, both positively and negatively. Team members saw the need for a highly interdisciplinary team. Still, internal cultures and personalities challenged team collaboration.

Table 9.3: Quotations and observations reflecting team diversity, Case 1

Excerpts and observations that capture team diversity's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Role diversity	(+) "Often [a discipline on this project] has a point of view of how things should look that others do not know about, and they are challenging the others." (Design manager)	Experimenting
	(+) When elaborating on the process of a new solution for a heat pump, a team member expressed: "We have created this through a very multidisciplinary process. [The process] needed us as consultants, and the contractor contributed, and we had external consultants. Also, the project owner has participated in several planning levels."	Experimenting
	(-) "Some are not understanding what it means to be a consultant. [...] We are experiencing that [a role] is not contributing to the total delivery. They are often waiting for someone to say 'yes, they want this,' so that they can draw their line instead of being a collaborative process." (Team member 13)	Collaboration
	(-) "You are sitting and deciding something in a meeting, but when one role is missing, even though they are in-house [with roles that are present] that work together, he has not heard about the former discussion in the next meeting." (Team member 5)	Engagement
Firm diversity	(-) In a meeting, I observed that [a firm] had internal discussions that the design manager was not informed of, leading to frustration from the design manager.	Engagement, knowledge sharing
	(-) "Traditionally, the contractor is not a consultant, but we do have some experience in this project. Therefore it is difficult with role clarity, meaning where the knowledge comes from and what knowledge you consider. There are many opinions, and maybe it is not that common to get so much advice on the technical details from the contractor. So it is a matter of culture". (Team member 12)	Seeking/giving feedback
	(-) "If we have had more separate consultants, it is easier to put pressure on the single actor. How it works in this team makes it hard to have clarification meetings. Especially since [a firm] is so well connected with the project owner." (Team member 5)	Speaking up

Excerpts and observations that capture team diversity's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Personalities	(-) "They are a bit introvert as persons and think it is uncomfortable to sit together and contribute verbally." (Design manager) (-) "I have experienced that there are people that are very sensitive to things, and that can be challenging. Hence we need clarity of what the goal is and pull everyone together." (Team member 13) (-) "On some occasions, I am a bit shy, so I hesitate to speak up when I disagree. For example, I should have been braver when my college was too quick [with a solution]. I could have spoken up louder." (Team member 8)	Speaking up, asking for help and feedback
	(+) "I want to specify that there are some people in this team that we are truly dependent on. We notice when the person is away for a period and then comes back. It is like the force center of the project is back." (Project manager)	Engagement, improvement
	(-) On several occasions, I observed that one team member was more isolated from the rest of the group in informal settings.	Speaking up

9.3.2 Team dynamic

Similar to the diversity, the team dynamic had characteristics that boosted and challenged psychological safety, especially the size and role clarity.

Team size.

The PM stated that the team size was substantial, based on his experience with past construction projects. The impact on the team dynamic owing to unacknowledged roles was the challenge with the team size. I observed a significant disparity between the number of people listed as participants and the number of people invited to the design meetings. My observation was confirmed by the organizational chart describing the specialty of each design team member. The chart did not include all consultants mentioned on the digital platform. Unacknowledged roles, according to one team member, made it difficult to know how to engage:

> "It is challenging when we are so many – whom are you going to talk to, and whom are you going to share information with?" (Team member 4)

The PM added that only a few were the engine of the team:

> "I just want to emphasize that in the team, with so many people, there are some who become indispensable, that the project is really dependent on. We noticed this when the person in question went on [a leave] for a period. And when he came back, you felt that the power center was back in the project." (Project manager)

Related to team size, it became evident that some team members were more interested in other team members as people than others. For example, on one of my observation days, I noticed a

group of five team members eating lunch after a meeting. They talked about personal topics, including recent trips, car troubles, and gym regimens. This relaxed atmosphere was characterized by laughter. It is natural for certain people in a group to connect better than others, and these informal dynamics do not have to be negative. However, another day, I noticed that actors from the same firms gathered between meetings instead of building relationships within the design team.

Role clarity.

Before I started my study, Case 1 had already been through some phases of the project life cycle, where tasks and roles were changed and developed.

> "It is the same as in all projects. You must identify your position within the organization and determine where there is a need for someone to make an effort." (Team member 4)

This description of roles in Case 1 is not unusual in the construction industry. Nonetheless, an informant stated that the combination of team size and task adjustments had resulted in overlapping roles and, as a result, confusion:

> "I do not know whom to contact because four people are doing the same thing." (Team member 5)

When I was studying the interviews, I noticed the gray zones that the contractor's merger into the team had generated a few months prior. One consultant explained that his role had been decreased, as a similar role had been added without explanation during the merger. Also, while being a talented leader, the new design manager from the contractor largely understood the contractor's side of the situation, according to a consultant.

For Case 1, I believe that the problems concerning team size and role clarity are much related to accountability. The existence of psychological safety within a team is not contingent on accountability, as described in section 2.2. However, if team members fail to follow through on their obligations, then engagement, teamwork, and individual respect and trust may suffer. During the interview, I noticed that informants were concerned about the team size since it made it difficult to trust that everyone was on top of their responsibilities because of the time required to transfer knowledge between roles.

On the other side, a team member expressed that his perception was that the team was pulling together:

> "The reason why this has been a successful work process is that it has gone smoothly. They have taken responsibility for their part, and we for ours." (Team member 8)

Another team member described that interpersonal risks such as speaking up and engaging together with following up on their responsibilities had created a good product:

> "We know that the decided solutions are well worked out and that several actors have voiced their opinions and concerns." (Team member 2)

Table 9.4 lists direct quotations and my observations from meetings that are indications of the role the team dynamic played in the team's level of psychological safety, both positively and negatively. Team members expressed how the team size made it difficult to understand the different roles and whom to turn to.

Table 9.4: Quotations and observations reflecting team dynamic, Case 1

Excerpts and observations that capture team dynamic's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Team size	(-) "I believe that responsibility disappears in this project. With so many people, who should pick up the ball?" (Team member 4)	Collaboration, seeking feedback
	(-) When comparing the larger design meetings to the smaller specialty meetings, the team members' awareness was more evident with few people present. The discussion tended to go into detail in the design meetings, only relevant for a few meeting participants. A team member commented: "Now everyone needs to pay attention to this joint meeting and not have small meetings so that we can finish what we need to."	Engagement, seeking/giving feedback
	(+) "[Team size] improves [the quality of the work process] because then we are more people with different views. We need to be interdisciplinary and have diversity. Of that, I am convinced." (Team member 2)	Collaboration
Role clarity	(+) "This is what we as a contractor contribute to the project - how we arrive at the result, building methods, view complexity according to critical areas, and how we can systematize and execute the task in which there are many players in a limited area. So then, it is important to have the right order of tasks. Often, architects have specific solutions that can be very difficult to put into practice. The key is that you locate this and find a way to build it." (Design manager) (-) "I would like to have the design manager on the consultant side because I see the benefit from a manager with a consultant's point of view." (Team member 1)	Engagement
	(+) I observed that actors were involved in discussions outside their roles and specialties in design meetings. (+) "I have developed my role through the process when I have seen the need." (Team member 4)	Improvement is a collaborative process.

9.3.3 Leader behavior

The development of psychological safety heavily relied on the actions of leaders. Especially inclusive decision-making, modeling for openness and weakness, time management, and task-oriented behaviors.

Inclusive decision-making.

I saw ample data in my analysis that justified my claim that the DM's leader behaviors shaped an environment of psychological safety. The data revealed that the DM actively encouraged team members to participate in decision-making and had a humble approach to his position as a leader.

Modeling for openness and weakness.

The DM was open about not having all the answers and sought extra resources when he needed them. Meeting observations showed that individuals from the [contractor's] competence center were present in multiple meetings, assisting the design manager. The DM also added this:

> "Yesterday, when we worked with the interdisciplinary plan, I had assistance from my boss because I am not used to this type of design management." (Design manager)

Time management.

I also saw that leaders' behaviors influenced the contextual effects on team members' perceptions of psychological safety, such as providing time and space for team members to understand the project's roles. For example, having co-located meeting days allowed team members to learn and develop the project's vision, despite some criticism that the meetings were too lengthy and detail-oriented. The DM explained that he worked to stay true to the collaborative delivery model by creating space for collaboration and making himself accessible to the team. In my interviews with team members, it appeared that his efforts were rewarded:

> "The progress is a jointly prioritizing where we think about all the tasks in the design process." (Team member 12)

Similarly, when elaborating on the characteristics of a good work process, a team member commented:

> "In [this project], it is a development process." (Team member 9)

Task orientation.

The negative side of being flexible and inviting team members to discuss issues was that the decision-making structure became vague. A team member explained that he saw the necessity for a clear agenda and minutes so that the obligation to follow up on a job did not rely on an individual's memory of what was determined in previous meetings. Due to a lack of clarity,

team members appeared to struggle with their roles, which hampered their learning-oriented behaviors.

Nonetheless, the supportive DM's behaviors are consistent with the literature on antecedents of psychological safety. The team's level of psychological safety was dependent on the behaviors. It is also possible that the new DM's leadership style got extra influence due to the history of destructive collaboration between two former design managers that had to be let go.

Table 9.5 lists direct quotations and my observations from meetings that are indications of the role the leader's behaviors played in the team's level of psychological safety, both positively and negatively. The DM was viewed by team members as open, transparent, and inviting for input. Nonetheless, they expressed a desire for a more precise structure to assist them in engaging and collaborating.

Table 9.5: Quotations and observations reflecting leader behavior, Case 1

Excerpts and observations that capture leader behavior's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Inclusive decision making	(+) "I believe [the structure] has been great. There have been debates that ended in 'that and that,' but I have never had the impression that we have not been included in anything that involves us." (Team member 1)	Collaboration
	(+) "I believe that [structure] should be handled by people who have a lot of experience with these types of projects and understand the necessary decisions and their order." (Team member 3)	Collaboration
	(+) During a meeting, I observed that together the designers and the design manager decided on the delivery sequence and priority. Disciplines handled details, allowing the DM to focus on the big picture.	Improvement is a collaborative process
Openness and weakness	(-) There was an open discussion about a team member who did not perform as expected after the meeting. Without the person present, a meeting participant expressed, "It's just not good enough."	Speaking up, seeking/giving feedback
	(+) When it came to technical matters, the design manager was transparent about his limitations and trusted the team members to fill the gap. The team members freely spoke and shared their knowledge.	Speaking up, improvement
	(+) "I consciously employ humor rather than stabbing them in the back." (Design manager)	Speaking up
Task orientation	(-) "I believe that the meetings should have been better prepared with a fixed agenda and task assignment so that we could present our ideas in an orderly fashion." (Team member 4) (-) "I wished that there was more structure for decisions, with deadlines for when things are to be finished." (Team member 3) (-) During a discussion, I saw the design manager was dissatisfied with the lack of focus on task orientation: "Now we need to disperse some responsibilities."	Speaking up, engagement, flexibility
Time management	(-) The lack of time management in meetings resulted in dissatisfaction, as demonstrated by the project manager: "Now we need to be effective everyone. We are wasting the early hours." Decisions were taken concurrently at the end of a meeting as members prepared to leave. "I'm not getting any answers, and that makes it difficult to lead you," said the design manager.	Experimenting, creativity, flexibility
	(+) [An actor] took the initiative and reminded the meeting attendees that there were five minutes remaining and that it was time to decide what subjects to cover at the next meeting.	Improvement is a collaborative process

9.3.4 Organizational factors

The data revealed several organizational factors that impacted the team's current level of psychological safety. I will describe them in the following.

Project history.

The project documents described a collaborative PDM. During the development process, there were two major actors, and a third was hired when the design phase began. During my interviews with the project manager and design manager, I learned about the difficulties encountered while integrating the contractor into the collaborative delivery model. The project manager revealed that two design managers had to leave the project because they were unable to manage the collaborative dynamic.

One of the former design managers was not surprised by how the team reacted when the contractor entered the project. The challenges stemmed from the consulting group's failure to anticipate going back into the design and cooperatively reevaluating the product they had developed. A team member underlined that they needed to develop trust in both solutions and each other's knowledge level:

> "That process took place gradually because we wanted to understand why the building was designed in this or that way. It was a time when people raised and asked questions about decisions, what they were based on, and what was sacred. […]. Then there was the question of where knowledge originates from. A contractor is not your typical consultant, but we have some experience in this case." (Team member 12)

According to the other former design manager, the project's first phases were productive, with user clarifications in close communication with the project owner. He described their detailed work to develop multiple objectives for the various areas of the construction.

Project delivery model.

When examining the many perspectives on how the delivery model's process had evolved, there appeared to be a mismatch in expectations of the collaboratively constructed model. The negative relational issues appear to have been avoidable if the contractor had been hired earlier, as access to information and making adjustments would have been more evenly distributed.

A member of the construction actor stated that the process through which PDM was formed was still having a negative impact on the group dynamic:

> "[The architect] is very close to the project owner. You should have anticipated the contrary. However, in this situation, it could be because they were involved in the project for so long and had a finished product that we [the contractor] did not consider finished. So we have pretty much reevaluated what they created, their ideal picture. As a result, they were initially hesitant to recognize it. And, because they've been here for

> so long, I don't think they need to be as cautious around the project owner." (Team member 5)

The current design manager experience was that when the project resumed after the team structure was changed, the collaboration was a positive experience:

> "We do not have a finished concept that we are to build. We have a project developed by the ones building it." (Design manager)

Another concern was raised by a consultant, who stated that the model's structure pushed for finished solutions too early, requiring them to redo things. The quote below demonstrates a type of top-down hierarchy in which the team member did not necessarily believe he had influence over the process.

> "I believe there is a lack of understanding. It is a pyramid [within the project organization] where understanding progresses to a certain level but is lost when you reach the top. On the top, it is like, 'why can't you just do it?'" (Team member 4)

Still, I observed that the team recognized the benefits of the collaborative ideology:

> "It is like night and day. With this form of contract, the contractor also has administrative personnel who have a little more project management experience and are solution oriented. […] They are really concerned about money in design-build contracts because it directly flows into their pockets. A design-build contract creates a little tougher environment. Working on a project like this is much more comfortable for me." (Team member 7)

Location and facilities.

Organizational factors also concern the facilitation of the work process. For example, face-to-face teamwork was one of the cornerstones of the collaborative project model for the PM. When I asked the team members, "Could you tell a story of a successful work experience that you have been involved in when working in this team?" they recalled situations in which they physically sat together. When asked about the advantages of a face-to-face working environment, they emphasized eye contact, body language, humor, personalities, and the opportunity to get to know one another.

I also observed ample evidence demonstrating that the success of digital communication, such as Skype, phone, and in the BIM model, depended on a mutual understanding formed in physical encounters. At the construction barrack, the team gathered weekly for either a design or BIM-collision meeting. After lunch, there were opportunities for specialty meetings, as the agendas were flexible. The facility provided the required space and digital assets for team members to collaborate on ideas. Also, in the main room, there was a poster where the design team had written down words they wanted to be associated with the project: joy, flow, pride, one team, engagement, respect, innovation, trust, safety, and modesty. This visual poster may

have served as a reminder of the initial team feeling and helped the co-location to feel safer. An informant confirmed this with the statement:

> "You need to feel comfortable, feel like you belong, like home." (Team member 6)

Time management.

Despite the positive sides of connecting, I observed that the structure of the design meetings was a concern, as described by a team member:

> "The meetings could be better structured with defined agendas and tasks to present our thoughts in a systematic matter. […] Then the things I presented and I said would be more thought through." (Team member 4)

Also, the discussions in the larger meetings tended to go into detail, leading to frustration and vague purpose:

> "We never make it to the finish line. It would have been preferable if someone had drawn the line and moved on to the next case. We are easily drawn into specifics of this project, which is wrong." (Team member 10)

Specialty meetings were the most important venue for team members to discuss ideas and express themselves without fear of being judged. Because each member knew their role in the meeting, specialty meetings were described as safer than design meetings. When asked, "What are the conditions for others to benefit from your knowledge?" a team member responded that it was necessary to feel respected and heard, which was difficult in a group of 20. Another person mentioned the difference in speed between design sessions and smaller specialty meetings:

> "[Specialty meetings] is more informal, and you do not have to compete for attention. It is a more social setting, and it is easier to find a solution that everyone understands." (Team member 7)

Hence, the findings suggest a link between psychological safety and meeting size. Another interpretation is that actors are more comfortable discussing concerns related to their profession.

Also, the structure for the specialty meetings appears to have been of value to the team members. I did not find these meetings on the agenda in the document analysis, and I observed that the meetings were held spontaneously whenever needed. It was unclear to the team members who was responsible for initiating these meetings:

> "The specialty meeting could have been planned beforehand by the design manager. But he doesn't have the knowledge and competence to understand the need for the meetings and the discussion we have to have." (Team member 4)

The design manager worked for the contractor and explained that most of his knowledge and experience came from the production phase. With this background, one could argue that it is unreasonable to expect him to be familiar with the required specialty meetings. However, based

on interviews, I believe this was not communicated to the team, and there was a misunderstanding regarding who was responsible for ensuring that the appropriate team members assembled and resolved interdisciplinary concerns.

Table 9.6 lists direct quotations and my observations from meetings that are indications of the role the organizational factors played in the team's level of psychological safety, both positively and negatively. Team members experienced the benefits of a collaborative ideology. Still, they reported feeling that there could be a clearer structure to help them engage and collaborate.

Table 9.6: Quotations and observations reflecting organizational factors, Case 1

Excerpts and observations that capture organizational factors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Project delivery model	(+) "It's a collaborative structure, and we've worked together to get it done. And all of this takes time. Because trust and roles must be established, collaborative structures take time." (Team member 12)	Improvement is a collaborative commitment
	(+) "I believe that it has been positive that we have focused on quality and not the economy in this project. Everyone feels like they've had a chance to contribute and that the project's requirements have been met along the way." (Team member 2)	Improvement is a collaborative commitment, collaboration
	(-) "If you want to establish a collaborative delivery process where the contractor has a say, you should engage them sooner rather than later. [...] Then, we would not have designed the solution to be as complete as it is now. We would have had other preconditions." (Team member 7) (-) "Because they've been involved for so long, [the consultant] doesn't have to be as cautious around the project owner. [...] I believe that [the contractor] should have had control over the consultants at an earlier stage." (Team member 5)	Collaboration, engagement, knowledge sharing, flexibility
Location and facilities	(+) After a meeting, I observed that two team members decided to stay at the barracks to continue a detailed discussion after this comment from the DM: "There are facilities here. It is open for use."	Experimenting, seeking/giving feedback
	(-) I saw that space was an issue when the team held larger meetings. In an observed meeting, they needed two different tables, which physically separated some participants from the others. Because these individuals did not participate in the discussion, it was easy for them to lose awareness.	Collaboration

Excerpts and observations that capture organizational factors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Project history	(+) "When you have a tough start, I feel it is pressure on everyone to show a willingness to collaborate and be positive." (Design manager)	Improvement is a collaborative process
	(-) "[During the development phase], we built trust in each other, the solutions, and people's expertise levels. […] Everyone worked differently because of the significantly varied cultures. Co-location is important for gaining sufficient focus on what to prioritize and agreeing on roles. From the beginning, [an actor] had their own design manager to whom the design team turned. They held separate sessions to discuss issues that were not shared in the design meetings." (Team member 12)	Improvement is a collaborative process, trust, collaboration
Time management	(-) "We are being pressured to do things too early. […] We are delivering something that will need to be revisited later." (Team member 10)	Flexibility
	(+) "I feel we have a project management team that is taking the necessary time. [...] We have a delivery model where the project owner pays by the hour, and there is no budget to worry about. As a result, no one is overly stressed, and the project is in a good mood." (Design manager)	Collaboration, flexibility

9.3.5 The multilevel effects

The contextual effects on the team's level of psychological safety spread top-down, according to my analysis given in the four subsections of section 9.3. It begins at the organizational level and moves down to the behaviors of the leader and finally to the team level. The connections of the effects are shown in Figure 9.1 on the following page. The horizontal relationships in the model describe the contextual impacts at the team level. I explain the connections in the model in the following.

The figure summarizes the previous chapters' findings of team diversity, team dynamics, leader behavior, and organizational factors' effects on psychological safety. Subsection 9.3.1, for example, divided team diversity into the three categories of role diversity, firm diversity, and personalities, as shown in Figure 9.1. Please review the subsections to understand each category in the figure better.

The PDM for the project was a collaborative model consisting of three main actors (see Figure 8.2, p.111) with different internal organizational cultures. Firm diversity itself is not a predictor for low psychological safety. However, for Case 1, the diversity was challenging, as the firms were to collaborate more deeply than in traditionally structured delivery models. The roles and firm boundaries were experienced as blurry, which was negative for developing psychological

safety. This is illustrated by the negative arrow pointing from “project delivery model” and “firm diversity” to role clarity and by the negative arrow from “firm diversity” to “role clarity”.

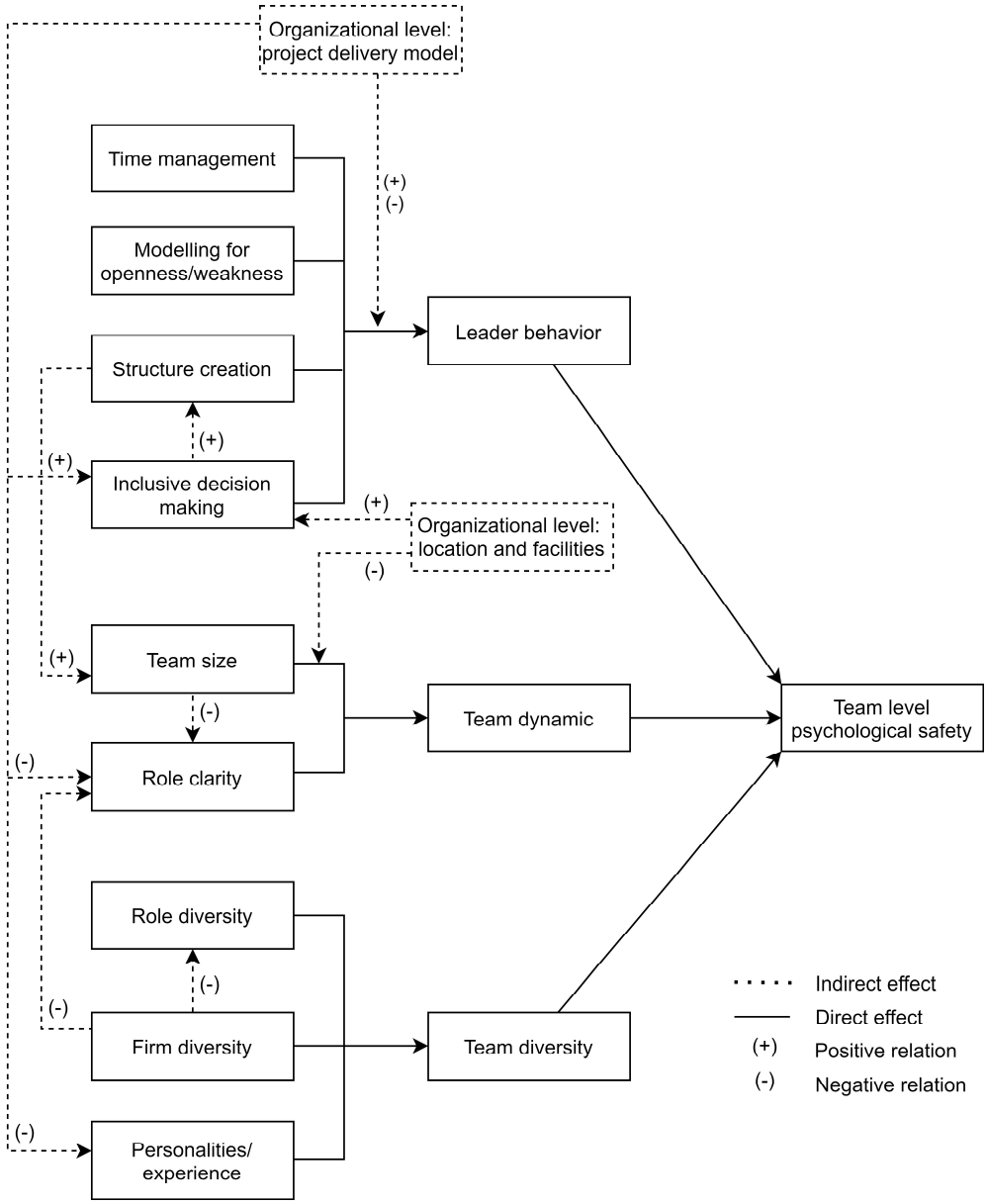

Figure 9.1: The multilevel contextual effects on psychological safety, Case 1

The team size emphasized the issue of crossing role responsibilities, illustrated with the negative arrow from “team size” to “role clarity”. It was challenging to decide where knowledge came from; this diminished role clarity and knowing where to seek help. Thus,

accountability became a problem because the firms and roles were pulling the project in different directions, negatively impacting the team dynamic's effect on psychological safety.

The positive side is that the role diversity helped the team create new knowledge as team members challenged one another. At the same time, the tight collaborative work structure seemed to be challenging for less extroverted individuals, illustrated by the negative arrow from "project delivery model" to "personalities". The results show that not all individuals were comfortable with the setting where they were "forced" to respond immediately. The findings raise the question of whether the collaborative models that focus on co-location and speaking up benefit the extrovert, not the shy and introverts. An alternative explanation may be that individuals did not have the knowledge or the authority to answer questions they received or that their tasks were not a matter for the whole group to discuss.

Also, the collaborative structure entails a more process-oriented leadership behavior, which the DM actively addressed. This is shown in Figure 9.1 by the positive arrow from "project delivery model" to "inclusive decision making". The observed inclusive decision-making process by the DM showed respect for the team members' knowledge, and improvement became a collaborative process.

The project history revealed that the project organization has developed over time, where the contractor was engaged at a later point than the consultant group. This situation is considered a part of the project delivery model, and as seen in Figure 9.1, it negatively impacted role clarity. Team members voiced that it was difficult for the team to integrate the new firm because it challenged the developed project and had a different work culture from the already established team. My impression was that there were different understandings of the work to be done after the merge, hindering shared group identification. Two design managers were let go because of the "cultural clash." The positive outcome is that it seems like the team learned and improved.

Learning and improvement are some of the known outcomes of psychological safety. The fact that there was an openness about why and how the two individuals were let go can be a contributing factor to the positive shift in the team climate. The situation can be viewed as an event where the team gained a collective understanding of the challenging situation and talked about the error. This learning culture was best observed in-between meetings where team members actively approached one another to clarify errors or seek feedback. Also, a new DM was engaged, and the qualitative data indicate that the project history affected his leader behavior. For example, he actively used humor when faced with cultural challenges.

9.4 Evidence of digital mindsets

This section presents findings concerning the team members' digital mindsets. Thus, in this section, I present findings to answer RQ2: *What is the experienced/observed level of digital mindset in the design team?*

I rely on descriptive statistics from the digital mindset face-to-face survey and attitudes and behaviors uncovered through observations and interviews to analyze and describe team members' digital mindsets.

Before delving into the specifics, I will describe the team's usage of collaborative technology. The digitalization situation is important for the further understanding of digital mindsets as the mindsets are visible in (1) reactions to situations where they can choose to try with the possibility of failing and (2) whether or not they are optimistic and engage in collaborative processes to learn and explore the technology. Then I will present the team members' perceived digital mindsets from the survey through descriptive statistics to map individuals' mindsets in the digital mindset matrix before giving evidence from the qualitative data.

9.4.1 Use of collaborative technology

Although Revit was the primary drawing software, I noted that the team members employed a variety of digital programs to perform their tasks. In their working lives, technology did not have the same position. Internal use of technology at their employer firm may have influenced their attitude towards digitalization in general. This is outside the scope of this study, and the analysis was limited to the team's use of digital tools when collaborating.

A project goal was to complete the designs before beginning the construction phase, including a complete digital model. This objective's repercussions were seen in the team's work process. The PM, for example, described the link between the project's goals and team productivity to be visible in the BIM model. The PM could examine the development of each discipline and which areas needed to be addressed during the collision-control sessions. According to the DM, the BIM coordination process was a success in this project. Nonetheless, it was not a choice but a necessity to cope with the project's digital work process:

> "It is difficult to operate in parallel with the old and new methods. Thus, people fall behind. As a result, it is almost a need for the core disciplines that they have 3D competency, can model, and engage in modeling." (Design manager)

This comment expresses the DM's expectations of his team members. In addition, a team member stated in an interview that certain individuals did not know how to work with the 3D model and that it substantially influenced productivity. The work they did in the design phase was to help minimize costly adjustments later in the project life cycle. This goal, together with

the structure of the collaborative delivery model, necessitated cross-functional collaboration in a digital format.

Although the BIM model was intended to hold all details, it was not extensively used as a project planning tool. Instead, the contractor established a supporting infrastructure known as a project hotel. The purpose was to ensure transparency by uploading all necessary data to that platform. I observed that the various firms had their own internal storage systems and did not actively use the shared platform. The team also actively employed communication methods such as Skype and emails to get input, as they were simple and quick.

Table 9.7 lists supplemented direct quotations from transcribed interviews and observations that are indications of the team's use of collaborative technology. The excerpts capture how the team members perceived working with the digital model and other support functions.

Table 9.7: Use of digital tools, Case 1

Excerpts and observations that capture the perceived use of tools		
Use	Positive perceptions	Negative perceptions
Visualize solutions in meetings with clients and users.	"We can better understand solutions because we have 3D models and visualization models. That is a benefit. We become more productive as we gain a better understanding of the design. It is an easy way to visualize our solution." (Team member 13)	
The BIM model was used to collaborate as all details were drawn into the model.	"It is easier to describe things in 3D, and then we can better analyze things and find answers together." (Team member 8) "Our usage of the IFC-model simplifies and clarifies details and linkages between building components." (Team member 6)	"Revit is the program we're using to draw in. I don't use it since I lack expertise in it. I work with AutoCAD. And when I can't open or do anything in the model, I lose overview and some productivity." (Team member 4)
The BIM model was used for collision control.	"We have an excellent handbook for the model, and the model has a high digital level." (team member 1) "The digital tools are used to see correlations with other disciplines and see where we can improve." (Team member 2)	"The model does not necessarily show everything we are working with, the correct details on how finished the solution is." (Team member 3)

Excerpts and observations that capture the perceived use of tools		
Use	Positive perceptions	Negative perceptions
Skype assisted communication, for example, in meetings, as not everyone was co-located.	"Sharing screens [through skype] helps extremely." Team member 10 elaborated that Skype could be a substitute for smaller meetings. "Skype makes my work much easier." (Team member 7)	"When the team is not physically present and attends through Skype, people [their concentration and technically] fall out. That is frustrating." (Team member 1)
The BIM model is used to develop agendas and reports.	"We actively use the digital model. […] We take snapshots to remember with a brief description of what you should do until the next meeting." (Design manager)	
Different firms used different tools.	"The key to good collaboration is that we exchange in an open format, that is IFC. Besides that, people must be allowed to work as they please." (Team member 3)	"The older [team members] are having difficulty understanding the new systems that we have, and there are quite a few of them. As a result, people may be discouraged from trying." (Team member 5)
A project hotel was used to store information.	I observed that all documents and deliveries that could not go into the digital model were uploaded to the project hotel to provide everyone with the same information.	"The hotel project is a good idea, but it has to be better organized. Structure is required so that you know where to put things and where to look for them." (Team member 4)

9.4.2 Descriptive statistics of digital mindsets

The aim of integrating a face-to-face survey as part of the qualitative interviews was to confirm my understanding of individuals' attitudes toward digitalization based on the qualitative data. The descriptive statistics provide an idea of the team members' attitudes toward digitalization and technology but do not provide an explanation for the outcomes.

The means and standard deviations for the four concepts that make up the digital mindset construct are displayed in Table 9.8 on the next page. Table 9.8 shows the group-level results from the digital mindset survey. These results are an initial test of the team's variance of beliefs and mindsets. Each of the four constructs is the mean of four items, and the results for each question are presented in Table 9.9. As evident in Table 9.9, the items within each construct show little variation, indicating that the team members have shared mindsets and beliefs. An exception is the growth mindset, with SD 1,03. When looking closer at the data visual in Table 9.9, this variation comes from one respondent who scores the lowest on growth mindset.

The measure of the items could vary theoretically from 1 to 5, with a theoretical midpoint of 3. As the items in Table 9.9 show, the measure of the fixed mindset is a reversed measure of the growth mindset. Similar is the relation between zero-sum and expandable-sum. Thus, when seeing Table 9.8 in the light of the reversed items, the results suggest that respondents reported a high level of growth mindset and expandable-sum beliefs, as the means are above the midpoint. The mean of the zero-sum construct is well below the midpoint and, therefore, strengthens the indication of team members having expandable-sum beliefs. The fixed mindset mean is below but also close to the midpoint, and therefore, the results show that some report a growth mindset and others a fixed one.

Table 9.8: Means and Standard Deviations for mindsets and beliefs (n=13), Case 1

Variable	Mean	Standard Deviation
Fixed Mindset	2,58	0,53
Growth Mindset	4,13	1,03
Zero-sum beliefs	1,71	0.43
Expandable-sum beliefs	3,35	0,57

Table 9.9: Results of digital mindset items (N=13, scale 1-5), Case 1

Answers to Likert scale questionnaire – mindsets Case 1							
Item	SD	D	N	A	SA	Mean	St. D.
Fixed mindset							
A person's level of technological savviness is something basic about them, and there isn't much that can be done to change it.	2	10		1		2,00	0.71
Whether or not a person will be quick and skilled at using new technology is deeply ingrained in the kind of person they are. It cannot be changed very much.		8	3	1	1	2,62	0.96
Not much can be done to change how well a person will keep pace with technological change. Everyone is a certain kind of person, and some will fare better with technological changes than others.		5	4	4		2,92	0,83
Though people can sometimes learn new things, you can't really change people's basic talent for adapting to new technology.		6	4	3		2,77	0,83
Growth mindset							
Everyone has the potential to develop new technological skills and abilities.	1			8	4	4,08	1,04

Answers to Likert scale questionnaire – mindsets Case 1							
Item	SD	D	N	A	SA	Mean	St. D.
Everyone, no matter who they are, can significantly improve their level of technological competence.	1			7	5	4,15	1,07
No matter what kind of person someone is, they can improve even their most fundamental technological skills with effort.	1			6	6	4,23	1,09
All people, regardless of age, gender, or education, have the ability to learn and master new technology.	1			8	4	4,08	1,04
Zero-sum beliefs							
New technologies introduced at work generally reduce the influence I have in the organization.	3	8	2			1,92	0,64
The introduction of new technologies at work generally results in less interesting work for myself.	7	6				1,46	0,52
New technologies introduced at work generally reduces the opportunities I have to succeed in my current job.	7	5	1			1,54	0,66
Resources used introducing new technologies at work generally means fewer resources available for my own support and development.	5	4	4			1,92	0,86
Expandable-sum beliefs							
I believe that new technologies introduced at work generally will increase the influence employees have in the organization.	1	2	5	5		3,08	0,95
I believe that the introduction of new technologies at work generally will create more interesting work for everyone.		2	2	9		3,54	0,78
I believe that new technologies introduced at work generally will enable employees to improve their performance and success in their current job.			7	5	1	3,54	0,66
I believe that the investment in new technologies will generally generate more resources in the organization which can be used to support employee development		2	6	5		3,23	0,73

* SD = strongly disagree, D = disagree, N = neutral, A= agree, SD = strongly agree, St.D. = standard deviation

The presented results indicate a high level of growth mindsets and expandable-sum beliefs. As explained in subsection 3.2.3, digital mindsets are the configuration of either (1) fixed*zero-sum, (2) fixed*expandable-sum, (3) growth*zero-sum, or (4) growth*expandable-sum mindset. To show the variance of digital mindsets in the team, I have calculated each team

member's mindset (growth vs. fixed) and beliefs (expandable-sum vs. zero-sum) and plotted them in the digital mindset matrix as a scatter chart (Figure 9.2).

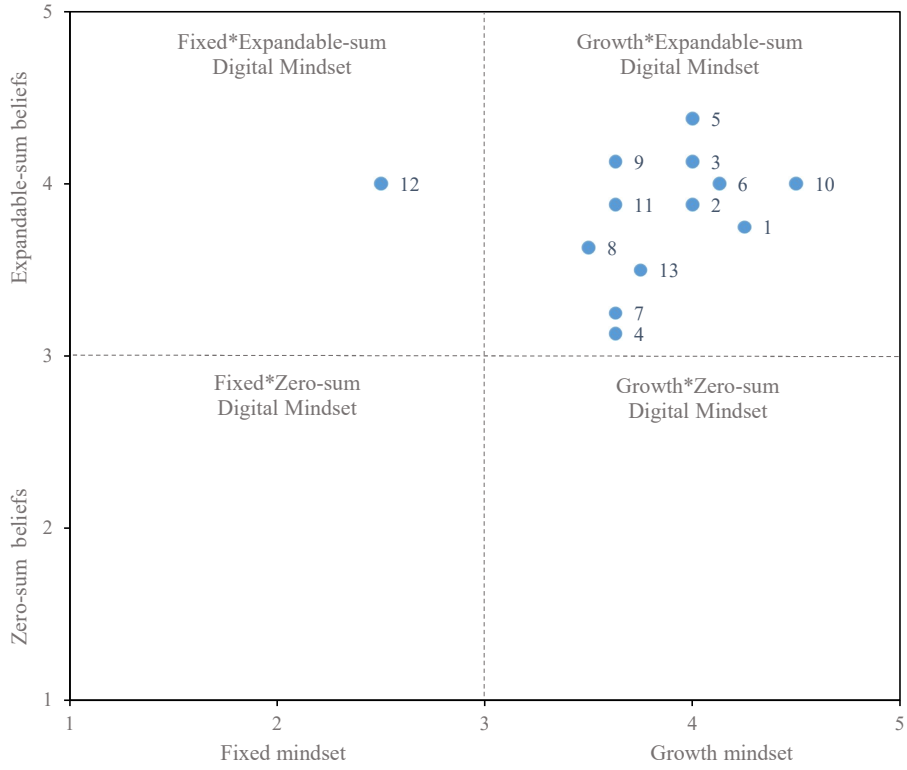

Figure 9.2: Respondents plotted in the digital mindset matrix, Case 1

As Figure 9.2 shows, there are variances in digital mindsets. Still, 12 out of 13 respondents fit in the category growth*expandable-sum mindset. Only respondent number 12 can be described with a fixed*expandable-sum mindset.

9.4.3 Qualitative assessment of the team members' digital mindsets

My analysis rests dominantly on qualitative data sources; therefore, my findings rely heavily on interviews and observations. For the qualitative analysis, I have used the theoretical framework based on the digital mindset theory (Table 3.1, p.38). It concerns the team members' beliefs about resources and learning new skills, their use of technology, support of change, and how they interact with the team based on their beliefs.

Mindsets about the ability to learn.

The project had high digital ambitions, and the leaders' expectations mirrored those goals. During the interviews, I asked team members to elaborate on how they dealt with the team's high level of digitalization. A team member stated that the diverse skill levels and types of expertise made it difficult. The difference in expertise was much due to not everyone working in Revit. Some explained that their field had another tradition of using technology, while others did not want to go through the learning process. One consultant, for example, displayed evidence of having a fixed mindset because he did not believe in his ability to learn:

> "The question then becomes whether it is useful for me, who has become so old, to educate myself as a technical drawer on the side? Or should I rather use my skills on something else?" (Team member 4)

Another informant described that the team, in general, was reluctant to use new processes, and this had stopped them from implementing technology he believed would have helped the planning process. As explained in subsection 3.2.1, avoiding new technologies is a sign of a fixed mindset caused by people's fear of failing to perform well. Nonetheless, I noticed that the team was behind schedule and that maintaining their progress was a management priority. The delay and merger when the contractor entered the project and introduced new technology could also explain why the team was hesitant to add another aspect, as it could have required investment in training and increased the team's stress.

I noticed that team members struggled because the software team members were expected to use was advanced:

> "I see that complexity is a hurdle for users when they believe the program is working against them, that you can't achieve what you want. For example, suppose I want to draw that wall and want to instruct the software on how to do so, but I don't know how. [...] Some people find it tough, and they find it difficult to do what they want because of software resistance." (Team member 1)

If complexity becomes overwhelming and there is a lack of assistance, avoidant behavior can develop. A consultant stated that she had observed this problem and considered that her team members should get the opportunity to learn:

> "There are individuals who have not worked in the program, and for them to feel that they work productively and efficiently, practice and training are needed." (Team member 3)

Smaller learning initiatives seemed to be easier for the team members. From a growth-mindset perspective, a consultant described a situation where he was open to trying a different approach for collaboration and learned:

> "The architects showed me how to share the screen and discuss without meeting. I normally want a meeting, but I learned that it is effective, as we do not have to use time on transportation. It is very effective." (Team member 10)

Similarly, a consultant described that a team member positively pushed him to use Skype when discussing details. He usually preferred a phone call, but he had learned how valuable it was to share screens to better grasp the points discussed.

These three excerpts show team members' understanding of the need to learn and a willingness to change. In addition, the team members seemed to enjoy the challenge. These behaviors align with people having a growth mindset.

Beliefs about resources.

Some team members' attitudes about access to information were influenced by the challenges generated by not working in the same drawing program. For example, a team member noticed that some members felt isolated from the group because they lacked the ability to use collaborative technology.

Similarly, the consultant who felt he was too old to learn thought he was missing out on information even though he was assisted by a co-worker whenever he needed to adjust something in the model. Typical of zero-sum beliefs, he felt his resources were reduced by not learning the tool, as information became hidden from him. Still, he recognized the benefit of Revit as he paired up with his co-worker to work with the rest of the team. As explained in subsection 3.2.3, it is typical for individuals with fixed*expandable-sum to see the potential of technology even though they do not believe in their ability to learn it.

Interestingly, a consultant that worked with assisting team members with the digital model expressed that the possible benefits from the high digital ambition were disrupted as the team did not work in the same programs:

> "So some information is lost during conversion to a shared 3D model. This, I believe, will be an issue for many years to come. The fact that some information may be lost will always be a challenge as long as we do not have projects where everyone draws with the same drawing tool." (Team member 2)

Despite the differences in how the team members coped with the project's digitalization strategy, several mentioned how the collaboration benefited from it. For example, I noticed how visualization in meetings strengthened the relationship between information and solutions. Available information increases the possibility of being transparent.

> "I believe [technology] has a positive impact, but I believe it could have been used more. You would have had more handwritten items and information that was not available if you had a lower level of digitalization. Everyone nowadays has access to a vast amount of information." (Team member 5)

Thus, some team members perceived technology as a hindrance because information was hidden from them, whereas others saw technology as a resource that aided knowledge sharing.

Support of digital change.

The team members' support of the digitalization strategy reflects their use of technology. Therefore, I analyzed their support by focusing on their descriptions and thoughts on how technology changed their tasks and work processes.

As fixed mindsets about learning technology existed, some team members minimized their interaction with it, as described here:

> "I believe that [being updated] is dependent on age; the somewhat older ones have a harder time learning the new systems we have, and there are several of them. As a result, some people give up because they find it tough." (Team member 1)

The way consultants work is defined by digitalization. Some team members said they saw the potential but were concerned about how much emphasis was given to BIM for increasing efficiency in the interviews:

> "BIM is useful, but it is not sufficient on its own. It's not simply a mechanical issue; you can overlook elements in the model, and if you don't know what other people have delivered, you have no idea what you're missing." (Team member 12)

Even though some were doubtful, they did not undermine or redefine their role in avoiding technology. Their lack of support was also connected to efficiency and "how they used to do it". Doing things without technology was described as faster and easier:

> "[2D sketches] are sometimes underestimated. You change the model with major processes, and many people are involved instead of like the old architect who sketches on the board where you get six versions in a second. Then you see what is critical, and everyone immediately understands it." (Team member 6)

Similarly, some team members found it difficult to trust the 3D model even though they supported digitalization:

> "I believe it can be a hindrance [to collaboration] if the digital model appears to be finished and mature even when it is not. When it appears to be finished, you are unaware that you must continue to work on the details. [...] However, I believe that without these digital tools, we would not have been able to work in a complicated and safe manner." (Team member 3)

On the other side were the team members who supported the new ways of doing things digitally. For example, the PM's attitude towards digitalization was optimistic:

> "It was a very demanding task before when everything had to be done in 2D. You had to be very skilled and have a good overview. It was not impossible, but it often required more than the average consultant managed. When the 3D model is used correctly, it becomes a very powerful tool for the team." (Project manager)

I noticed that technology aided team collaboration by making it easy to comprehend each other's roles and levels of knowledge. The DM stated that it was much easier to hold people

accountable because they actively used the BIM model when discussing solutions rather than a checklist. They took notes on what needed to be revisited and who was in charge of following up. An informant expressed:

> "Technology ties us together because it is easier and faster to gain an understanding of the project." (Team member 13)

In addition, Skype was mentioned in the interviews as a way to strengthen the team's communication. Some team members were dispersed, but the DM stated that they could fully engage because they had access to the same sound and visuals as the co-located team. The consultant, that was full-time remote, had the role of a BIM manager. He was in a better position to learn and engage with technology in an existing digital-focused role than others who were physically separated from the team.

According to my findings, some team members actively embraced digitalization, and others indicated that they were proactive and collaborative:

> "I see that digital tools can be a fantastic asset for me, especially when you model a building before you actually build it. You have the opportunity to discover all crashes and things like that." (Team member 8)

Interaction with others.

The learning examples show that some team members believe that learning and developing new skills are collaborative processes. They shared tips and tricks across disciplines rather than competing to be the best. These behaviors are typical for expandable-sum beliefs. Also, these team members were willing to share knowledge, aligned with the growth*expandable-sum mindset.

In the interviews and my observations, I saw a variety of digital competence. What was interesting is that this factor does not seem to lower the gains from the tools, as expressed by an informant:

> "I see that many companies use the work practice of an experienced senior cooperating with a younger consultant who manages the program successfully. They produce good results when they collaborate. What cannot happen is for one person in a meeting to be completely unaware of what is going on in the model. That isn't going to work. It has to be coordinated." (Team member 1)

Also, the PM was honest about not having all the answers and needed to find others with technological skills to collaborate with:

> "You can say that I, without bragging, am a sound engineer. But I can't make 3D illustrations. With pencil and paper, I was good at technical drawing. […] I depend on people around me who know how to do it." (Project manager)

Both comments give an impression of fixed*expandable-sum mindsets, as they describe others and themselves as not having to learn but instead finding others to collaborate with. What is

beneficial in the light of digitalization is that these individuals tend to see the potential of technology, both for themselves and for the project, and thereby support it.

Table 9.10 lists direct quotations from interviews that are indications of the presence of digital mindsets, together with a summary of the discussion above.

Table 9.10: Summarization of the presence of digital mindsets, Case 1

Beliefs/ behaviors	**Excerpts that capture digital mindsets**	**Type of digital mindset**
Mindset about their ability to develop new technological skills	"Our daily lives are increasingly digital, yet I still enjoy sketching. However, we work digitally and choose to introduce ourselves to new tools that we require in specific situations." (Team member 3)	There are signs of fixed mindsets due to age and fear of technological advancement. Most of the excerpts demonstrate growth mindsets since they describe scenarios in which individuals had to gain skills to do their tasks better.
Belief about resources	"Yes, [digital tools] is absolutely necessary, but there is a lot of talking in the meeting as well. But using digital tools for visualization has been both rewarding and has been used in a good way." (Design manager) "In any case, I feel that I am losing something when I do not have that competence." (Team member 4)	Those drawn to the fixed mindset appear to believe that technology was reducing their information resources. Nonetheless, the main beliefs were comparable to those of expandable-sum since team members describe technology as a resource that benefits the entire team.
Use of technology	"So we have a rather advanced drawing tool, and I'm a little reluctant to mess with it too much." (Team member 2)	Excerpts from the interview provided the sense that some people avoid or minimize their interaction with technology, typical of fixed mindsets. According to my observations, most team members actively used digital programs to explain their ideas, which is indicative of a growth*zero-sum digital mindset.
Support of digital change	"BIM is a support, but it alone does not work. It's not just a mechanical matter, you can miss elements in the model, and if you do not know other people's deliveries, then you do not know what you are missing. So you need to have the understanding of what to do when." (Team member 12)	Some expressed reservations about using tools because they provide a misleading picture of how sophisticated the solutions are. Also, team members expressed their recognition for technological assistance and admitted that the project would not have been possible without it. As a result, their support conveys both fixed*expandable-sum and growth*zero-sum mindsets.

Beliefs/ behaviors	Excerpts that capture digital mindsets	Type of digital mindset
Interaction with others	"These are heavy tools, so it is not a day course or a three-day course to become skilled at Revit. It requires more time. We don't think it's necessary for us elders to spend time learning it. We must manage the projects by employing a technical drawer that sits and sketches. That is how we must adjust." (Team member 4)	Team members with a fixed mindset found others with technology abilities with whom to collaborate, as is usual for a fixed*expandable-sum digital mindset. Those that felt confident in their abilities engaged in collaborative activities to share knowledge, which is typical of a growth*expandable-sum mindset.

9.4.4 Summarization of statistics and qualitative assessment

The survey results show that most team members believe that people have the potential to develop technological competence (knowledge and behavior). Still, the fixed and the growth mindsets results give different impressions of how much individuals can improve their talent for adapting to new technology and keeping pace with changes. For example, the growth mindset item concerning age and learning scored a mean of 4,08, whereas the fixed score concerning people having a basic talent for adapting is close to the midpoint. Also, the qualitative results do not show the same support for everyone to be able to develop their technological skills. It was typical that older team members were reluctant and needed to pair up with others to keep up with the team. Also, the team members with digital-focused roles described a general fear of technology being too advanced, which supports the fixed mindset survey results concerning not everyone being able to adapt to change.

I did not identify clear tendencies of the fixed*zero-sum mindsets in the data, which confirms the results in the scatter chart (Figure 9.2, p.150). Those with a fixed mindset showed support for digitalization and either minimized their interaction with technology or found others to collaborate with. Thus, they described having a fixed*expandable-sum digital mindset, and others described that it characterizes their teammates.

Interestingly, no one answered that digitalization reduced their resources or their possibility of succeeding with their work. In the qualitative analysis, I saw more signs of zero-sum beliefs concerning resources connected to those with a fixed mindset about their learning ability. I found that those who were not using Revit or needed to pair up with others felt like they were missing out on information.

Similarly, complete growth*zero-sum digital mindsets were not apparent in the qualitative analysis. Zero-sum beliefs existed, but not to the degree of competition for technological resources. The competitive advantage team members could gain was connected to their role and place in the PDM, not due to technology alone. These results are also evident as several

team members were close to this category in the scatter chart. Still, a significant part of the team mentioned how the team's collaboration benefited from more transparency and a stronger connection enabled by technology. I believe that most team members were collaborative; sharing their knowledge and problem-solving was, to a degree, a social experience. These behaviors are closest to those of a growth*expandable-sum digital mindset.

What can be understood from the triangulation of the understandings from the interviews, observations, documents, and the survey is that at a group level, the team has an active and supportive attitude towards the digitalization strategy. Team members with growth*expandable mindsets tried to expand their roles to extend their relational boundaries and responsibilities to handle technology. However, some team members aimed to reduce technology's demands on their tasks and, thereby, the negative implications. The positive side is that they did this by working with others.

9.5 Psychological safety antecedent to digital mindsets

This section explores the connection between the observed characteristics of psychological safety and the identified digital mindsets. The discussion considers psychological safety as an antecedent for digital mindsets, as shown in Figure 1.1, introduced in section 1.4. Thus, in this section, I discuss RQ3: *Does the team's level of (negative or positive) psychological safety affect the observed digital mindsets?*

The last research question is built on a proposition that a high level of psychological safety facilitates positive digital mindsets and low negative ones. In the former sections, through triangulation, I found that for the team in Case 1, there is a high level of psychological safety, and most individuals fit within the spectrum of the digital mindset group growth*expandable-sum, and some in the fixed*expandable-sum category. Figure 9.3 is a 3D scatter chart showing each team member's digital mindset and level of psychological safety. The diagram is the combined result of the descriptive statistics of the psychological safety and digital mindset surveys. Both measures could vary from 1 to 5, but since all respondents scored above the midpoint of 3 on all measures, except respondent 12, I have zoomed in on the diagram to show the variance better.

The main contribution of the diagram is that the team scores highly on all three measures and that there is no pattern showing that those with a significantly high digital growth*expandable-sum mindset have a greater perception of psychological safety. The further question is whether the qualitative data indicates that the present climate of psychological safety supports the team members' high (positive) digital mindsets.

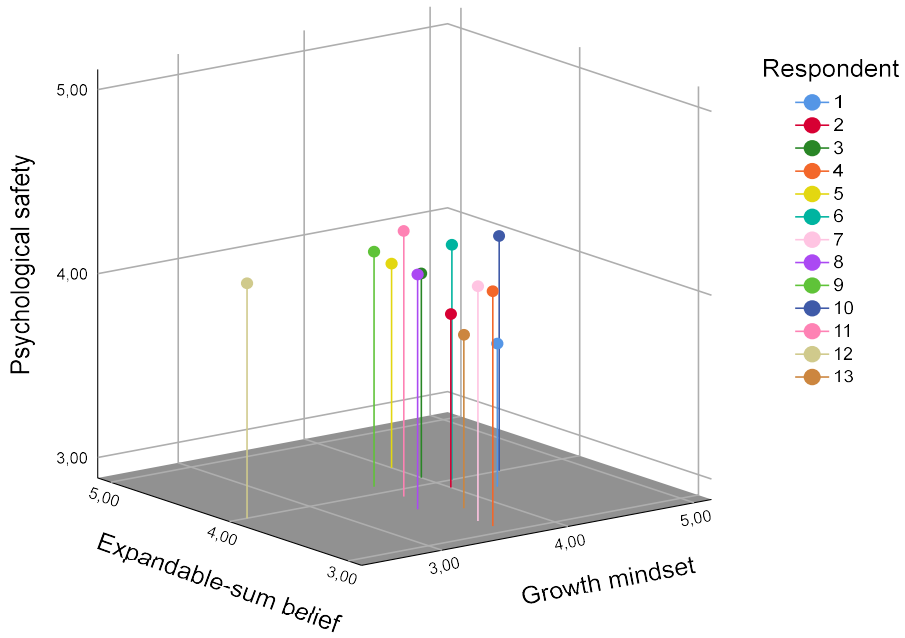

Figure 9.3: Visualization of levels of psychological safety and digital mindsets, Case 1

9.5.1 The effect of psychological safety

An important aspect of the findings on psychological safety in Case 1 was that team members did not feel that people were being rejected for being different. The group had people with various technological backgrounds and skill sets, and team members described that they accepted people working differently or needing extra support. Still, even though team members were not rejected for struggling with the primary drawing program, people were skeptical about how it complicated collaboration and slowed their progress. These perceptions could work against the framing of cooperation dependent on technology as a learning opportunity (Edmondson, 2003). Also, team members who did not work in the main drawing programs felt outside the collaborative network, facilitating zero-sum beliefs about how and if they could benefit from collaboration within the digital tools.

Related to the acceptance of being different was that team members reported respecting and valuing each other's knowledge and that the team's progress depended on it. Still, I found ample indications that the merge of the contractor, even after some months, challenged the team's psychological safety, especially understanding each other's knowledge, which was not due to the lack of respect but to not knowing who knew what. Included in the confusion was that the different disciplines did not have the same traditions of technology use, and some felt that their way of working was not fully appreciated.

Thus, despite the team members respecting each other, taking risks regarding technology was not as present. From my observations, it was up to the contractor to decide on the digitalization strategy after the merger. During the merger, the combination of the tension put on the team where collaboration was difficult, and the changes to digitalization could have reinforced zero-sum beliefs. Thus, the boundaries between the project actors challenged the cultivation of growth*expandable-sum mindsets, as the power to take the initiative to improve tools and processes firstly lay with the contractor's team.

In the theoretical chapter, I also proposed that psychological safety suggests certain learning and innovative behaviors (Table 2.2, p.26). Table 9.11 lists summaries and connections between findings from the former sections that are indications of the role behaviors associated with psychological safety played in the team's digital mindsets, both positively and negatively.

Table 9.11: Behaviors facilitating digital mindsets, Case 1

Behavior	Psychological safety	Digital mindset
Speaking up	In discussions across disciplines, team members tended to speak up to clarify details and solutions. Stating their opinion is more of a norm than an extra-role behavior.	Speaking up was tied to technology since they addressed solutions and details from the model but not the usage of technology directly. However, seeing others speak up may have helped to encourage a collaborative digital environment.
Seeking feedback/help	Team members sought feedback in meetings on new and thought-through ideas, despite knowing they could be rejected.	It was not obvious that people sought assistance with digital difficulties. The working model (as a project/organizational cultural feature) indicated that this would be handled internally.
Engagement/ collaboration	The project history altered team diversity and dynamics, making collaboration difficult. As a result, responsibilities overlapped and occasionally blurred. Nonetheless, they initiated smaller meetings to experiment with alternative solutions.	During the design process, the contractor chose how they would digitalize the work, and individuals had to accommodate their choices. Even though team members were free to choose which programs to work in, it presented a difficulty to people with different mindsets.
Flexibility	Team members were flexible in changing smaller solutions. Still, time and, to a degree economy pushed for decisions.	Being flexible helped team members assist each other when it came to technology.

Behavior	Psychological safety	Digital mindset
Experimenting/ creativity	Team members engaged in tasks related to their discipline and, at times, discussed solutions outside of their roles.	Team members found learning opportunities while collaborating, where they either learned or helped others.
Improvement is a collaborative commitment	Despite the fact that the team experienced challenges during the merger of the contractor, they collaborated to find buildable solutions inviting all disciplines.	Mostly, the BIM managers worked on improving the work process in the digital model, and there was little flexibility for team members to assist with this.
Knowledge sharing	Team members report that knowledge sharing was high, which was also seen in speaking up and seeking feedback.	The growth-oriented digital mindsets benefited from knowledge sharing. Still, there was little training provided besides a manual for working on the model.

Theoretically, psychological safety provides a learning environment (Newman et al., 2017) characterized by speaking up, seeking feedback, and sharing knowledge (Edmondson, 2004). I observed that team members sought feedback from each other but not that much when it came to using the primary drawing tool. Learning the programs was not a topic; my observations suggest that this was to be done in-house for the consultants. Consequently, those with fixed*expandable-sum mindsets confirmed their digital mindsets, as they did not experience a situation of learning but a situation of needing to find others to collaborate with to keep up. Keeping up would be visible, and for those with a fixed mindset, the possibility of exposing failing.

Notably, the team had been working for months before I started the case study, and the DM explained that seeing the results of the work done on the digital model had taken some time and effort. The team had been through a technological learning process. During my observation time, the project's digital model aided team members' discussion of buildable solutions. They asked for input on the 3D model's details and thereby disseminated project information. Using technology enhanced their cognitive resources, which facilitated the expandable-sum beliefs.

The digitalization strategy also contributed to team members' perceptions of technology as a social experience involving information and knowledge sharing. Despite the fact that the team had no technology training during the project, BIM managers supported them. The BIM managers served as a knowledge resource for people who lacked confidence in their abilities to learn in order to support the digitalization strategy. More importantly, being exposed to BIM managers' knowledge sharing influenced team members' perceptions of engaging and helping one another. Edmondson (2003) described the importance of sense-making as a social activity

influenced by contextual factors and actors. Providing support framed digitalization as a collaborative learning situation, and I observed that those with a growth*expandable-sum mindset engaged in bottom-up innovation by assisting others. Thus, knowledge sharing helped facilitate and for some, develop more positive digital mindsets.

Schein and Bennis (1965) found an environment of psychological safety to create tolerance for failure and remove barriers to change. Thus, theoretically, psychological safety is characterized by innovative behavior, where improvement becomes a collective commitment through experimenting and sharing ideas (Edmondson, 2004). Even though the team in Case 1 did not face any technology changes, they collaborated with a new group of people and with a unique digitalization strategy, as is typical for design teams. When the team collaborated in person or over Skype, they offered assistance with work digitalization. As a result, this enabled employees who have a growth mentality to teach others.

Even though the team made a concerted effort to stick to the collaborative delivery methodology, digitalization improvements were on the sideline. What was challenging was that the teamwork was temporary and economically time-constrained by project actors who did not necessarily lead the team daily. Although the PM had the main responsibility for the project, the DM and his team were in charge of assisting and guiding the digitalization. When the technology became too demanding, the DM could do little to allocate them or provide training, as Solberg et al. (2020) suggested. As a result, ensuring that the learning environment integrated digitalization was not explicit or part of the management strategy. What the DM did do was to provide support in the form of BIM managers, which benefited both the development of psychological safety and digital mindsets.

Essentially, psychological safety provided the team with the tools to face the project's high digital goals resiliently. According to Solberg et al. (2020), having a strong, shared mindset is important for the organization to align team members' behavior with the project's vision and goals regarding digitalization. The variation of individuals' mindsets can both contribute to and counter this shared understanding of what is strategically important and the success of digitalization initiatives. Psychological safety facilitated the shared mindset of assisting each other as a bottom-up effect. Still, keeping technology on the side of the learning culture can make it difficult for team members to deal with their mindsets, preventing them from fully utilizing the benefits of psychological safety when working digitally.

9.5.2 The reciprocal relation

Many of the contextual factors in this case study that I identified as affecting psychological safety could potentially directly influence digital mindsets, which implies that some of the antecedents are comparable. I will discuss this in the following.

The size and diversity of the team posed a threat to psychological safety. Due to traditions and varying technological skills, multiple actors and several discipline-specific roles also provided different interpretations of how to interact with the technology. The team's diversity emphasized the divergence of digital mindsets and how they resiliently dealt with the digitalization strategy.

Because the team was co-located, it was able to face the difficulties of its size and diversity. Co-location ensured information sharing by providing a sense of transparency. Also, the BIM manager assisted team members in meetings, allowing people with less positive digital mindsets to participate. The BIM managers' assistance can be viewed as a resource that assisted the team in preventing feelings of incompetence or fear of failure, which is critical for both phenomena.

Also, the leader's behavior was critical in establishing a climate of psychological safety and supporting digital mindsets. The DM, in particular, was humble, openly admitted to not having all the answers, and sought assistance where necessary. He framed teamwork as a learning process. According to Solberg et al. (2020), managing digital mindsets is mainly the leader's responsibility. Leaders can "frame the context in such a way that more positive digital mindsets will flourish." Case 1 findings suggest that psychological safety can provide leaders with the language to discuss and establish a notion of such an environment. I saw a team climate where technology behavior was encouraged rather than compelled.

More importantly, the phenomena had a reciprocal relationship, as illustrated in Figure 9.4. My most important contribution, illustrated in Figure 9.4, is that positive digital mindsets benefited the development of psychological safety. The majority of the team members had an improvement attitude toward technology, indicating they were willing to develop and learn new skills, according to the examination of the team's digital mindset and behavior. They also saw technology as an opportunity, which meant they were willing to push the boundaries of their work and relationships in order to employ digital technologies. These attitudes of the members with the growth*expandable-sum mindsets are comparable to Edmondson's (1999a) description of a psychologically safe team where improvement is a collective commitment.

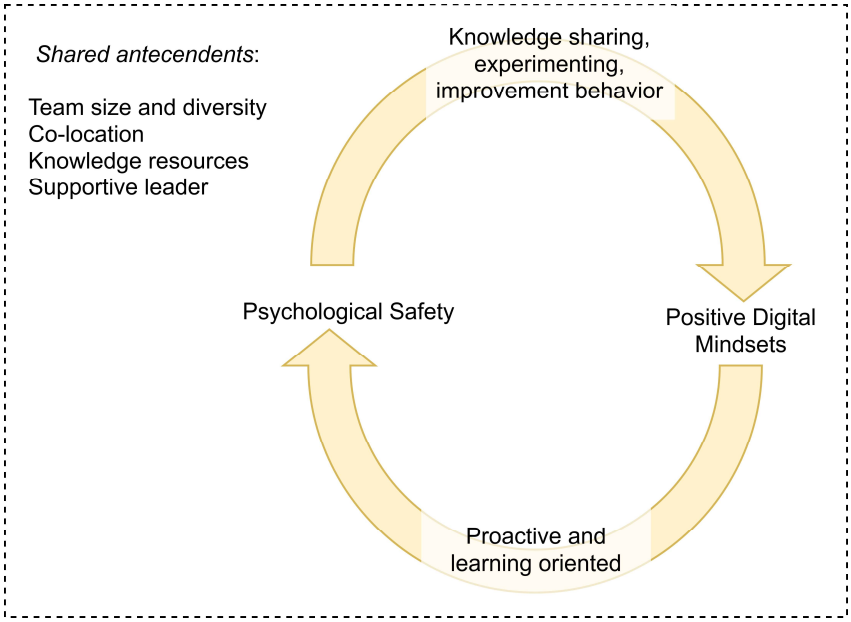

Figure 9.4: Reciprocal effect between psychological safety and digital mindsets

Individuals with growth*expandable-sum mindsets, according to the literature, contribute to the development of climates of psychological safety. According to Detert and Burris (2007), proactive personalities have a higher sense of psychological safety, and Edmondson and Moglef (2005) suggest that people who are open to change are less vulnerable at work. Case 1 showed that growth*expandable sum mindsets strengthened perceptions of psychological safety by making it easier to share knowledge. Therefore, individuals with a digital mindset generated learning and knowledge-sharing opportunities.

Still, psychological safety comprises more than positive digital mindsets and based on Case 1's findings, those with a more fixed mindset and zero-sum beliefs would have faced challenges in a team with low psychological safety. According to this study, if the team did not have a high level of psychological safety, the digital mindset and behavior would be less focused on collaboration and expansion. Table 9.11 on page 159 shows that psychological safety has an impact on the team's digital mindsets and behaviors.

Chapter 10
Case 2 Results and Discussion

An investigation of psychological safety in a digitally advanced design team working on a US construction project.

10.1 Introduction

The Case 2 results and discussions of the case-specific research questions are presented in this chapter. First, this introduction presents a brief summary as to why the case is interesting. The findings are then presented by each research question, one for each section. Finally, in the last section concerning the relationship between psychological safety and digital mindsets, I discuss the within-case findings against the literature.

The Case 2 study is unique because the COVID-19 pandemic emerged at the start of my data collection period in 2020. Due to the unanticipated change to virtual working conditions, the team was wholly dependent on digital communication and collaboration during my case study.

Despite the crisis forcing the team to work virtually from their homes, the project continued and was not delayed during my observation time. From my interviews, I saw ample data to justify my claim that the new working conditions had not significantly disturbed the team's collaboration and progress. For example, when I asked, "How does the new virtual working process affect the collaboration within the team?" a team member answered the following:

> "I think because we're so digital already, we didn't have that many in-person meetings, from what I recall. For me, given my level of involvement, I haven't seen a change really or a difference." (Team member 10)

In the interview with the Design Manager (DM), I came to understand how the team managed to keep steady progress when the crisis struck. The DM described that, prior to the crisis, they had been quite digital already. One reason was that San Francisco city had decided when the project started in 2017 that the project would be a digital pilot for their new electronic plan review process. So, instead of all plans being approved and reviewed in a physical form, the pilot changed it to be all-digital by using the software Bluebeam to create an online server to which they invited all their city staff. The city staff marked up their comments on schemes in Bluebeam, and then the team was invited to respond to the comments. The design manager

explained that it had been a learning process going from the very formalized process they knew to "flip a switch, and now everything is digital." So, what was significant when the crisis transformed their collaboration to digital was that a digitalization learning process had already begun.

Another reason the team coped so well with the forced digitalization due to the crisis was the project phase they were in. When I started observing the team, they worked towards design development delivery. Thus, the team had gone through the initial phase, where roles and relationships had been established.

> "I think due to the fact that we had already established those relationships in person in the office before, it was an easier transition. I think it would be somewhat different if we were first starting the project now to try to speak to everybody and kind of know their idiosyncratic. People have their own tendencies to how they communicate. Some people sound very aggressive and rough on the phone. But if you know them, you know it's not personal. I think that certainly helps." (Design manager)

The DM commented that it would be interesting when disciplines such as acoustics and waterproofing were to be integrated into the digital design team. Similarly, a team member described that they had been at the construction site prior to the crisis and got familiar with the site and that the work they were currently doing did not necessarily require physical meetings or site visits. One of the team members contributed the following:

> "You know, later on, we would have kickoff meetings at the job site, and there would be some amount of in-person interaction. I think that will be impacted. But as of right now, this project is still in design, so it hasn't had a huge impact." (Team member 8)

Because I began collecting data when the crisis hit, I observed and held interviews online. I observed the consequences of a virtual transformation and asked team members about the effect on progress, productivity, and team climate. As the team dynamic and digital communication was established prior to the crisis, and the design phase did not require face-to-face meetings, I argue that the case study is fairly similar to what it would have been prior to the crisis.

Equally important was the presence of preconditions for psychological safety to be valuable for the team to reach their performance goals. During my observations, their meetings and communication revolved around discussing ideas and details of solutions that had already been suggested. Thus, the interdependence of tasks was high, requiring behaviors associated with psychological safety to reach sustainable solutions. For example, a team member described their need for collaboration and knowledge sharing:

> "We coordinate all of our design work with all the other design disciplines like civil engineering, architecture, MEP, which is mechanical, electrical, plumbing, and other consultants, and don't forget landscape architects as well. So we deal with the project, we deal with meetings, we read the drawings to understand what the building is going to be about, and the site conditions." (Team member 9)

Despite the crisis, they found methods to seek feedback and reach solutions:

> "We originally only had permeable pavers, and so I had to coordinate and kind of email, phone conversations with the different disciplines to get that worked out and implemented into the plan. So when that finally gets done, that's always like progress being done." (Team member 14)

The team had characteristics and history that indicated that psychological safety could be present, and the digitalization situation due to the crisis challenged team members' digital mindsets. If psychological safety was current, and to what extent will be discussed in the following.

10.2 Evidence of psychological safety

The first step in the analysis process was to provide evidence for psychological safety. In this section, I present findings to answer RQ1: *What is the experienced/observed level of psychological safety in the design team?*

I rely on descriptive statistics from the survey and norms and attitudes uncovered through observations and interviews to analyze team members' perceptions of psychological safety.

10.2.1 Descriptive statistics of psychological safety

The means and standard deviation for the quantitative psychological safety survey are displayed in Table 10.1 on the next page. Theoretically, the measure of psychological safety could vary from 1 to 5. The overall mean of 4,25 is well above the theoretical midpoint of 3. Thus, the results shown in Table 10.1 suggest that respondents reported a relatively high level of psychological safety. Also, the standard deviation (St.D) of 0,68 shows that the individuals share similar perceptions of psychological safety.

Table 10.1: Results of psychological safety items (N=15, scale 1 to 5), Case 2

Likert scale questionnaire – psychological safety Case 2							
Item	SD	D	N	A	SA	Mean	St.D.
1. When someone makes a mistake in this team, it is often held against him or her.	3	10	2			4,07	0,59
2. In this team, it is easy to discuss difficult issues and problems.		1	1	8	5	4,13	0,83
3. In this team, people are sometimes rejected for being different.	8	5	2			4,40	0,74
4. It is completely safe to take a risk on this team.		1	3	9	2	3,80	0,77
5. It is difficult to ask other members of this team for help.	10	5				4,67	0,49
6. Members of this team value and respect each other's contributions.			1	7	7	4,40	0,63
Total level and variation:						4,25	0,68

* SD = strongly disagree, D = disagree, N = neutral, A= agree, SD = strongly agree, St.D. = standard deviation

Despite the team's low total SD, the results from the individual items in Table 10.1 show that the opinions vary among the respondents.

The high level of psychological safety is most evident in the negative response to the statement *"It is difficult to ask other members of this team for help,"* where ten respondents answered strongly disagree, and five agreed, also making it the most united answer with the lowest SD. Also, a high level is evident when seven respondents strongly agree, and seven agree to *"Members of this team value and respect each other's contributions",* and eight strongly disagree, and four disagree with *"In this team, people are sometimes rejected for being different."*

As seen in Table 10.1, some respondents react negatively to statements 2 and 4. The member answering negatively to *"It is completely safe to take a risk on this team"* scored the highest on the other psychological safety items. The respondent had been involved with the team for seven months and was hired as a sub-consultant. In the interview, he described a collaborative and flexible team. The one that responded negatively to *"In this team, it is easy to discuss difficult issues and problems"* also scored positively, but not highly, for psychological safety. From his answers to the other items, he feels respect from the team and that it is easy to ask for help. He is moderate in his perception of taking risks and being rejected for being different. This team member's firm was engaged as a third-party reviewer to ensure that details for the energy system had been considered. Thus, he had a position requiring taking interpersonal risks such as asking questions, reporting mistakes, and speaking up.

All in all, the descriptive analysis shows a highly united perception of psychological safety. Thus, the results indicate mechanisms within the team that facilitate psychological safety. Still, some of the items are weaker than others, pointing towards barriers to the development of the team phenomena. This will be further elaborated on in the following description of the qualitative findings.

10.2.2 Qualitative assessment of psychological safety

In my interviews and observations, I saw ample data that supported the survey's findings of a high level of psychological safety. Interviewees were asked to share stories of a successful work process with the team, including how they perceived the process and the context, who was involved, and how they were involved.

Item four from Table 10.1 got the lowest score of the psychological safety items. As described in section 2.1, interpersonal risks are behaviors such as speaking up, proposing an idea, or reporting a mistake. Thus, the item sums up the general perception of the other psychological safety items. The team member who answered negatively to this item worked as an engineer providing electrical gas and power supply into the building and therefore had to coordinate closely with other disciplines on the team. Despite him being averse to the item, his interview answers gave the opposite impression, for example, the following description of the team:

> "So far, it's been pretty smooth sailing. All the consultants have been working in unison. And the coordination team with [the PM] and [the DM] have been really efficient and on the heels of ensuring everybody gets what they need, like files. […] I can reach out to anybody, I write [the DM] a mail, and within 30 minutes, he responds. It's not like I had to go around in circles." (Team member 6)

Moreover, I observed that team members were continuously confronted about their ideas; it was how ideas were developed, and the project progressed. Still, in the interviews, none talked about mistakes or blame. A team member sportingly commented:

> "No, I feel on this job that everyone works very well together, and no one's gonna blame each other. It's not a point-your-finger at someone else when something gets messed up. It's – okay, how do we solve it?" (Team member 7)

In meetings, team members reported what they had done and asked for input from others, especially approval from the owner. Thus, they were actively seeking feedback and asked about the views and experiences of others. I got the impression, based on interview conversations, that this was a comfortable process for the team members. For example, a team member described:

> "You know, there's a very open dialogue. So I don't know that there's any reason why a suggestion or an idea can't come up and be brought to the entire group. I think the only thing that you might, at least speaking for myself, say is something that might be embarrassing, like – Hey, I have a dumb question. And they ask the question and hope

> that it is well received. People are cognizant enough and respectful enough to either say – we appreciate the comment, but no thank you." (Team member 5)

Furthermore, a team member expressed that the team had a "coaching climate", where asking for help or opinions was well received. He further explained that this type of climate created a sense of acceptance, helping them reach out to each other. However, the team being supportive did not imply there were no conflicts. I noticed that those who attended meetings on behalf of the project owner or as a third-party consultant were more confrontational when discussing solutions. Meetings were also set up with a clear agenda, and one team member noted that when they were on the list for the day, they were aware of how they presented themselves and so "protected" their ideas:

> "I think behind the scenes, before we present an idea or concept, we pretty rigorously go through it, and then we try to figure out who our audiences are and understand their own idiosyncrasies. We're pretty strategic in the way that we protect an idea. There have been no objections to any of our ideas. If there are concerns on their part, they're just technical concerns or feasibility concerns. Where they're like, that's gonna be hard to make, or it's not going to last very long." (Team member 13)

Feeling the need to be prepared is not a sign of low psychological safety but of being accountable. Thus, indications of a climate of psychological safety were observed as they could have productive discussions where they seemed not concerned with self-protection. I saw ample signs in the qualitative data that team members were not rejected for stating their opinions, for example, this excerpt from an interview:

> "We're always trying to contribute by suggesting – hey, what about if we did it this way or that way? Sometimes it's complimentary. And they'll accept it, which is really great. That makes us feel good. And other times, they'll say – no, we'll stay the course and continue doing this way. That's fine as well." (Team member 5)

Still, the survey results in Table 10.1 show that one team member responded negatively to the item concerning discussing difficult issues and problems. When I delved deeper into the specific interview, I discovered that the team member was focused on how his work entailed initiating discussions. His role as a third-party consultant gave him no authority as he was not liable for the system's working. Primarily, he was engaged to control on behalf of the project owner:

> "I am sort of doing a dance. So in some sense, I'm there because the owner does not have full confidence that their MEP and energy modeler can get the job done. I do not want to step on anyone's toes and overstep my role, so that can be challenging. […] And so it's a criticism sandwich with compliment bread. And you are trying to sort of figure out how to get people to come around on something without being overly critical." (Team member 8)

He further described that the project's demands for the energy system created gray zones for who was responsible for what. Thus, the process of tying the heating system with the solar

system created situations where the engineer and the subcontractor had not talked, even though their tasks were interconnected. So, he had to take responsibility and sit them down to create a buildable solution. These aspects of his role in the project could be the reason for his negative response to the questionnaire item. Still, despite this, he described that "there was a good amount of collaborative spirit" on the project.

A psychological safety item similar to discussing issues and ideas is asking for help. A team member expressed that whenever he felt confused, the barrier to seeking support, especially from the DM and the PM, was low:

> "Working on this project for me is good. There is really good support. If I have a question about the standard, I am not sure or comfortable with how to do something, then I can ask them, and then they will give me guidance. So that actually helped me a lot." (Team member 12)

Adding to this point, another team member expressed that even the less experienced team members gained from the acceptance of asking questions:

> "And on our end, the less experienced people are comfortable enough with messaging somebody and saying, hey, how do I do this? And I think everybody's resourceful enough to ask for help or look up information if needed. So far, it's been a positive experience." (Team member 10)

However, the perception of the barriers people had speaking up varied. For example, one team member described that there had been occasions where individuals had spent days on delivery, and when they were asked how they were doing, they listed all the questions that should have been asked when they received the tasks. According to him, the absence of help-seeking behaviors came from the insecurity of being exposed, which is a sign of low psychological safety:

> "I think some people have a fear, and some think the expectation is that they should know everything. And that's not at all the expectation. I've set some of them down and told them that I expect you to ask questions." (Team member 3)

The psychological safety item concerning respecting and valuing each other's contribution got a high score from the survey. This result was confirmed in the qualitative data through their giving-feedback behavior. The PM actively expressed that he valued team members' suggestions, for example, this comment to a team member in a meeting: "Those strings could be very cool. It reflects well on the rest of the project."

Adding to the point, a team member described that the project had many successful stories due to people being open-minded and the respect showed when new ideas were presented:

> "Sometimes, [explorative landscape design] ideas can be a little bit hard to sell or hard to ignite and get going. This project team is unique in that [the PM] and [the DM] are very accepting and trying to make it work, which is pretty cool and rare. A lot of times, the architect can sort of be more hesitant to get into something that bridges that gap

> between landscape and architecture. And so it was a very successful meeting related to getting something else going for the project." (Team member 11)

In the interviews, team members also expressed that they trusted what the other disciplines presented in meetings, and even though they questioned their solution, they did not have a reason for not respecting it. In one of my meeting observations where the team planned the next step of the process, a project owner representative expressed that he was confident that the PM had control over the situation: "We do not have the competence of that, so it will be up to you if you would like to have us in the meeting."

As I presented in the theoretical framework, psychological safety can also be observed and understood by identifying behaviors. The open interview questions allowed me to listen for learning and innovative behavior. In the observed meetings, I listened for examples of seeking and giving feedback and help, speaking up, language, respect, and informal dynamics. Examples of characteristics that suggest the presence/absence of team psychological safety are listed in Table 10.2 on the next pages. In the process of creating the table, I used the theoretical framework (Table 2.2, p.26) and inductively created and deleted nodes when going through the qualitative data.

Table 10.2: Indications of characteristics of psychological safety, Case 2

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Speaking up	[Interview, team member 15] "That was part of the conversation – me encouraging them to think about and visualize how we use this space and how many people can really comfortably sit in this room." [Observation] Comment from a meeting: "I have a question about this. Excuse me, I am going out of my expertise, but...", another reply: "Thanks for clarifying that."	[Observation] In a meeting, there was a clear hierarchy structure of who was to speak. The PM, DM, and the owner representative speak the most and ask the most questions.
Seeking feedback/help	[Interview, team member 6] "We were having issues with certain weight utility elements coming in the way, and then we proposed that maybe civil could more muster up slightly northwards so that we could fit our work in there. They were quite fine with making that adjustment." [Observation] The first half-hour of the meeting was not planned, but the ones that were on the call started discussions and asked questions they needed to talk about. [Observation] Comment from an individual after presenting a solution in a meeting: "I am obviously curious about what you think, so let me know."	[Observation] The most active roles in the project seemed to have an easy time asking questions in the meeting, but few others did if they were not "forced" into dialogue.
Engagement	[Interview, team member 11] "We have a very good team of people asking good questions. And they're sort of self-monitoring." [Interview, team member 10] "Most people want the project to do well. I think everybody's very excited about it. Thus, it kind of encourages productivity."	

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Flexibility	[Interview, team member 10] "And I know that if I am done or have extra time, I can look and see what [team members] are working on or check in with them if they need help. It's nice to have that clear vision of what's expected of me and everybody else." [Interview, team member 12] "They might say, 'okay, can you guys help us with this?' And then we will say 'okay, sure' because we support each other to deliver this project. So it will slightly add a little bit of responsibility, which is, I think, a good thing." [Observation] Response from a team member when asked to contribute to a delivery: "Yeah, we can absolutely work with you on the structure of the wall."	
Experimenting /creativity	[Interview, team member 3] "[A team member] suggested, 'I think we need to separate this building seismically. I think the best spot would be right here'. And it was in a spot that wasn't great. Potentially, it was going to put a joint through the building. We went to [project manager's] office and discussed it with them. And they said, 'sure, actually, we can accommodate that. We can adjust the configuration of the building to be able to put that in a more advantageous spot." [Interview, team member 6] "So, when we hopped onto that call, everybody was adjusting, and we could fit everything together. We had to move things around and rearrange some stuff, but we were able to meet all the city's criteria. It was a happy story at the end of the day." [Observation] Comment from a meeting when discussing the mailbox design: "We can play around with these solutions and see what we come up with."	[Interview, team member 11] "If I work with one of my coworkers [internally], I can just throw trace paper in front of them and say, 'what do you think about this'. It doesn't have to be completely flushed out. And then with someone else [in the team], I might have to pull together a more detailed, linear version."

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Collaboration	[Interview, team member 11] "This team is unique from [a collaboration] standpoint because everyone is willing to pull other people in. We're not working in a silo-way. So it does feel more productive because of that buy-in from all parties." [Interview, team member 12] "It's good that the team can help me and that we can sort of feel that togetherness. Because they are more experienced than me." [Observation] From a meeting: "This has been great. It is so collaborative." [Observation] [The DM] asked if they could discuss a specific solution to see if they could find other options. It became an open discussion where the contractor, the owner, and several consultants were involved and shared knowledge.	[Observation] In a meeting, it seemed like [the PM] had to defend their solutions to [the owner representative] so they understood why they have designed as they have. Instead of collaboration, there is information sharing.
Improvement is a collaborative commitment	[Interview, team member 14] "Sometimes I think, why don't we just put a planter right there, which creates many issues for disciplines that I'm not aware of. It's important to coordinate with everyone to make sure you're not causing any issues down the road." [Interview, team member 3] "I think it's our responsibility to ask the architects what they expect. We've had some discussions because, initially, deadlines were set very early. We didn't get enough information early on and couldn't turn it around as quickly. So we managed the expectations, and they were fine with it." [Interview, team member 6] "At all times, we can provide feedback on how to make it better and more efficient." [Observation] Several gave input on when and why they would like design meetings to be as efficient as possible.	

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Knowledge sharing	[Interview, team member 4] “We’re sharing a lot of our internal spreadsheets that we’ve developed. And we’ve reviewed their preliminary framing layouts. I think it’s been very good for them. But it’s been good for us too, because they’ve been doing a pretty good job.” [Interview, team member 5] “We’re working with a number of great professionals who are experts in their craft. So we learn from them, and they gain from us. And it is truly a collaborative effort.” [Observation] The process of asking questions and specialties explaining their choices gave the meeting participants an understanding of the solutions as a whole.	[Interview, team member 9] “There’s a difficulty in presenting technical documents. They’re not used to reading construction drawings.”

In summary, the qualitative analysis revealed more variation in perceptions of psychological safety than the descriptive statistics. Nonetheless, there were clear indicators of a climate of psychological safety, with team members feeling comfortable proposing ideas, seeking feedback, and respectfully discussing issues.

10.3 Contextual effects on psychological safety

The second step in the analysis was to identify contextual mechanisms affecting the team's psychological safety to provide insight into the results from RQ1. Thus, in this section, I present findings to answer RQ1a: *What contextual (multilevel) effects can explain findings in RQ1?*

To answer the research question, I used the description in section 2.2, as guidance for data collection and analysis, which specifies what contextual elements influence psychological safety. I asked team members questions about work processes and how team characteristics and settings affected the discussions and collaboration. In my observations and the document study, I also recognized structures that explained some of my conversations with the team members. In the observed meetings, I listened for examples of, for example, informal dynamics, group identification, structure creation, task orientation, and time management.

When COVID-19 became a public health crisis in 2020, the team in Case 2 shifted to remote work. This change in the work setting impacted psychological safety due to the lack of social cues, the potential for isolation, and distractions. In my analysis, I found that contextual factors such as work setting, informal dynamics, leader behavior, information sharing, equal resources, accessibility, and accountability became important for upholding psychological safety when being dislocated.

The contextual effect I found is presented in the following.

10.3.1 Team diversity

At the start of the case study, I became aware of the many differences within the team. The DM provided me with a list of everyone involved in the project and who the most active and central members were. According to the record, the design team included a wide range of consultants, third-party consultants, architects, contractors, owner representatives, and internal leaders. How the actors were contracted was described in subsection 8.4.1.

Role diversity.

The interviews indicated that role diversity was not that much of a problem in itself for the team members. Despite the disciplines working differently and having adverse goals, they described their roles as well-defined and people as respectful of their tasks.

Still, I remarked that the different firms had their structure of how specific roles and responsibilities of each discipline were to be distributed:

> "Once we get the design solidified, then I'll work with other members in our office to get things produced. So we have about 12 people in our office, so I'll pull in a few other people for big production efforts." (Team member 11)

Having several people filling the same role could potentially challenge team members' engagement and seeking-help behaviors. The overlapping responsibilities that this created are better understood by looking at the firm diversity.

Firm diversity.

There was some tension between the different firms, and not everyone trusted all actors to do what was best for the group. A team member described how the lack of trust created a barrier to flexibility and creativity within the team but also commented that this was something that characterized the construction industry in general:

> "The design industry process, to me, is not collaborative. It is actually a friendly adversary process. The nature of the design phase is to put many ideas out there. But there are rules that we all know how to do. We already know how the wall assemblage has to be built and the types of windows we will use." (Team member 15)

Moreover, due to two requirements set by the owner, San Francisco City, the PM described that the team required more firms than were typical for these housing projects. For example, the project was required to include minority firms:

> "So there's a requirement that a woman-owned or a small local business be part of the design of some projects funded through the city. I think it's pretty unusual to San Francisco. But it's one of those things where they're trying to support local growth and smaller companies." (Team member 4)

Interestingly, the task overlaps that this requirement created was described by several team members as creating flexibility and not interfering with their coordination. Second, the finished building was planned to be all electrical, which necessitated the addition of even more positions and firms to the group:

> "This project is also all-electric, which means it is somewhat unique. So we have a sustainability consultant behind affiances, and there is a secondary sustainability consultant. Beyond affiances, they do all the energy analysis to show how to build the models in the different systems." (Design manager)

The owner contracted a third-party consultant to oversee the electrical systems and the engineers working with the different aspects of it. This team member had no decision-making authority, but still, he described himself as used to and comfortable with the role.

Experience.

There will be a variety of personalities on a team with a variety of roles and from a variety of firms. For example, a team member detailed how one person tended to problematize:

> "The good thing is that the team members are all pretty collaborative. I don't think anyone's been showing a huge ego except for maybe [a consultant]. At the end of the day, he does tend to concede or decide to change something to make it work. It's just only because everyone else on the team is rarely supportive. It's not like he needs to have that personality. Maybe he's used to other projects, where if he doesn't immediately set an expectation that something's not going to work, then people go the wrong way." (Team member 4)

However, based on my observations and conversations with team members, personalities do not appear to be a problem since the team members viewed themselves as professional and respectful of one another. Also, the members' personality differences were not as noticeable because the team interacted digitally.

Moreover, the results revealed that experience was more relevant to team members than personality. The team's leaders' knowledge was clearly appreciated; nonetheless, age disparities appeared to be a problem to the team dynamic. A team member described that he had noticed a generational change, where those who graduated in the past ten years were very different in practice than those who had been around for a longer period. The difference in experience created a knowledge gap that was challenging to diminish:

> "A challenge [in this project] that we have is that what we do is so complicated. And it has so many facets, so many different things that need to be known that I think it takes experience. You don't know what you don't know." (Team member 15)

Table 10.3 on the next page lists direct quotations and my observations from meetings that are indications of the role team diversity played in the team's level of psychological safety, both positively and negatively. Team members described a structure of responsibility despite role and firm diversity. Still, internal cultures and experiences challenged team collaboration, flexibility, and creativity.

Table 10.3: Quotations and observations reflecting team diversity, Case 2

Excerpts and observations that capture team diversity's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Role diversity	(+) "I will say that the rest of the team has a positive mind. I feel like architects and landscape architects can sometimes have a broader mind. When you get more into the engineering side of things, the excitement to get something unrealized into the project can be a little bit harder. But there has still been a pretty good collaboration." (Team member 11)	Engagement/ collaboration
	(+) "The overlap with BAR is, in a sense, more of meshing so that if they're overwhelmed, we can fill in instead of doing the same thing twice." (Team member 5)	Improvement, collaboration
	(+) "I don't think that the size of the team really impacts that adversely. We have a leader and team members with very well-defined roles and responsibilities. So, if you stay in your lane, you won't have any problems. I mean, we're also human, and we have our personalities and characters. We're professional, but we're also trying to be personable about those things and be respectful of our roles." (Team member 12)	Engagement
	(-) "Whatever discipline they have, they structure their work based on what they think is the most important to do at that time. And they may not be able to address certain issues that other design team members bring up. It usually turns into something where, if we think it's vital, we have to be insistent and usually bring in the architect." (Team member 9)	Collaboration, improvement
Firm diversity	(-) "We don't necessarily work as teams because when something goes wrong in construction, people are going to point fingers. Thus, it's hard to come to the table in those conversations and bring real trust because you might say something that might cause money to somebody else. The contractor does not like to bring ideas that potentially cost money because they're trying to save the owner money. It's very hard to think outside of the boundaries that we've already decided." (Team member 15)	Experimenting, flexibility
	(-) "I think [productivity] has to do with scheduling and individual needs. Here's an example, as a design firm, architects maybe have like 5-10 people working on one project, and civil engineers might have as few as one to maybe two to three. And then for us, we have maybe four. So you know, there are times people take a vacation. And they can be available remotely, but it's really about how timely they can respond." (Team member 9)	Collaboration
	(-) "There's a strange situation in San Francisco. San Francisco has a sort of law or policy when you're doing work that San Francisco partially funds. The Mayor's Office of Housing is partially involved with this project, so the team has to give away 20% of the work to small and local businesses. In theory, it's to increase their ability to get off the ground enough." (Team member 3)	

Excerpts and observations that capture team diversity's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Experience	(-) "Many people in the Bay Area, maybe English is not their necessarily preferred language, there are a lot of Asians that immigrated, or they're the second generation. So, it can be difficult to understand what's needed and how to communicate it clearly. So, all these are constant challenges. That's part of the job. When I write an email, I write it, review it, and rewrite it a little bit." (Team member 9)	Collaboration
	(+) "My leader and team members, they are more experienced compared to me. So the additional guidance of how they approach the design issue and how they address things is a big deal." (Team member 12)	Learning, seeking help
	(-) "It takes practice and experience to understand what to be looking for, the things that you need to face, that you need to address. It is challenging to pass that knowledge on to the younger generation." (Team member 15)	Learning, experimenting

10.3.2 Team dynamic

Similar to the diversity, the team dynamic supported and challenged psychological safety, especially team size and role clarity.

Team size.

The team was large in size but not uncommonly so, according to the project manager:

> "So each team member has specific expertise and a role to play. And although that sounds rather large, it's very common for projects that we work on, which are these larger multifamily residential projects, to have teams that are this size." (Project manager)

What was problematic due to the team size was the distribution of information. As described in section 2.2, information sharing may facilitate psychological safety if it conveys a perception that it is safe to engage in collective behavior. I observed that many were invited to and attended design meetings. Some saw the benefits of the transparency that followed when all got the same information, as it helped them feel included. For example, a team member expressed his need for the larger informative meetings, as they provided an opportunity for cooperation:

> "I feel like I need to put myself in a position where I'm communicating, but I also need to receive that same transparency, in order for me to be at my best as well." (Team member 10)

Others felt there was a lack of understanding of how their time was best spent. The size of the team seemed to make it difficult to decide who needed to present in the different meetings:

> "I would sometimes say, like last week, we didn't need to be at the meeting. I sat on the call for an hour and a half, and there was really nothing for us. I think it was 45 minutes of trash pickup talk. I really don't need to hear much about that." (Team member 3)

Role clarity.

Interestingly, despite the team size and the firm diversity, there were clear perceptions of roles.

> "I think, for me personally, I was able to feel productive because from the beginning, our roles and responsibilities were so clearly defined, and it was transparent. I knew everybody else's roles and responsibilities, so I was able to move forward with my work." (Team member 10)

Additionally, a team member noted that the community working on these types of projects in San Francisco was relatively small, and many had worked together previously. This prior collaboration and experience together, even if virtual, contributed to the effectiveness of teamwork when being dislocated. Through my interviews, I found that well-established role understandings and positive work relationships helped team members feel more comfortable taking interpersonal risks in a dislocated work setting. One team member's comment highlights the significance of these established relationships in promoting effective collaboration:

> "We work with many similar consultant teams, and we have relationships, so we're able to communicate efficiently, understand each other, and try to even be proactive in understanding the design." (Team member 9)

For Case 2, I believe that the reason for team size and roles not being an issue was related to accountability and accessibility. To seek help and feedback, they were more dependent on quick answers as there was no opportunity to meet physically. Also, accountability helped team members' perceptions of feeling psychologically safe as they got the answers they needed and the project progressed. For example, a team member described the stress of getting answers when not having the assurance of meeting people:

> "Sometimes it takes a bit longer. If they have a voicemail forwarding, it takes a while for them to hear, get the message, and call me back. Instead of before, it was instant." (Team member 14)

Table 10.4 lists direct quotations and my observations from meetings that are indications of the role the team dynamic played in the team's level of psychological safety, both positively and negatively. For example, team members expressed how the team size made it difficult to distribute information efficiently. Still, role clarity gave them confidence in performing their tasks and crossing discipline boundaries.

Table 10.4: Quotations and observations reflecting team dynamic, Case 2

Excerpts and observations that capture team dynamic's effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Team size	(+) "It's a project with a pretty tight budget. We've been trying to limit the number of people that would work on it until the project gets to a phase where it's pretty figured out." (Team member 4)	Engagement, collaboration
	(-) I observed that many were present at several design meetings without speaking or speaking up. At the end of a meeting, the owner representative commented: "There are too many people involved in these design meetings. We need to work out whom to invite and not."	Speaking up
	(-) "The more people you involve, the more questions get raised, and the more people spend hours on the project unnecessarily. So it's all about experience and knowing whom to pull in on a discussion, the important people, to get something done quickly and efficiently without bringing in 20 people who would maybe slow the process down." (Team member 9)	Collaboration
Role clarity	(+) "I immediately knew what my role and responsibilities were. So I quickly jumped in, and the only thing I needed was a little update on what had changed from when I was helping out months and months ago. [The DM] had written this clear list of what's expected for us to produce, drawings and design-wise, and our roles as far as who coordinates with the consultants and who is responsible for what drawing type." (Team member 10)	Engagement, flexibility, collaboration
	(-) "And that's the same thing with contractors. We expect them to do their job. I don't want to have to give them a set of drawings and then sit down and read each page and explain it to them. [...] And then each member of the team, all the way through the construction, has a set of responsibilities and obligations within their role. All members of the team do not always understand that well." (Team member 9)	Collaboration
	(-) "So, in some sense, I'm there because the owner doesn't have full confidence that their [consultants] can get the job done. I don't want to step on anyone's toes and overstep my role, so that can be challenging." (Team member 8)	Speaking up, collaboration

10.3.3 Leader behavior

In my analysis, I saw ample data that justified my claim that the DM's behaviors helped shape an environment with high psychological safety. The importance of leaders' behaviors was amplified when turning to the virtual work environment. Both the DM and the PM stated that they needed to be more inclusive, open, and humble in order to comprehend team members' experiences of the situation and foster a climate in which they could perform at their best.

Inclusive decision-making.

I observed that team members were invited to influence the project's progress in the design meetings. There were discussions about what meetings were needed and how to approach deadlines, and leaders asked questions such as "Does anyone have anything to report or to ask about?" Including team members in the structure creation involved both the PM and the DM being approachable, as seen in their responses to team members' suggestions. Inclusion further diminished the power distance, as expressed by a team member:

> "As far as culture is concerned, it's pretty collaborative. There's no pacifism, and it's not authoritative that whatever the highest power says, we have to follow and keep our eyes and ears close. That is how the culture is. I can speak about my forte. And from there comes the structure, which is very strong. We just follow the work processes, and at all times, we can provide feedback on how to make it better and make it more efficient." (Team member 6)

Furthermore, the leaders showed that opinions were valued and engaged team members when needed. Supporting the argument was this comment by a team member:

> "In the FSK project, a south retaining wall might be an issue, and we were quickly invited on a Zoom call yesterday to make us aware that that is something that we're going to have to address pretty soon. Examples like that are a good way to keep the process moving forward." (Team member 14)

Similarly, another team member expressed that by including and informing, the leaders fostered an understanding of shared goals:

> "Usually, the prime consultant organizes things pretty well. There are lots of meetings and discussions. Thus, everyone's on the same page, understands things, and makes commitments to deliver the required design decisions to the project." (Team member 9)

Team members stressed the importance of leaders being aware of including them and providing assistance in staying focused while working from home. As one team member put it:

> "It is just so overwhelming what's going on, and it's a disruption to our daily lives. I think it's just checking in more, having more regular meetings, where we can have an interface of 'Hey, how are you doing? Here are some of the issues that we see.' And just circling back and regrouping and maintaining that focus." (Team member 5)

During interviews, I noticed that team members applauded the DM and the PM in their effort to distribute information and thereby creating a sense of relatedness:

> "The main thing is communication. I think that [the DM] and [the PM] are already doing those things. [The DM] sends out a summary after every meeting. And there's a value in that, and making sure that it's saying, 'well, this is what we understood. Please let me know if there's anything else that I missed'. And then, the whole team can move forward with this summary of what we all discussed. It's cementing the communication there." (Team member 11)

Modeling openness and weakness.

A team member emphasized the leaders' capacity to exhibit openness and vulnerability in order to understand what the team was going through when changing to home offices. Similarly, a team member stated that project leaders had some duty to ensure that they understood the needs of team members:

> "Just understanding alone is helpful like, what if I've never touched Bluebeam in my entire life? Just understanding the adjustments that I have to make to learn, produce, and perform." (Team member 10)

Especially the DM was described as being coaching-oriented. As leader behaviors reflected openness and weakness, it helped team members to seek help themselves, which team members did, as expressed in an interview:

> "Everybody's really good at gut checking, making sure that they are doing what they need to be doing and asking questions regularly and checking in regularly using either Google Hangout or Slack." (Team member 11)

Structure creation.

Still, the soft-management approaches did not compromise the structure creation, and leaders had a strong task-oriented behavior. A team member commented that the structure helped him align with the project's goal:

> "[The leaders] do a really great job because it is very structured. Some bits are in the future that we know are coming up. Having that structure and knowing when things are coming up, and planning ahead is a huge deal for me. […] With the schedule, it's easier to envision where you're going to go with the project." (Team member 7)

Importantly, the DM and PM provided structure before and after meetings, which I found to be critical for the development of psychological safety. Prior to meetings, agendas were distributed, which included a list of topics and persons responsible. Making people accountable prior to meetings ensured participation. Also, giving team members a heads-up on what was going to be discussed allowed other team members to plan their engagement prior to the meeting, which could influence their speaking-up behavior. Furthermore, following meetings, minutes detailing what was agreed upon and what was planned for the next session were distributed. These two mechanisms centered on meetings existed before the crisis, but I noticed that they became more significant once the team was dislocated to ensure inclusion and engagement.

Time management.

Despite the focus on structure, in meetings, the DM and the PM were more focused on getting through the agenda than on time management. Discussion tended to go into detail, and the balance between letting everyone be heard and keeping up the structure was challenging.

Table 10.5 lists direct quotations and my observations from meetings that are indications of the role the leader's behaviors played in the team's level of psychological safety. Team members experienced the DM as approachable and inviting of input. Leaders of the project combined structure while also modeling openness and weakness, which gathered the team towards the same goal. Still, it challenged the team's perception of time management.

Table 10.5: Quotations and observations reflecting leader behavior, Case 2

Excerpts and observations that capture leader behaviors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Inclusive decision making	(+) "As we are going through the deadlines, I ask team members that are responsible for their sheets to do a soft check and fill out their progress towards the goals. Once we are kind of halfway, we revise, and we also have intermediate check-ins." (Design manager)	Speaking up, engagement, improvement, collaboration
	(+) "That's a sign of good leadership, that they open up for dialogue- does anybody have any questions or concerns? Thus, that opportunity is afforded to everyone. Engaging them that's key because there are many different stakeholders. To acknowledge that, to be able to invite any sort of comments, good, bad or indifferent." (Team member 5)	
	(+) In an observed meeting, they discussed who should be invited to some of the meeting days for the next week to best use everyone's time.	Improvement
Modeling for openness and weakness	(+) "[The management actor] is a small business. They're still messing around with things, the layouts of the units. But we have had a couple of meetings on the units, where we've been able to say – change the orientation of the bathroom to get the plumbing away from this spot and move it over to another." (Team member 3)	Improvement, engagement, speaking up
	(+) In a meeting, the PM often asked what the team felt about several solutions. He seemed to listen and be genuinely interested in everyone's opinions.	Speaking up
	(+) "For many of us, this is the first time we are working on an all-electric building, so there are some speedbumps in learning the building systems. [...] So there are things we can do, and our engineers telling us we can do." (Design manager)	Experimenting, collaboration
	(+) "[The work process toward a solution] was successful because of the communication. It was easy to talk to [the DM] and get his updates." (Team member 7)	Seek feedback

Excerpts and observations that capture leader behaviors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Structure creating	(+) "At the start, I created a responsibility matrix that took a series of tasks and assigned the team members to those tasks. And then from there, we extrapolated various deadlines and check-ins, so that informs how we produce the work." (Design manager)	
	(+) "In terms of the project, it's mainly the project management that keeps things moving forward and communicate. [The PM] and [the DM] are very good at that. They cc people in emails or phone calls to make sure that their bases are covered, and then everyone's aware of things. That's very helpful." (Team member 9)	Engagement
	(+) "I mean, as creatives, we all have our idiosyncrasies, but we also have processes that have been said from the very beginning. With those combined, we can have a dialogue. We can have a discussion, we can agree to disagree, we can collaborate, and we can do all of those things that involve good communication. [...]. And then, wherever things run astray, get us back in line so that we can stay focused and be productive. Lots of creativity." (Team member 5)	Collaboration, experimenting
	(+) Most meetings had clear agendas. An example from a meeting is when they went through items, and the disciplines attached to each item had to answer to their solutions. Since it was so structured, members were naturally engaged.	Knowledge sharing, speaking up
Time management	(-) It was observed in several meetings that the discussion tended to go into detail and, thereby, not relevant for many of the meeting participants. Exemplified by this comment by a team member: "Can we now move on from this discussion? We have been using some time."	Engagement, improvement
	(-) The PM commented in a meeting: "The architect will come on at 11 o'clock so maybe we should revisit this discussion and continue with this meeting." Besides this comment, there were few signs of time management.	

10.3.4 Organizational factors

The data revealed that organizational factors such as the PDM, location and facilities, and time management impacted the team's current level of psychological safety. I will elaborate further in the following.

Project delivery model.

Early on, I observed that the project had not named the delivery model, and there were several perceptions of what label should characterize it. For example, one team member could tell me that it was a design-bid-build contract. However, because the contractor had been involved in

the project long before the building phase began, the DM termed the PDM an integrated project delivery model (IPD):

> "One can describe this as an IPD as [the contractors] are on board now and monitoring. So this project started with them onboard." (Design manager)

He further described that, in contrast to a design-bid-build contract, the owner was cross-checking the financials and not them as an architect. Based on the document analysis, the delivery model was more similar to a construction manager/general contractor (CM/GC) structure, as described in subsection 8.4.1. The PM confirmed the findings of the project organization's hierarchy:

> "So currently, we are in design development, and our goals are broad coordination of all the different team members into the design and making sure that we have, by the end of design development, a coordinated set of documents that can be reviewed by the client and also budgeted by the contractor." (Project manager)

My impression from interviews and observations was that the owner representative was a project manager above the team who followed the work of the various consultants in detail. Thus, there was a clear power distance when making decisions. Similarly, the owner representative frequently asked the questions in the observed meetings, and the team responded. The interview with the DM made it clear that they were to report back to the owner if any choices or modifications were made:

> "Given that this is an affordable project, there are more strict limitations on where we can have budget overruns and spend money. We need to be really aware of doing overtime that will cost the client more money. It's all tied together." (Design manager)

Time management.

The PDM also had an impact on the project's time management. The boundaries of the delivery model appeared to have enabled the leaders to set defined goals, such as delivery dates. However, it did have an impact on their ability to explore and be flexible, as stated by the PM when describing the team's productivity level:

> "I'd say so far; it is pretty good. I feel we've been working together pretty well. I mean, there's some hiccups. On a 1 to 10 level, we're probably seven or so. We have a tight timeline for this project that impacts our productivity in that it's difficult sometimes to resolve things before it gets pushed out to consultants to try to resolve. But otherwise, I think it's going fairly well." (Project manager)

Locations and facilities.

As the design team was compelled to work remotely due to the COVID-19 pandemic, all communication and collaboration took place digitally, primarily through Zoom meetings. Despite the change in working conditions, team members reported that the quality of their collaboration remained unchanged. According to one team member:

> "I think most of us are focused on either a list of items or something that's on the screen in terms of the drawings. And in fact, as you can probably imagine, having 12 or more people sitting around a long table, it's hard to gather around a single drawing. Even when we were there in person, we had a large screen that filled the room, so we were all focused on that. An in-person meeting is pretty much the same as what we're doing right now." (Team member 5)

The team's prior experience with digital communication and access to a range of communication channels may have contributed to their successful adaptation to remote work:

> "I think we were so digital already. We didn't have that many in-person meetings from what I recall. For me, given my level of involvement, I haven't seen a change really or a difference." (Team member 10)

The availability of communication tools, such as Zoom with its hand-raise mechanism, chats, and cameras, was critical to the team's ability to communicate effectively. However, some team members expressed the need for more visual cues in meetings, as only a few turned on their cameras. Additionally, they noted the need for shorter and more dynamic conversations in order to maintain engagement.

Despite the benefits of digital communication, some team members missed face-to-face interaction, especially when exploring creative solutions. One team member said:

> "I think it was a big help being face to face and being able to talk freely and have a physical page in front of us to sketch on. I don't know why, but it seems it can be more effective in person." (Team member 4)

Nevertheless, equal access to information and interaction through digital means was perceived as a positive aspect of remote work, with one team member stating:

> "I think anything helps right now. Anything that can help us communicate, especially with people working from home." (Team member 14)

Table 10.6 lists direct quotations and my observations from meetings that are indications of the role the organizational factors played in the team's level of psychological safety. Team members experienced the benefits of the boundaries provided in the PDM. Still, they reported a power distance from the owner representative, which challenged their flexibility.

Table 10.6: Quotations and observations reflecting organizational factors, Case 2

Excerpts and observations that capture organizational factors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Project delivery model	(+) "We've come up with some challenging ideas, and we need the architects to help us with the clients. Sometimes the clients don't see the best solution. […] Then, we can work together to convince the client to do something they may not be comfortable with initially. In that way, politically, within a team, I think it's the communication, and it's us buying into an idea together. Sharing that idea and making it better all the time." (Team member 11)	Flexibility, creativity, improvement
	(-) In meetings, the owner representative was to be informed and had the last word in discussions. The PM and the DM focused on the team member's questions and wishes. This hierarchy seems to create a power distance.	
	(-) "I think with IPD, the goal is to share risks and share benefits. That's the problem, too, right? Does the architect share in that benefit if the contractor can bring the project within budget? If there's a construction defect, architects and engineers also have to share the risk, and we're not comfortable with that idea." (Team member 15)	Collaboration, improvement
Location and facilities	(+) "Luckily, [the main consultant], having the resources that they do, were able to set up the remote access for [a team member]. He could be working from home as if sitting right in front of that computer […]. Basically, we're all working independently, but collaboratively yet remotely, as if we're all together." (Team member 5)	Collaboration, flexibility
	(+) "Personally, I think the virtual meeting is better because we're all looking at the Revit model on the screen at the same time, and when we're sitting in the room, we tend to pull out a paper and try to grow it by hand. We don't rely on the Revit model when we're in the room. I'm starting to believe that looking at things virtually is better." (Team member 15)	Collaboration, engagement
	(-) "I do like to go to people's offices and sit down and actually discuss things face-to-face because many things can come up in the meetings. It's more difficult with questions over these conferences." (Team member 3)	Speaking up, seek feedback
	(-) "We probably could have done that virtually, walk them through the exact same discussion. I think it is faster to do it in person. You could gauge someone's reaction. You could see it in their face, responding positively or not, as opposed to when I'm on the phone, and I can't necessarily see someone." (Team member 4)	Engagement, speaking up
Time management	(+) "These larger project deadlines driven by the client's schedule to complete construction are often tied to money, but then there are also internal deadlines to kind of complete work. By setting those deadlines for meetings, I think that really drives us complete tasks." (Design manager)	Improvement, collaboration
	(+) "Obviously, the owner has an occupancy date that they're striving to open the building. And so we do our best to meet that and be proactive in trying to understand possible impacts to that." (Team member 9)	

10.3.5 The multilevel effect

According to my analysis given in the four subsections of section 10.3, the contextual effects on the team's level of psychological safety propagate as a top-down process, but the effects were also reinforced and counteracted at the leader, team, and organizational levels. Figure 10.1 depicts the links between the effects. The model also illustrates the contextual influences at work at the team level, which are represented by horizontal linkages. In the following, I explain the model.

The figure summarizes the previous chapters' discussions of team diversity, team dynamics, leader behavior, and organizational factors. Subsection 10.3.1, for example, divided team diversity into three categories: role diversity, firm diversity, and experience, as shown in Figure 10.1. Please review the subsections to understand each category in the figure better.

The PDM was not clearly defined, which does not appear to be a concern in and of itself for psychological safety. Nonetheless, the model's structure established a power hierarchy, which impacted the behaviors of the design team leaders, as seen by the negative arrow from "leader hierarchy" to "structure creation". For example, I observed that the power distance from the owner representative limited leaders' flexibility because the workflow relied heavily on the actors' replies and requests. The result of my analysis also showed that the PDM on the project level positively influenced the leaders' time management.

However, the DM and PM's inclusive decision-making process moderated the influence of the leadership hierarchy and reduced the consequences to psychological safety, as seen by the positive arrow pointing to "leader hierarchy". Including the many actors in the planning process and providing information appears to help the various disciplines align with the leader's goals and timelines. The larger design meetings and alignment with the goals are possible explanations for why team members experienced role clarity despite firm diversity and team size. As seen in Figure 10.1, inclusive decision-making positively affected the impact of role clarity and firm diversity on the development of psychological safety.

Furthermore, the structure established by the PM and the DM contributed to the team members' perceived role clarity. Although the PDM pushed the team to be efficient and, to some extent, limited their flexibility, it required the leaders to establish clear expectations regarding delivery dates and responsibility distribution. Figure 10.1 shows how the structure influenced the role and firm diversity's impact on the development of psychological safety.

Role clarity also helped team members understand how and why responsibility was distributed, mitigating the impact of role diversity as seen in the figure, including discipline-cultural disparities on the development of psychological safety. Mutual respect may have promoted the development of psychological safety and created an environment favorable to idea-sharing. The team members described how the team's respect helped them collaborate, which comes

from understanding each other's contributions. As a result, role clarity gave them confidence in carrying out their responsibilities and crossing discipline boundaries.

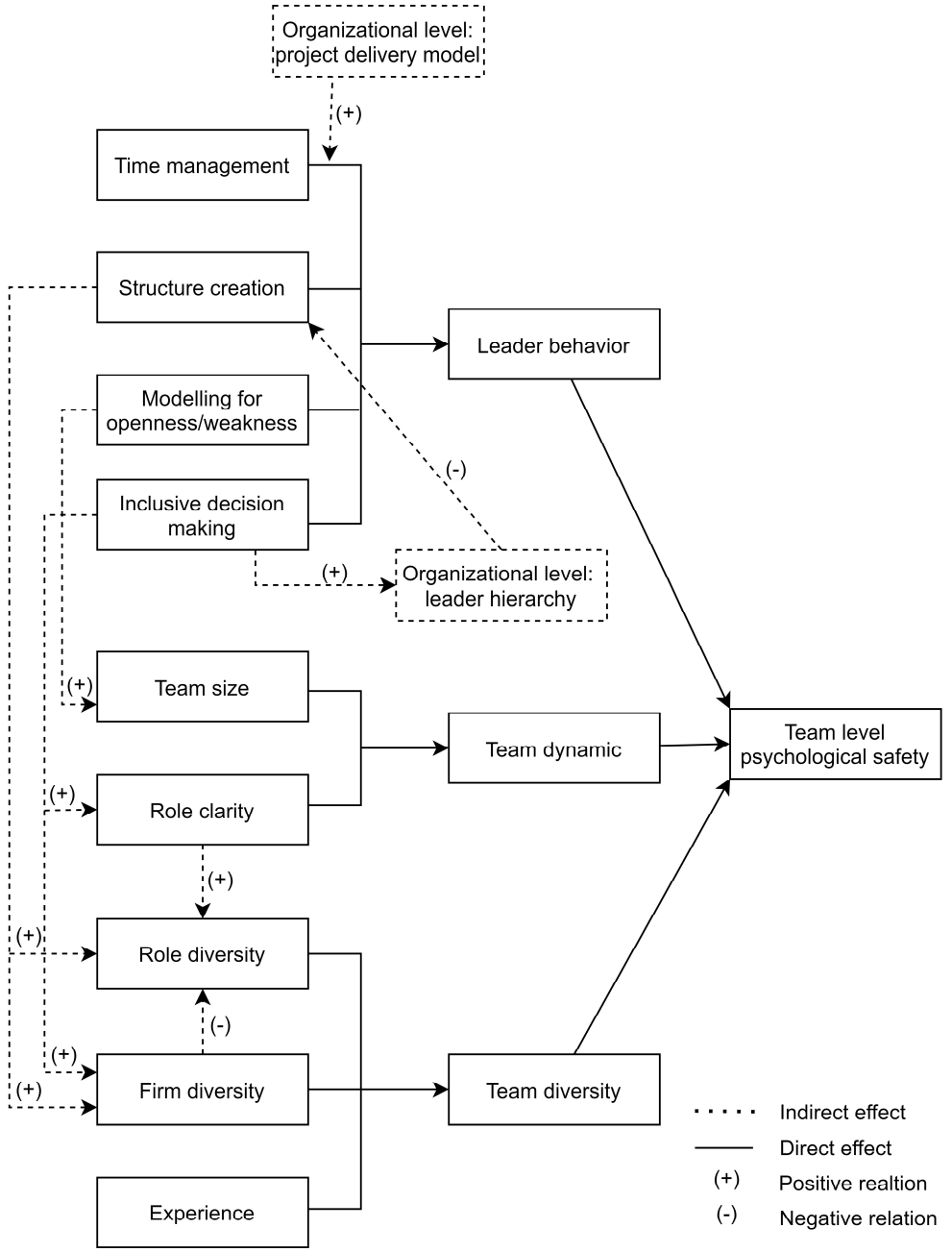

Figure 10.1: The multilevel contextual effects on psychological safety, Case 2

The design team leaders combined structure while modeling openness and weakness, which brought the team together toward a common purpose; as seen in the figure, this mitigated the possible effect of team size on psychological safety. Psychological safety necessitates structure, but for the structure to be valuable, there must be a supportive culture.

10.4 Evidence of digital mindsets

The third part of this case study addresses the team members' digital mindsets. Thus, in this section, I present findings to answer RQ2: *What is the experienced/observed level of digital mindset in the design team?*

I rely on descriptive statistics from the digital mindset face-to-face survey and attitudes and behaviors uncovered through observations and interviews to analyze and describe team members' digital mindsets.

Before delving into the specifics, I will describe the team's use of collaborative technology. The situation of digitalization is important for the further understanding of digital mindsets, as the mindsets are visible in (1) reactions to situations where they can choose to try with the possibility of failing, and (2) whether or not they are optimistic and engage in collaborative processes to learn and explore the technology. Then I present the team members' perceived digital mindset from the survey through descriptive statistics to map individuals' mindsets in the digital mindset matrix before giving evidence from the qualitative data.

10.4.1 Use of collaborative technology

In the use of the tools Revit and CAD and weekly Zoom calls, a team member described the project as relatively consistent and not unique. Nonetheless, I observed that technology did not play the same role in their professional life. Their employer's use of technology may have influenced their attitude toward digitalization within the design team. This is beyond the scope of this study, and the analysis is limited to the team's use of collaborative technology.

The fact that team members employed different tools had an impact on teamwork. The DM, in particular, voiced concern about not everyone working in Revit because they lost the ability to coordinate disciplines in 3D with clash detection. However, the DM explained that while working in 3D was preferred, it was not a project goal. The team leaders had also developed a BIM execution plan at the start of the project, in which they outlined how the various consultants worked with software solutions and adjusted the project's digitalization level as needed. To add to the point, I only observed 2D graphics used in meetings when discussing items or concerns.

Further, the project was a test run for San Francisco's new electronic plan review procedure. Previously, all plans were approved and evaluated in physical form, sending plans back and forth to the building department. The new electronic plan review process included employing Bluebeam to create an online server where the city staff marked up their remarks, and the team was invited to respond. The team further used Bluebeam internally as a collaborative platform where all project members could mark and respond to issues in project documents.

> "Bluebeam is a PDF feature with a collaboration ability called a session on Bluebeam Studio. That way, we can invite a series of collaborators to one document. So we technically have a whole set of markups. At various intervals, we have an internal quality check. So we send that set after the deadlines to those reviewers. They provide their comments in the session, and then we expand on those comments as we work through that set." (Design manager)

Furthermore, the team reported little had changed in their collaboration when the COVID-19 pandemic forced them to operate from home. Nonetheless, Bluebeam became a valuable resource for them and served as the shared database. As one team member put it:

> "What is nice is that with Bluebeam, everybody can look at the same document, the same issues, and can contribute to the comments and concerns. And then, without having to schedule a meeting, we can access a document, address the comment, and mark it as completed. So it's a red line set that everyone can look at. There's less risk of miscommunication, so that is a big game-changer." (Team member 10)

Furthermore, in being all-digital due to home offices, the team used various support functions in addition to Bluebeam to communicate and collaborate. The most extensively used was Zoom to facilitate meetings. However, not all team members were pleased with how the virtual meetings were held:

> "I don't think it comes down so much to the tools but to the strategy of how they're creating these meetings. Maybe they need to think about how the digital tool changes how you run the meeting. I mean, there's such a difference between a structured meeting with a specific task or a goal and one that's just freeform. Like, let's talk about a random problem that came up, which is kind of what they're doing." (Team member 4)

Table 10.7 lists supplemented direct quotations from transcribed interviews and observations that are indications of the teams' use of collaborative technology. The excerpts capture how the team members perceived working all-digital and using the support functions.

Table 10.7: Use of digital tools, Case 2

Excerpts and observations that capture the perceived use of tools		
Use	Positive perceptions	Negative perceptions
The use of BIM 3D to coordinate was limited, and in meetings, they mostly used 2D illustrations.	"We started with a BIM execution plan. And it lays out if the consultant is working in CAD, how we're going to exchange information, and then this is the expected level of detail across the different phases." (Design manager)	"Unfortunately, that's how it is with some of the consultants we work with. So, for instance, Revit has a great capacity for clash detection, which is coordination among disciplines in 3D. You can't really take advantage of that when our mechanical engineers aren't drawing their ducks in this space of the digital model." (Project manager)
Bluebeam was used to share information, distribute responsibilities, and have checklists.	"I am finding that [Bluebeam Studio] is a very productive way of reviewing drawings" (team member 15) "One of the amazing things is that we have been using a tool called Bluebeam Review. And it is sort of Acrobat from Adobe on steroids. Superior software." (Team member 5)	"People don't fully understand all of the different requirements and how these things need to be efficiently deployed and configured to allow people to use these things efficiently." (Team member 9)
Due to the pandemic, all meetings were held digitally, and Zoom was used to facilitate them.	"[In virtual meetings] I can just keep working on other stuff. And then if something comes up, I can pay more attention to the meeting again." (Team member 4) "For this project, in particular, all in the team have always laid importance on virtual meetings and conversations." (Team member 6)	"There are several platforms. And every team uses different ones. You know, there are inconsistencies in understanding how it works." (Team member 9) "People haven't been sharing their video. I haven't felt like they've used the online tools very well." (Team member 4)
In addition to Bluebeam, the team used other support functions to collaborate.	"If [getting answers through Bluebeam] still doesn't happen, we can just pick up the phone, set up a Zoom meeting, try to work things out digitally." (Team member 6)	

10.4.2 Descriptive statistics of digital mindsets

The means and standard deviations for the four concepts that make up the digital mindset construct are displayed below in Table 10.8. Table 10.8 shows the group-level results from the digital mindset survey. Each construct is the mean of four items, and the results are presented in Table 10.9. As evident in Table 10.9, the items within each construct show little variation, indicating that the team members have shared mindsets and beliefs. However, looking closer at the answers to the items in Table 10.9, it is evident that there are individual variances.

The measure of the items could vary theoretically from 1 to 5, with a theoretical midpoint of 3. The fixed mindset is a reversed measure of the growth mindset, and the relation between zero-sum and expandable-sum is similar. Thus, Table 10.8 suggests that respondents reported a high level of growth mindset and expandable-sum beliefs, as the means are well above the midpoint. The zero-sum mean is well below the midpoint, strengthening the assumption of expandable-sum beliefs. The fixed mindset mean is close to the midpoint, which indicates that there are individuals with both fixed and growth mindsets.

Table 10.8: Means and Standard Deviations for mindsets and beliefs (n=15), Case 2

Variable	Mean	Standard Deviation
Fixed Mindset	2,28	0,38
Growth Mindset	4,12	0,68
Zero-sum beliefs	1,70	0.65
Expandable-sum beliefs	4,07	0,72

Table 10.9: Results of digital mindset items (N=15, scale 1-5), Case 2

Answers to Likert scale questionnaire – mindsets team 1							
Item	SD	D	N	A	SA	Mean	St. D.
Fixed mindset							
A person's level of technological savviness is something basic about them, and there isn't much that can be done to change it.	1	12	2			2,07	0.46
Whether or not a person will be quick and skilled at using new technology is deeply ingrained in the kind of person they are. It cannot be changed very much.		13	2			2,13	0.35
Not much can be done to change how well a person will keep pace with technological change. Everyone is a certain kind of person, and some will fare better with technological changes than others.	2	7	6			2,27	0,70

Answers to Likert scale questionnaire – mindsets team 1							
Item	SD	D	N	A	SA	Mean	St. D.
Though people can sometimes learn new things, you can't really change people's basic talent for adapting to new technology.		8	4	3		2,67	0,82
Growth mindset							
Everyone has the potential to develop new technological skills and abilities.		1		10	4	4,13	0,74
Everyone, no matter who they are, can significantly improve their level of technological competence.				11	4	4,20	0,56
No matter what kind of person someone is, they can improve even their most fundamental technological skills with effort.		1		7	7	4,27	0,88
All people, regardless of age, gender, or education, have the ability to learn and master new technology.	1	1		7	6	3,87	1,41
Zero-sum beliefs							
New technologies introduced at work generally reduce the influence I have in the organization.	5	8	2			1,87	0,74
The introduction of new technologies at work generally results in less interesting work for myself.	7	7		1		1,73	0,88
New technologies introduced at work generally reduce the opportunities I have to succeed in my current job.	7	8				1,53	0,52
Resources used introducing new technologies at work generally means fewer resources available for my own support and development.	7	6	2			1,67	0,72
Expandable-sum beliefs							
I believe that new technologies introduced at work generally will increase the influence employees have in the organization.		1	3	9	2	3,80	0,77
I believe that the introduction of new technologies at work generally will create more interesting work for everyone.		1	2	7	5	4,07	0,88
I believe that new technologies introduced at work generally will enable employees to improve their performance and success in their current job.		1	1	7	6	4,07	1,03
I believe that the investment in new technologies will generally generate more resources in the organization which can be used to support employee development.			1	7	7	4,33	0,72

* SD = strongly disagree, D = disagree, N = neutral, A= agree, SD = strongly agree, St.D. = standard deviation

The presented results indicate a high level of growth mindsets and expandable-sum beliefs. As explained in subsection 3.2.3, most people have both a fixed and a growth mindset, similar with zero-sum and expandable-sum beliefs, and it is the sum of these four constructs that make up a person's digital mindset. Digital mindsets are individually held, and to show the variance of digital mindsets in the team, I have calculated each team member's mindset (growth vs. fixed) and beliefs (expandable-sum vs. zero-sum) and plotted them in the digital mindset matrix as a scatter chart (Figure 10.2).

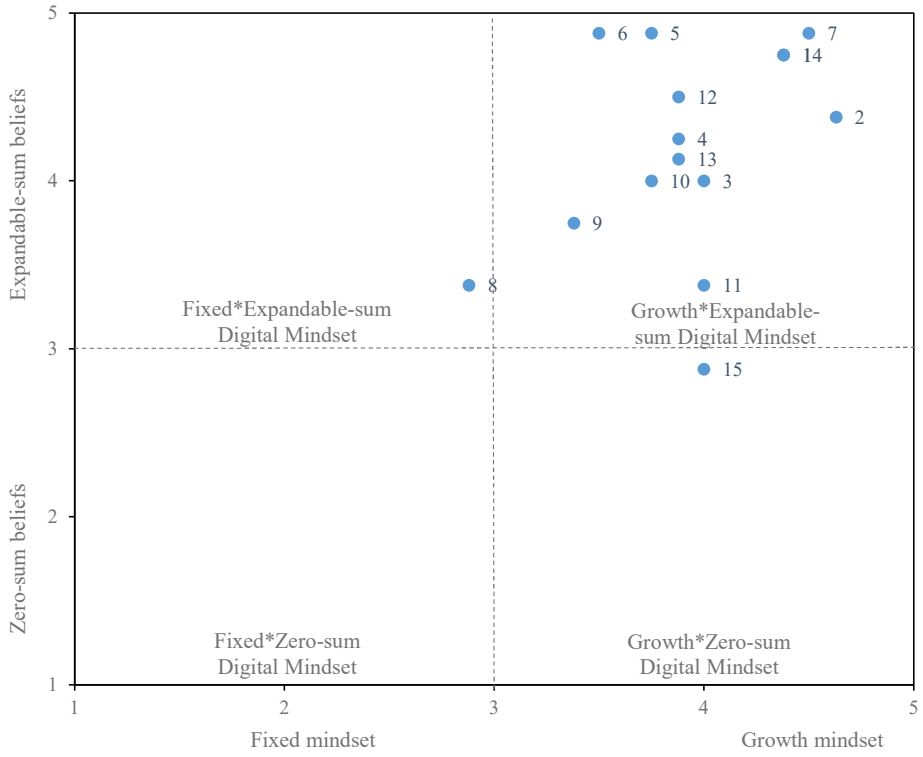

Figure 10.2: Respondents plotted in the digital mindset matrix, Case 2

As Figure 10.2 shows, there are variances within the team. However, 13 out of 15 respondents fit in the category growth*expandable-sum mindset. Only respondent nr. 8 can be described as having a fixed*expandable-sum mindset, and nr. 15 has a more dominant zero-sum than an expandable-sum belief and, therefore, is categorized as having a growth*zero-sum digital mindset.

10.4.3 Qualitative assessment of the team members' digital mindsets

The descriptive statistics shown in Figure 10.2 indicate that most of the team members have a growth*expandable-sum mindset. In my interviews and observations, I saw ample data to justify that growth mindsets and expandable-sum beliefs were present. I present these results in the following.

Mindset about the ability to learn.

The DM stated that they devised a plan based on how the team's various actors interacted with technology at the start of the project. Nonetheless, the project owner stipulated that all team members had to use Bluebeam. Several team members, particularly those new to the program, voiced their enthusiasm for it. The following comment indicates that knowing that the Bluebeam review process was a pilot eased testing it:

> "I think the city chose a few projects, and this is the first time doing [electronic reviewing process with Bluebeam]. Knowing that it's a learning process for everyone, there is a little more room for trial and error, and it's a little more relaxed than it sounds. So I think that makes it easier." (Team member 5)

Additionally, a team member described how the DM's enthusiasm and commitment to the digital work platform formed a learning-oriented frame:

> "[The DM] is very knowledgeable in a program called Bluebeam, which is what we're using to submit drawings to the city. He quickly taught me how to draw instead of going into our main model and messing things up. […] It was nice to learn the tool in a different way that can architecturally be more beneficial to me. So it was a learning experience. And I was able to get creative, come up with ideas, and then collaborate with the design team. It was fun." (Team member 10)

Team members' belief in their ability to develop new skills stood out in the data, typical for growth mindsets. For example, I asked the team members to share a story of an episode where the use of digital tools helped them to be productive in this team. A team member answered:

> "Before this project, I haven't had a chance to use Smartsheet and Bluebeam. These two programs have really helped me a lot, particularly when we are working from home. In Bluebeam, I can see the red remarks or comments right away. And then by learning that, I feel my skill sets is growing." (Team member 12)

Despite the fact that the majority of team members exhibited a growth mindset, some were more in line with the fixed mindset, believing that their ability to learn was limited. What was noteworthy was that some explained the difficulties of turning digital because of the nature of their creative profession.

Beliefs about resources.

A few team members mentioned that their use of technology did not add value to all elements of their work, which is comparable to the argument made about the limited benefit of learning it. Their descriptions of the hindrance with the digital tools indicated that they perceived technological resources as limited, as an informant expressed:

> "The challenge with looking at things in the Revit model rather than on paper is that the Revit model doesn't tell you how something's going to be built. [Some] struggle to take that information that they're navigating in the model to understand how that condition needs to be detailed for construction." (Team member 15)

Similarly, a team member stated that it was difficult to keep up with all of the information that was given out. He was not comfortable relying on being remembered when team members copied persons on emails, as there was a risk of missing critical information.

Still, the general assumption among the team members was that the use of Bluebeam, including the digital review process, was a resource in the form of access to information, easier collaboration and coordination, and time and, thus, a resource that benefited the entire team. A team member focused on the transparency the program provided, typical for expandable-sum beliefs:

> "Usually [information] is on one or another person's desk, and then you miss comments, and you're very limited to these red lines. But with Bluebeam, everybody has access to it." (Team member 10)

Adding to the point, a team member stated how knowledge sharing at the digital platform aided their collaboration:

> "[Bluebeam] is a very good way of having everything in one place. So you're not in a silo. If there's an issue from the fire department about the assembly and a pipe going through the wall, our plumbing engineer, mechanical engineer, structural engineer, and the architect can all see that and address it uniformly." (Team member 5)

Another team member described the process of learning technology as one in which they exchanged tips and tricks. As described in subsection 3.2.3, those with growth*expandable-sum digital mindsets typically see the learning effort as collaborative, engaging, and assisting digitalization. I found a number of examples of this mindset in the data, which are exemplified in this excerpt:

> "Luckily, we have [a team member] and other people within the office who are willing to take the time to train us and make sure we're comfortable enough." (Team member 9)

Also, when COVID forced them to go all-digital, they had to rely on virtual meetings. In my observations, I saw minimal use of cameras. Still, when it was used, a team member expressed the use of camera as a resource:

> "Before, the standard was conference call [without camera]. Now it's Zoom, and some people will have their cameras on, so you're slightly more interactive and slightly more personal. I think that's good." (Team member 4)

Support of digital change.

The majority of team members showed support for digital changes, but they did not engage in bottom-up innovation. The trend appeared to be to follow the level of digitalization set by the team leaders, which was more in line with the combination of growth*zero-sum digital.

On the other hand, team members' comments in the interviews tended to cast doubt on the digitalization strategies. They did not undermine the project's digitalization plan because they adhered to it in their work, but several expressed concern that the industry was not suitable for digital transformation. The design manager's comment exemplifies this:

> "I think as you are related to architecture, not just architecture but building in general, such a creating profession, it's really difficult to go from a very formalized process to like a flip of a switch look now everything is digital." (Design manager)

Also, a team member described project actors who were not technologically sophisticated. For example, drawings had to be printed regardless of how much effort they put into modeling during the design phase. According to a team member, this was an old industry that had a difficult time shifting culturally. Similarly, team members remarked that allowing them to be creative and draw while sitting physically together made their job go more smoothly. In addition to that, an informant stated:

> "Other industries, like the software industry, just look at the code on the screen, and it vanishes once you hit the run button. Civil engineering is something that you can feel physically with your hands. It's all about seeing things in person, physicality." (Team member 6)

The descriptive statistics predict that there were few with zero-sum beliefs in the setting of the project. Few team members worked for the same company, and thus, competing for resources when new communication tools were introduced may be irrelevant to them. Bluebeam and the increased use of Zoom were the digitalization that most team members were unfamiliar with. Situations seldom create opportunities for team members to gain an advantage over others since they work individually on tasks related to their discipline. One team member stated that he supported digital changes but was concerned about the number of possibilities and changes that they needed to address as consultants, where they did not have the option of adapting. What helped him in this specific project was the framing by the leaders:

> "And everybody has a different level of experience with it. So you can get lost, you can get overwhelmed. So luckily, [the PM's firm] has some set of standards, and the office has a lot of sessions and tutorials. So it is very helpful. But I still struggle with the abundance of resources. […] We can do it, but it does get overwhelming." (Team member 10)

Interaction with others.

Although some team members believed that the resources provided by technology were limited, I did not observe any signs of competitive behavior typical of those who hold zero-sum beliefs when interacting with others. The results could imply that the zero-sum beliefs were weaker or that the supportive culture made up for them.

I observed that most team members engaged collaboratively with others. However, because some team members exhibited a fixed*expandable-sum digital mindset, there were team members who joined forces with others to manage the digitalization, as exemplified by the design manager:

> "Like [a team member] likes to draw by hand. And so, especially in the early stages, he may develop a schematic design or layout over the weekend, and then I'll bring it into the computer. That's where the transition to digitalization occurs." (Design manager)

When it comes to interactions with others, the interviews revealed that a few team members held growth*expandable-sum digital mindsets. These individuals actively exchanged expertise on how to improve performance in Bluebeam, for example. As explained in subsection 3.2.2, expandable-sum beliefs are proven to affect collaboration since the individuals see a gain that benefits all involved, and when combined with a belief in their ability to learn, these team members tend to be change agents.

Table 10.10 on the next pages lists direct quotations from interviews that indicate the presence of different digital mindsets, and it provides a summary of the discussion above.

Table 10.10: Summarization of the presence of digital mindsets, Case 2

Beliefs/ behaviors	Excerpts that capture digital mindsets	Type of digital mindset
Mindset about their ability to develop new technological skills	"I have been learning how to use it. In fact, this Monday, now that we have a little bit of a pause, we signed up for a webinar to go through a crash course. Two hours of learning, and one hour of learning all of the tips and tricks of Bluebeam Review." (Team member 5)	There are signs of fixed mindsets due to the construction industry being creative. However, most excerpts show growth mindsets, describing situations where they had learned skills to better perform their tasks and cope with being all-digital.
Belief about resources	"You can get overwhelmed. Luckily, [the PM's firm] have some set of standards, and a lot of sessions and tutorials. But I still struggle with the abundance of resources." (Team member 10)	Most team members have expandable-sum beliefs, seeing technology as a resource. Those that had the combination with a fixed mindset seem to feel technology complicates information flow, whereas those with growth mindsets express how technology enhances collaboration. Still, some expressed that 3D modeling created a false understanding of the project's maturity level and that resources for learning technology are limited.
Use of technology	"Well, Zoom is so helpful. And we have the team chat, individual chats. And I think I'm pretty flexible. As long as I understand what works best for the team, I'm willing to adapt." (Team member 4)	Excerpts showed that the team has a dominant growth mindset. Some took the initiative to improve their virtual collaboration; however, most just made an effort to learn the technology.

Beliefs/ behaviors	Excerpts that capture digital mindsets	Type of digital mindset
Support of digital change	"I used to read the paper. And even in our office, we used to red-mark and very directly write how it is in your mindset. So for me, with that in mind, definitely a transformation using digital things. I have to train my mindset to digital because there's shelter in place. With Bluebeam, you can see graphically. So it's kind of a little bit similar to when you draw." (Team member 12)	Several team members implied that they were skeptical about the use of digital tools, as they lost the human side of the process needed for interdisciplinary creative work. Simultaneously, team members expressed that they actively embraced the project's digitalization strategy. Thus, their mindset in the project is similar to a growth*zero-sum; however, a fixed*zero-sum in the context of the construction industry.
Interaction with others	"The older guys feel like they can learn technology from younger people." (Team member 6) "[The DM] is very knowledgeable in a program called Bluebeam. […]. He quickly taught me how to draw sketches there without going into our main model and messing things up." (Team member 10)	Those team members with a fixed mindset found others to collaborate with, typical for a fixed*expandable-sum digital mindset. Those that were comfortable with their skills engaged in collaborative processes and shared knowledge, typical for a growth*expandable-sum mindset.

10.4.4 Summarization of statistics and qualitative assessment

The zero-sum beliefs items received the lowest score in the digital mindset survey (Table 10.8, p.196). I found in the qualitative data that team members were skeptical of the changes technology imposed on their profession. As a result, they were cautious of the praise placed on technology resources. Nonetheless, zero-sum beliefs did not present to the extent that they caused competition for technological resources or avoidance of the project's digitalization strategy.

Consequently, despite one team member possessing this mindset (as shown in Figure 10.2, p.198), complete growth*zero-sum digital mindsets were not evident in the qualitative inquiry. According to Table 10.10, I found tendencies for this mindset in the analysis of digital change support. In addition, I found no evident patterns of fixed*zero-sum mindsets in the qualitative data. Those with a fixed mindset supported digitalization and either reduced their interaction with technology or found people with whom to collaborate. As a result, they described having a fixed*expandable-sum digital mindset, and others described it as defining their teammates.

The expandable-sum beliefs were evident in their beliefs about resources and interactions with others. A considerable part of the team stated how the connection enabled by technology aided the team's collaboration. I believe that the majority of team members were collaborative, sharing their knowledge, and problem-solving was a social experience to some extent. These are the behaviors that are most equivalent to a growth*expandable-sum digital mindset. Belief in their ability to learn was prevalent in the qualitative data, which corresponded with the survey results, as the growth mindset received the highest scores of the four concepts.

The triangulation of understandings from interviews, observations, documents, and the survey reveals that the team has an engaged and supportive attitude toward the digitalization strategy on a group level. Team members with growth*expandable mindsets attempted to broaden their roles to expand their relationship boundaries and responsibilities in dealing with technology. On the other hand, some team members attempted to lessen technology's demands on their tasks, including the negative consequences. On the positive side, they collaborated with others, as they saw the potential of technology for themselves and the company.

10.5 Psychological safety antecedent to digital mindsets

This section explores the connection between the observed characteristics of psychological safety and the identified digital mindsets. The discussion entails considering psychological safety as an antecedent for digital mindsets. Thus, in this section, I discuss RQ3: *Does the team's level of (negative or positive) psychological safety affect the observed digital mindsets?*

I found that in Case 2, there is a high level of psychological safety, and most individuals fit within the digital mindset group growth*expandable-sum. Figure 10.3 is a 3D scatter chart showing each team member's digital mindset and level of psychological safety. The diagram is the combined result of the descriptive statistics of the psychological safety and digital mindset surveys. Both measures could vary from 1 to 5, but since all respondents scored above the midpoint of 3 on all measures, except respondents 14 and 15, I have zoomed in on the diagram to better show the variance.

The main contribution of the diagram is that the team scores high on all three measures and that there is no pattern showing that those with a significantly high digital growth*expandable-sum mindset have a greater perception of psychological safety. The further question is whether the qualitative data indicates that the present climate of psychological safety supports the team members' high (positive) digital mindsets.

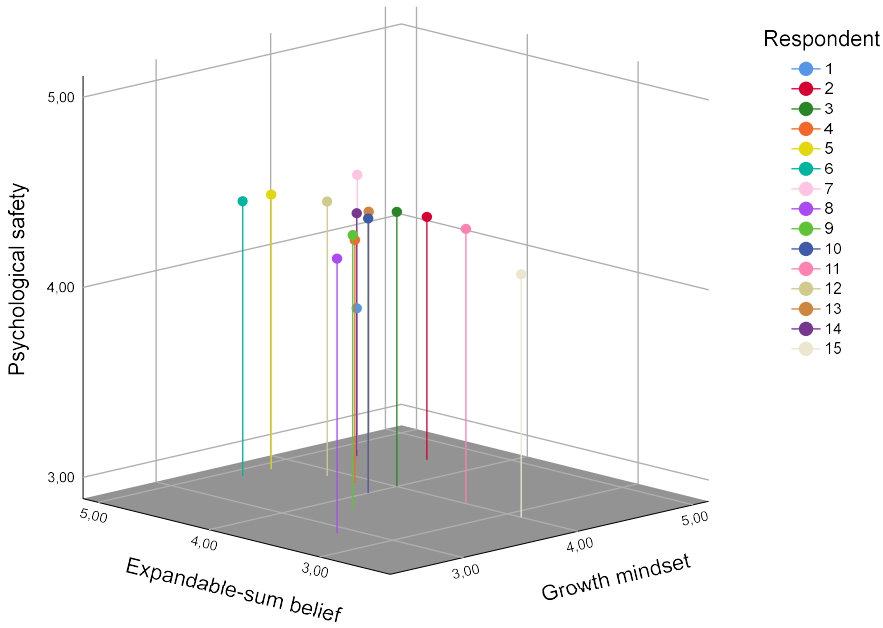

Figure 10.3: Visualization of psychological safety levels and digital mindsets, Case 2

10.5.1 The effect of psychological safety

An important part of the findings on psychological safety was that team members of Case 2 reported feeling that it was safe to ask other members for help. I observed that this coaching climate facilitated digital mindsets, which benefited teamwork. For example, several team members described how they had gone through a learning process to collaborate within Bluebeam. Learning requires interpersonal risks as it puts one's prior knowledge to the test (Edmondson, 1999a). Before the pandemic, they had to experiment, and successfully learned to work with the digital platform, reducing their resistance to the forced digital changes. Also, the continuing support of others when having home offices might encourage persons with a dominant fixed mindset to recognize that they can grow and expand their skills further (Solberg et al., 2020). Thus, psychological safety allowed growth mindsets to flourish.

Simultaneously, there was a limit to how much help-seeking could help individuals working in discipline-specific programs with a less growth*expandable-sum digital mindset. What was crucial in this regard was that team members reported not feeling rejected because they were different and that they respected each other's contributions. It was critical for the team to interact in a virtual work environment by respecting that others worked differently than themselves and trusting them to deliver. This understanding climate may have facilitated the development of expandable-sum beliefs about technological resources being helpful to the

entire team (Sirola & Pitesa, 2017). Resources that they talked about were time, transparency, and quicker collaboration.

On the other hand, with everything being virtual, some people may fall outside of the collaborative network. When relying on technology, a team member stated that there were increased concerns about getting access to information or answers and that some people did not fully comprehend the need to use the tools effectively. Insecurities and a lack of psychological safety can arise from the perception that not everyone has equal access to resources, in this case, information (Edmondson, 2004). Nonetheless, there were few zero-sum beliefs among the team members. Moreover, their support for digitalization showed that they believed resources could be expanded through collaboration. The fact that zero-sum beliefs did not strengthen when the pandemic forced them to stay home may indicate that they felt psychologically safe enough to engage and believed that the team was pulling together.

In the theoretical chapter, I also proposed that psychological safety suggests certain learning and innovative behaviors. Table 10.11 lists summaries and connections between findings from the former sections that are indications of the role behaviors associated with psychological safety played in the team's digital mindsets, both positively and negatively.

Table 10.11: Behaviors facilitating digital mindsets, Case 2

Behavior	Psychological safety	Digital mindset
Speaking up	Team members did speak up in meetings, but their behavior appeared to be guided by the meeting agenda. Leaders or the project owner's representative were usually the ones who spoke up about issues that weren't their responsibility.	They don't openly discuss how to use digital tools, and at meetings, the focus is primarily on 2D drawings.
Seeking feedback/help	Due to the meeting format, team members sought feedback on their presented ideas. Outside of meetings, interviews revealed a lot of interaction among disciplines. For the project to progress further, it was necessary to seek feedback.	The DM, in particular, was approached by team members seeking assistance with Bluebeam, and he generously shared his expertise. Similarly, team members recounted how they helped others manage collaboration in Zoom, for example, by using screen sharing.

Behavior	Psychological safety	Digital mindset
Engagement/ collaboration	Team members' engagement was visible in their effort to reach out to others to find solutions to progress the project.	Because their interdependence was significant, they had to explore the digital tools' possibilities when dislocated. They were able to grasp the potential and realize that virtual collaboration was feasible.
Flexibility	Team members were flexible regarding developing solutions and changing their minds. Some people also indicated that they tried to help when asked or observed a need.	Because the team members were adaptable, they helped each other with techniques for using the digital collaboration platform. They also expanded their collaborative behavior when being dislocated. The ability to change their behavior lowered the bar for asking questions, even for younger team members.
Experimenting/ creativity	Experimenting seemed to differ depending on whether they worked internally or with the team. According to the interviews, creativity was more prevalent in the closed processes of the different disciplines.	Team members' disparate technology usage may have hampered their ability to experiment across disciplines. They did, however, transition to a completely digital work environment requiring testing new ways of working.
Improvement is a collaborative commitment	On their own initiatives, team members coordinated with one another. Although the team had to continue working in a shelter, they adjusted and kept the project on track.	The DM was solely accountable for improving the digitalization strategy and assisting the team with Bluebeam. Several team members expressed their desire for the project to be more digitally savvy, but they did not have the financial or time resources to make this a priority.
Knowledge sharing	Team members indicated that they respected each other, which eased knowledge sharing.	Knowledge was shared among team members in the digital work environment, which benefited those willing to learn and saw the potential the transparency gave.

I did not notice team members speaking up concerning the use of digital tools in meetings, as shown in Table 10.11. An explanation is that each actor had their own tradition of what kind of program they worked on, and there may not have been times when the group as a whole

needed to speak up about digitalization issues. Nonetheless, I learned through the interviews that they shared tricks and insights about Bluebeam's features when talking outside meetings.

Even if the agenda impacted how much members spoke up in meetings, I saw that the structure gave the team members a feeling of safety. They were aware of what would be discussed and so could prepare themselves, including how they would use technology. Avoiding circumstances where people believe their skills are being put to the test can help people develop growth mindsets or assist those with a fixed mindset because there is no need to prove themselves (Dweck, 2007).

When the team transitioned to a virtual team, the implications of going fully digital influenced their work, and being willing to learn became vital, comparable to Dweck's (2012) findings about change. Because they were worried about putting their knowledge to the test, both older and younger team members were more hesitant to take interpersonal risks, influencing their seeking-feedback behavior. The interviews revealed that the threshold for seeking feedback was lower when having face-to-face discussions, mostly due to social cues. Nonetheless, the team members stated that there was an understanding that technological adjustments were more difficult for some as they had distinct prerequisites. This accepting climate may have eased the strain on those struggling, avoiding the development of zero-sum beliefs that there were few resources for which they had to compete (Solberg et al., 2020).

A team member described the project as extraordinary because of the team's collaborative efforts toward the same goal. They had no choice but to interact with the help of technology due to the interdisciplinary nature of their responsibilities, and the project's progress depended on the team's digital maturity (Kane, 2017). I discovered that most team members were optimistic about the digitalization process and had altered their habits to help them perform better in their roles (Kahn, 1990). This meant that they believed in their ability to learn and, more importantly, experienced that they could (Solberg et al., 2020). Also, individuals with expandable-sum beliefs typically see success as increasing and benefiting everyone involved (Solberg et al., 2020). As a result, having already developed a supportive climate may have aided these growth*expandable-sum digital mindsets tendencies.

When it came to adjusting to digital changes, team members' flexibility was a vital aspect of the supportive team climate. For example, there was an understanding that individuals could decide how and in what programs they wanted to work. This framing fits well with the growth*zero-sum digital mindset characterized by participation in digital change while focusing on oneself (Solberg et al., 2020). Because 3D modeling in the same program was not a management priority, leaders let employees determine how much they wanted to expand their learning and role. In meetings, I saw that they actively adjusted their behavior by experimenting with new ways to use the interaction technology, suggesting that the impact of experimenting on the emergence of digital mindsets was tightly connected to flexibility.

The project developed through improving solutions, and each discipline was accountable for collaboratively identifying issues or concerns to find the best result. Their primary drawing tools, such as Revit and AutoCAD, were managed by each team member either independently or in-house. Dragoni (2005) explained how a leader's achievement priorities and coaching might actively impact the occurrence of a desirable mindset. As previously stated, having everyone work or model in the same software was not a managerial priority. As a result, team members were not encouraged to improve or expand the team's digitalization strategy. The DM was primarily responsible for their BIM model and his coordination duties.

Members' knowledge sharing revealed indicators of growth*expandable-sum digital mindsets, similar to their collaborative effort. Prior to the crisis, it appeared that learning Bluebeam had been a positive learning experience for the team. In addition, the DM served as a knowledge resource for the team. Sharing knowledge served as a type of contextual support, allowing people to see a circumstance as an opportunity to learn and so strengthen their growth mindset (Solberg et al., 2020). Individuals with growth*expandable-sum mindsets in the team tended to make knowledge exchange easier because they were comfortable working remotely.

10.5.2 The reciprocal relationship

Many of the contextual factors that affect psychological safety that I observed, in this case, could potentially influence digital mindsets directly, meaning that some of the antecedents are similar. I will discuss this in the following.

As with psychological safety, digital mindsets were affected by the virtual work setting, as it influenced team members' use of technology and their interaction with others. I observed the situation to enforce a need for learning-oriented mindsets.

Also, the objectives of the PDM had a positive and negative impact on both psychological safety and the diversity of digital mindsets. The project did not push team members to modify their digital work habits. However, the team needed to connect and interact virtually. When team members were having difficulty interacting in the virtual environment, team leaders did not have much flexibility in allocating team members. Thus, when the pandemic forced them to take shelter in place, team members had to rely on their own confidence in their capacity to learn and advance their skills while employing technology to do their tasks.

Nevertheless, leaders' behaviors accommodated the organizational level constraints. For the two phenomena, leaders need to assess what is needed for the team to function (Deng et al., 2019; Solberg et al., 2020). For the team, for example, the digitalization strategy did not entail that team members were to make big improvements on their own initiatives, but it required them to be supportive and actively engage with the chosen technology.

What I found was that leaders framed the situation as a learning process. The DM, for example, provided information about how to master Bluebeam and had a flexible approach so that team members may address their problems in a way that felt comfortable to them. As a result, leaders of the design team needed to provide a framework and be approachable in order to help the various digital mindsets. Being humble, flexible, and providing a frame is very similar to creating a climate of psychological safety.

Furthermore, as Solberg et al. (2020) described, the DM affected team members' sense-making through his role modeling. The DM described that he was eager to learn, and several team members described that he was approachable whenever they felt stuck using the technology. Dragoni (2005) suggests that leaders with a learning-oriented mindset emphasize learning when interacting with subordinates, which again influences their preferences for learning and expanding their skills. Having an individual in a power position with a growth*expandable-sum digital mindset may have also reinforced team members' perception of psychological safety. Edmondson (2004) described that approachable leaders could reduce the barriers to engaging in discussions. The leaders framed the situation as one that was possible despite it being a state of emergency. They actively showed a positive attitude toward digitalization, which is essential for developing both a growth*expandable-sum mindset and a climate of psychological safety.

I learned from the interviews that the younger team members were most comfortable with technology. However, they were also the ones who were struggling to speak up and seek feedback. Their lack of experience made them more isolated from the team and thereby challenged their psychological safety. The consequence was that the benefits from the younger team members' knowledge and growth mindset were not present, as they were not as comfortable with their roles or lacked psychological safety.

More importantly, there was a reciprocal relationship between psychological safety and digital mindsets, shown in Figure 10.4 on the next page. My most significant contribution, illustrated in Figure 10.4, is that positive digital mindsets facilitate psychological safety. The analysis of the team's digital mindset and behavior showed that most team members were supportive of technology and willing to adjust their behavior to collaborate in the virtual environment. They also saw technology as an opportunity, meaning that they were willing to alter their behavior to use digital tools. These attitudes of the growth*expandable-sum team members have similarities to Edmondson's (1999a) description of behaviors associated with feeling psychologically safe where improvement is a collaborative commitment.

I noted earlier how the supportive learning culture supported team members in strengthening their growth mindset, yet, certain team members possessed a growth type of mindset regardless of the team context. These team members had an intrinsic belief in their ability to learn, and when that belief was paired with expandable-sum beliefs, they were able to share their

knowledge with the rest of the team. In the analysis of the contextual effect on the occurrence of psychological safety (subsection 10.3.1), I found that personalities were less visible since all meetings were held online. Knowledge sharing, on the other hand, has been shown to promote psychological safety (Carmeli et al., 2009; Carmeli & Gittell, 2009; Chen et al., 2011), and having team members with a growth*expandable-sum digital mindset aided team members in extending their collaboration and engagement to the virtual work environment.

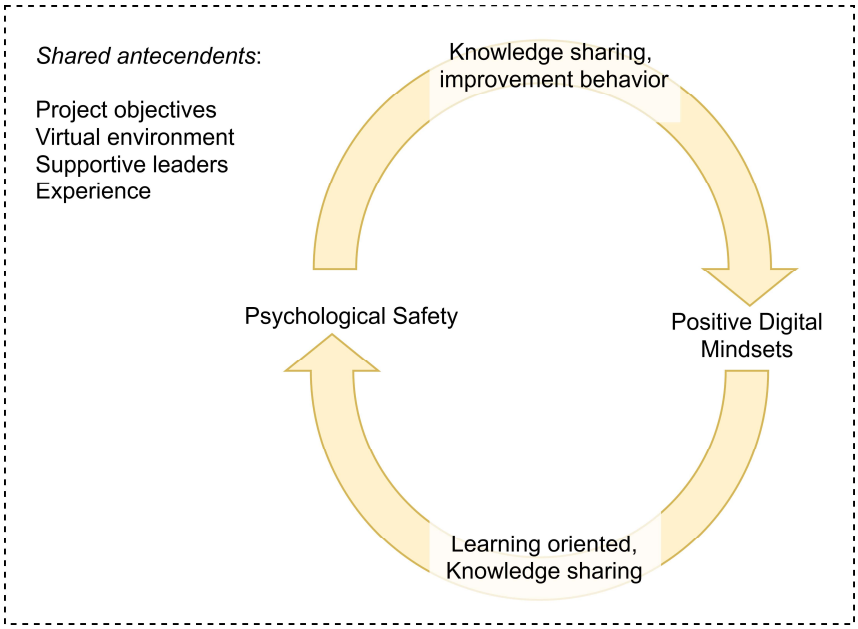

Figure 10.4: Reciprocal effect between psychological safety and digital mindsets

Despite the fact that the team had experienced the benefits of technology, they argued that other aspects, such as meeting organization, needed to be adjusted. According to Edmondson (1999a), engaging to improve a process is also a form of interpersonal risk-taking, which is an attribute of psychological safety. In addition, their desire for anything to change indicated that they were confident in their ability to adapt and change their digital behavior and saw the possibility of doing so (Solberg et al., 2020). As a result, having a positive digital mindset was found to increase psychological safety and vice versa.

Chapter 11
Case 3 Results

A study of a project-based organization's response to a virtual work setting.

11.1 Introduction

This chapter presents the results of Case 3 in response to the research questions RQ1 and RQ1a. The findings aim to shed light on whether and to what extent the organization under study fostered psychological safety while working in a virtual environment. The case study is based on interviews with principals, resulting in a smaller sample size compared to Cases 1 and 2. Consequently, this case offers a narrower scope of coverage compared to the other two cases.

This introduction presents a brief summary of the steps that led to the office turning into a virtual work environment. This description can also be found in the article in Appendix B. The process is interesting for studying the development of psychological safety because being virtual emphasizes the need for such an organizational climate. Then, the findings are presented by each research question, one for each section.

The effect COVID-19 had and could have on the office came gradually. The information flow started on 3 March 2020 (Tvedt et al., 2023). An email was sent out by the Managing Principal (MP) with the message: "Our goal is to maintain a healthy and safe workplace." Notably, the email directed employees to approach their leaders for guidance and support. This information was followed on 9 March by a memo from KPFF's president expressing the shared commitment to employees' health and safety, their families, and their clients and communities. The email included a Coronavirus Precaution Protocol FAQ, advising to postpone travels and consider virtual meeting options.

In the following days, the practice in the SFO went on close to normal. The researcher attended face-to-face meetings, and it was observed that everyone focused on their projects and tasks. This changed on 11 March. With the note "effective immediately," all were asked to refrain from physical meetings. The PM signed the email with "We will notify you when we can relax these rules."

Only a day later, on 12 March, the management group encouraged all employees to work from home. The office was still officially open, with instructions to continue Best Practices related to safe hygiene and social distancing. KPFF started with the logistics of setting up home offices, managed by the Office Information Technology Manager (ITM) – for example, remote network access and an alternative solution for those without KPFF laptops. The MP expressed that he still expected a full 40-hour week for the work processes.

On 15 March, the KPFF president broadcasted a message to remind employees that the organization's core values were to remain effective during this unprecedented time. The message was that the management trusted all to do their best and keep their commitment to providing excellence to clients and that it all was achievable due to the relationships, stability, and passion existing in the KPFF environment. Attached to this email was a memo for the employees, Best Practices Working Remotely, created by the MP. The memo contained practices related to communication and IT functions. Employees were asked to check in daily on an electronic sign-in sheet and have regular contact with their immediate supervisor. At this point, there were no rules about what communication platform to use.

However, it was not until 16 March that the office closed down to all due to the shelter-in-place order issued for the six Bay Area counties. At this point, all employees were technically equipped to work remotely based on the MP's analysis that morning.

Information about the monitoring and the effect of the situation came step by step, but the process of turning the SFO office remote was sudden. From 11 to 16 March, the office changed from a busy, bussing, and physical environment to a virtual organization.

11.2 Evidence of psychological safety

The first step in the analysis process was to provide evidence for the employees' perceptions of psychological safety. Thus, in this section, I present findings to answer RQ1: *What is the experienced/observed level of psychological safety in the PBO?*

Findings in this section are limited to leaders' descriptions of the office environment, my observation of office-wide meetings, and analysis of activity on Teams and through emails. In the interviews, I asked leaders to share stories of situations of collaboration and transparency while having home offices. I also asked how employees coped with the virtual work condition. These general questions allowed me to listen for examples of characteristics of psychological safety.

With the virtual work environment, practices and techniques for communication with clients and team members needed to change. The transition required testing, and with experimenting

came the possibility of failing. The principals encouraged staff to experiment to adapt and were supportive of a learning culture:

> "If you come to me with a problem, you better have a solution. I'm not going to give you answers. But if you fall down and make a mistake, I'll be there to support you and then take the heat for it if I need to." (Principal 3)

The crisis brought external and internal challenges to the PBO's climate, which both management and employees needed to discuss to move forward. In a crisis, information can be unpleasant and difficult to give, and the principals were concerned about how bad news would impact employees' engagement:

> "You got to be careful with how you deliver the message to those with limited experience. The leadership group, which is the principals and associates, all should feel a high level of urgency right now and worry and concern so that this isn't thought of as a vacation. This is our future, and we need to put things in place to protect us." (Principal 3)

Nonetheless, I observed management and employees discussing problems and issues in meetings, and principals described the SFO as transparent with an "open-book" culture. This was clear when the management was compelled to make difficult decisions:

> "A month and a half ago, we had to let our four engineers go because our workload was just decreasing. And that was difficult. I mean, we were very transparent about the situation. And now we're looking at a weaker backlog of work. We're being transparent with the staff and letting them know that if things don't improve anytime soon, we may have to have another round of layoffs. Not to scare people, but to create a heightened awareness of what we're trying to do and get everybody to think more about business development at the same time." (Principal 5)

Despite the potential threat to their work, employees reported that projects were encountering difficulty or were being put on hold in meetings. Simultaneously, the MP struggled to get people to speak up in virtual meetings. The ITM voiced concern that employees might be too afraid of losing their employment to be open about their challenges. Employees' fear of losing their jobs is not regarded as a lack of psychological safety. However, it was an internal threat that the leadership needed to confront to prevent compromising knowledge exchange and collaboration.

Despite the difficulty of staying on top of the situation, management included employees in decision-making. Observing the sequence of the Monday planning meetings, I noticed that management had faith in the various levels of leaders and their employees to do their jobs and that if they couldn't, they would speak up. As one principal expressed it, they had respect for one another's contributions and faith in people's accountability:

> "Yes, there is a very large level of trust that people are working, that people feel like they're working efficiently. As engineers, we deal with that whether we're in the office

> or not in the office. Even when we're within the Office, it's not like all the managers are constantly looking over all the engineers' shoulders." (Principal 4)

Employees did not hesitate to take interpersonal risks after a few weeks of becoming used to working from home. They began networking on their own initiatives, for example, by creating channels on Teams where they could seek assistance with projects and technical challenges. Connecting to the office server necessitated feedback and testing loops. The PBO's ability to function normally was predicated on an environment in which people spoke up and challenged processes. Employees also exhibited a personal interest in one another, developing running and pet channels. In the weekly newsletter, they shared how to improve the situation: "Are you proud of the [working from home] set up you've established during shelter in place? Then share it with the team!"

I also listened in on office meetings, where I observed employees' behavior. In the observed meetings, I listened for examples of seeking and giving feedback and help, speaking up, language, respect, and informal dynamics. Examples of characteristics that suggest the presence/absence of psychological safety are listed in Table 11.1 on the next pages. In the process of creating the table, I used the theoretical framework (p.26) and inductively created and deleted nodes when going through the qualitative data.

Table 11.1: Indications of characteristics of psychological safety, Case 3

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Speaking up	[Interview, Principal 5] "But you know, people are very comfortable speaking in a group setting like our daily meetings and whatnot." [Interview, Principal 6] "I wonder if some people are more willing to speak up because they're in the comfort of their home?" [Interview, MP] "[In the meeting], people started talking amongst themselves, and I wasn't even doing any talking." [Observation] Employee: "I am more concerned with [a project], but I don't really know what to do about it." These "shoutouts" of concerns helped the group to make the most robust plan possible.	[Interview, ITM] "I honestly think it could be better. I think that a lot of people are not speaking up or asking questions that they have an interest in knowing. Is it because they're scared for their job. That's not making them efficient, of course." [Observation] MP: "So, does anyone have any questions or any issues to report? No one that needs anything?" The tone of his voice gave the impression that he was tired of no one answering.
Seeking feedback/help	[Interview, Principal 4] "With the number of check-ins, huddle groups, pod meetings, and things like that, I'm assuming that there's enough discussion going on for people to understand that we still need to work efficiently and intelligently. If they find that they're not getting the answers to their questions, they should be raising their hand." [Interview, MP] "I had a great one a couple of weeks ago. One of the younger engineers I don't work with too often reached out to me and asked me if I could help him review a drawing he was working on and needed some help with." [Interview, Principal 6] "People reach out to me all the time to ask if I'm available for a call or whatever."	[Interview, Principal 5] "Hopefully, people are open enough to come up with either a planning meeting or give you a call afterward and let you know that they're facing some challenges with something." [Interview, Principal 5] "And someone in particular, because she's newer, appreciates having other engineers around to ask questions. Whereas to make a conscious decision to call somebody on teams maybe it's not her first choice. In the office, she would just go to her neighbor and say, 'Hey, have you ever done this before?'"

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Engagement/ collaboration	[Interview, Principal 5] "I mean, there's a few that I'd wish would speak up a little more. But in general, everybody's comfortable and collaborating and knowing each other better." [Interview, MP] "There is more involvement and engagement amongst and between a broader group of people than there was before." [Interview, Principal 5] "[Use of Teams] became very efficient, and actually, it became a great tool for us. We have conversations and share screens and message one another back and forth or just get on a call at a moment's notice."	[Interview, ITM] "If you don't know whether or not you are going to be laid off, for example, then you are going to spend some of your time trying to figure out how productive the company is, are jobs coming in, if my job is in danger, who's working on which project? This is not an effort directed at solving problems and generating revenue. This effort is directed at preserving the job, which is human and understandable. If they had more information, they could make these decisions better." [Interview, MP] "If you don't ask a question the right way, yet again, you get silence, and you're going to get people who just don't engage."
Flexibility	[Interview, MP] "I feel like It's been more efficient in a lot of ways that people are able to focus and get their work done and not get interrupted and getting work done." [Interview, Principal 6] "As soon as shelter-in-place started, we were up and running that Monday." [Interview, Principal 4] "Yes, there is a very large level of trust that people are working and feel like they're working efficiently. As engineers, we deal with that whether we're in the office or not in the office."	[Interview, Principal 6] "We always could have been improving their inefficient work processes. We've sort of taken Bluebeam and used it as a tool to do things the way we used to do them rather than changing the way we do them entirely. [...]. It's probably a little harder right now to make kinematic changes like that. I think you're getting to get a more honest read with people in the room."

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Experimenting / creativity	[Interview, Principal 5] "So we met and talked about it. Initially, my position was that we should go ahead and do what they were asking us to do. But it was the youngest engineer that kept fighting and finally convinced me that we should give it a shot. So this shot means we have to produce a document that we submit for them to review and, from that, a lot of backup information and whatnot. So very technical issue, and we went back and forth several times." [Observation] Office members found creative solutions to being social and keeping the office culture. For example, they announced happy hours with themes such as sports in the weekly office newsletter.	
Improvement is a collaborative commitment	[Interview, Principal 6] "I know some people have gotten together for hikes and things like that." [Interview, Principal 5] "Employee staff that works in my group brought up the concept of a program called Hive, and we used it to manage a construction project." [Observation] Several employees assisted management in a morning meeting by reporting things that should be improved. [Observation] When talking about "social media", an employee said it would be nice if employees could tweet about things they were doing, for example, virtual yoga or similar activities: "everyone is very curious about how others are adapting to the situation."	

Mechanisms	Positive form	Negative form
Observed behaviors and perceptions associated with psychological safety (interviews and meeting observations)		
Knowledge sharing	[Interview, Principal 6] "The sharing of information is huge. I think it helps with emotional support. It also tells people what work is coming up, what we see in the market." [Observation] In meetings, employees shared knowledge about the status of projects they were working on and relevant market information.	[Interview, Principal 6] "[Information sharing] has to be really deliberate. It can't be organic like it is in the office."

Essentially, the office climate demonstrated signs of a high level of psychological safety, as all behaviors defined in the theoretical framework (p.26) were identified, specifically, employees' behavior in adjusting to the new conditions and voicing issues and concerns to better the situation, as well as taking action on them. According to the MP, they were able to understand the transition as a learning process:

> "If we step back, as bad as this has been and we're still not sure yet what the end game looks like, it still has created an amazing opportunity to experiment, play, and look for ways to put us in a new direction." (Principal 3)

11.3 Contextual effects on psychological safety

The second step in the analysis was to identify contextual mechanisms affecting the described climate of psychological safety. Thus, in this section, I present findings to answer RQ1a: *What contextual (multilevel) effects can explain findings in RQ1?*

I used the description in section 2.2, as guidance for the analysis, which specifies what contextual elements influence psychological safety. Leaders answered questions about their experience with the transition, including how their responsibility and the office environment had changed from prior to the crisis. In my observations and the document study, I also recognized structures that explained some of my conversations with the principals. In the observed meetings, I listened for examples of informal office dynamics, leader behaviors, and organizational history.

I identified three main categories of contextual effects on psychological safety: employees' dynamics, leadership behavior, and organizational factors. Each category has been divided into sub-categories, and the significant findings are presented in the following.

11.3.1 Employees' dynamics

I observed that the PBO, as a consultant firm, had employees with a variety of experiences and personalities. Diversity in itself was not a barrier to psychological safety; however, the new virtual situation changed their work processes which were challenging for some.

Personalities.

A principal outlined the benefits of having home offices for employees who were seen to be typical introverts. Leaders saw that these individuals were more engaged in conversations when they were comfortable in their homes.

At the same time, a principal described that it was just as challenging to engage the more quiet employees to participate in virtual team-building activities as when they were physically at the

office. For example, they did not show up for the Friday lunches. Thus, leaders tried to be more aware of them and determine if they struggled to stay connected in the virtual environment. Being isolated can impact the overall cohesion and trust within the virtual team, further hindering the development of psychological safety. Being at a physical office provides some benefits for those who do not easily connect with others, as described by a principal:

> "I think there's a lot of benefits about people coming to the office to work, like the cascading of information via the people you don't tend to work with day in and day out and just being able to interact with other people." (Principal 3)

Experience.

The varying levels of experience were a negative effect of diversity following the transition to a virtual work environment. The PBO was staffed by engineers and administrative personnel with varying levels of experience. The principals voiced concern about employees with less experience because they found it difficult to reach out and know what questions to ask. In support, a principal stated:

> "Because she's newer, she appreciates having other engineers around to ask questions. Whereas, to make a conscious decision to call somebody on teams, maybe it's not her first choice when not in the office." (Principal 5)

The principal further described that it was challenging to know whether or not younger and generally less experienced employees were focused when dislocated from their colleges. He further described that it created uncertainty in meetings, as they did not respond to open questions.

> "I think for younger people, I don't want to generalize, but the millennials have a hard time focusing. I think it can sometimes be difficult to gauge whether they're engaged in virtual meetings when it's a bigger group". (Principal 5)

The MP voiced another issue with experience in relation to psychological safety. He stated that newly hired employees would miss out on the social culture and the relaxed orientation process that they would typically receive in a physical workplace. He expressed worry that it would be challenging for these employees to establish strong personal relationships and communicate effectively with their colleagues in a virtual setting. In traditional office settings, observing nonverbal cues and body language is easier, which can contribute significantly to building psychological safety.

Culture.

Relatedly, the MP saw how the PBO benefited from the personal relationship and culture they had established before turning to a virtual work environment. Having personal relations lowered the threshold of reaching out when needing assistance. The culture continued to be a management priority, and they facilitated events such as employee of the month and Friday lunch and gathered to celebrate big and small occasions. A principal described that the PBO's

climate still, after some weeks, had not changed as much as he thought it would. Through the transition, the organization managed to maintain the culture fairly well due to established relationships and norms:

> "I think for what we've been through, the office morale overall is okay. I don't think it's great. I don't think it's bad." (Principal 3)

Table 11.2 lists direct quotations and my observations from meetings that are indications of the role employees' dynamics played in the team's level of psychological safety, both positively and negatively. After the transition, leaders struggled with employee diversity. Still, leaders reported that the strong culture that they had established upfront was critical for their success.

Table 11.2: Quotations and observations reflecting employees' dynamics, Case 3

Excerpts and observations that capture employees' dynamics effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Experience	(-) "I think it would be easier when we're all in the office because there'll be resources you can talk to that may be difficult when you're isolated. But I think there are individuals that need little interaction to get going on. I think it's very difficult for some people to raise their hand when they need it. Digital transformation can happen for some right now without being in the office, but others need support from the BIM staff." (Principal 5)	Seek help/ feedback, collaboration
Personalities	(+) "The stereotypical engineers, introverts, find it difficult to communicate, either in person or virtual. Some of those people might find it easy to communicate virtually as opposed to in person. Like, do you think it's easier to be on a call with ten people and talking versus being in a conference room where you're standing up in front of all ten people? It might feel safer to them." (Principal 4)	Speak up, engagement
Culture	(-) "I think the culture is important. And I don't know that you can get that completely when everybody's working remotely. I don't think we could [be a fully remote] organization. We had a strong code, and then we went virtual." (Principal 6)	Collaboration
	(+) So we have great people. Here are people who all care about each other. A lot of my staff do things with one another outside of work. There's a lot of camaraderies." (MP)	Collaboration, seeking help

11.3.2 Leader behavior

I saw ample data that justified my claim that management behaviors shaped a climate with high psychological safety. At the start of the crisis, leaders focused on the practical issues of the transformation. Whereas after some weeks, leadership was about balancing understanding the situation as a crisis and keeping up the motivation of the office. I found leaders' accessibility, inclusive decision-making, structure creation, and modeling for openness and weakness to facilitate psychological safety. The results are presented in the following.

Accessibility.

To accommodate the new way of collaborating, leaders expressed that their responsibilities changed and that they had to be more accessible to accommodate the new situation. At the start of the crisis, leaders provided psychological support, as they were aware that the crisis posed stress and uncertainty both for employees' professional and personal lives:

> "I'm very concerned about people's health, safety, and welfare. Which I'm always concerned about, but it's a different dimension. It's sort of protecting them against a hidden killer. Taking care of employees in a completely new environment. Where the rules have changed." (MP)

In February, both the MP and the corporate manager rapidly updated employees about the situation and changes to keep them safe. Compared to prior to the crisis, they now felt a responsibility to be accessible for employees to feel safe to reach out to them:

> "I feel it's my responsibility to make sure I kind of get a gauge of how people are feeling. If there are any concerns or struggles with anything, whether work or not work-related, I'm always available to them. That's always been the case, but I feel I need to be more visible." (Principal 5)

Leaders expressed that their need to be accessible also possessed a challenge to their own well-being and productivity:

> "People expect an instantaneous response. When you don't respond right away, you get nasty comments. Which is frustrating because you end up on calls like this all day long, and new stuff is still going nuts the whole time." (Principal 3)

Inclusive decision-making.

Still, instead of turning to a crisis behavior, management included employees to take advantage of the learning opportunity that the crisis presented. Especially in meetings, the MP showed an interest in the experiences of the employees and asked for opinions, and opened up for employees to suggest improvements or concerns. For example: "Does anyone have any problems or successes they want to share?" The MP showed that all voices were essential. The findings indicate that encouraging employees to evolve digitally and inviting them to decide the path forward allowed them to explore new ways of performing their tasks.

Collaborative structure creation was also an observed behavior from the MP and the principals in facing market changes. As the weeks went by, projects were put on hold or stopped entirely. A principal mentioned that a part of the job was to be transparent and make employees understand the need for all hands on deck.

Structure creation.

Importantly, the meetings worked as a platform for collaboration and information sharing, a structure needed for employees to connect. The MP facilitated relationship growth despite the

office not being physically together. In particular, the choice of having morning check-ins, office lunches, and continuing the horizontal collaboration with planning sessions are analyzed as the core behaviors that foster psychological safety. The effect of the adhesive behavior seemed to be collaboration happening without the managers' assistance, as seen in the support initiated by the employees. The employees were mirroring the MP's behavior, contributing to developing psychological safety, such as collective improvement and information sharing. After the new normal of home offices was established in mid-April, they connected psychologically and professionally at their own initiatives.

Model for openness and weakness.

Also, leaders were transparent and modeled openness. An example was when four employees were let go as the workload decreased one and a half months after the transition to home office:

> "It's probably one of the most difficult things leaders are faced with, delivering awful news in a situation where there's no way around it. [...] But when we have to let people go because there's no work, that's awful. It's just an awful feeling. There's little that anyone can do. I mean, we do the best we can. We talk to people about it." (MP)

During meetings, a behavior practiced by the MP to handle the challenges of being transparent was admitting to not having all the answers. In responding in April to when employees would return to the office, the MP replied, "I have no idea. We will not do it before it is safe and will not force anyone."

Table 11.3 lists direct quotations and my observations from meetings that are indications of the role the leaders' behaviors played in the team's level of psychological safety. Leaders were approachable and inviting of input. Combining structure and psychological support facilitated employees' engagement and improvement behaviors.

Table 11.3: Quotations and observations reflecting leaders' behaviors, Case 3

Excerpts and observations that capture leaders' behaviors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Accessibility	(+) "I've heard from probably half a dozen people from the perspective of availability and accessibility. This has been very beneficial for them. I actually like this. I mean, I went into engineering to be an engineer and to work with engineers. I have spent more time in the last three months doing just that." (Principal)	Seeking help/ feedback, engagement
	(-) "I mean, the first month was brutal because every day was meeting after meeting. The lunch hour from twelve to one became a free time to schedule. After we got through March and April, I started working with groups in a way to be more prudent with how to schedule meetings, how to do this in a meaningful way that helped them first and mostly." (Principal)	Engagement
Inclusive decision making	(+) In meetings, leaders actively sought feedback from employees on how they were coping with the situation and what they saw in the market. The MP followed up on the information that he received.	Speaking up, knowledge sharing, improvement
	(+) The MP actively sought feedback from the employees on what they needed to perform at home offices: "Remember that you can report anything, and we will assist you if we can."	Improvement
Structure creation	(+) The meetings connected people despite being physically apart as it was a platform where employees both could provide their concerns, connect and assist the transition.	
	(+) "When people start, we have almost like a board game where there are certain things you're supposed to do. One of them is to reach out to one of the owners to set up a lunch meeting so that you can talk and try and start building a rapport with one another." (Principal)	Collaboration
	(+) I observed that the sequences of Monday meetings continued to keep a steady workflow.	Improvement
Openness and weakness	(+) Leaders were transparent about the situational crisis and not knowing what the future would look like.	Speaking up
	(+) "Transparency is one of our key tenants. I've never been in an engineering company that's as transparent as ours. We share finances with everybody. We share lots of information with everybody. We don't have closed offices. It's a very open book." (Principal)	Engagement, knowledge sharing
	(+) "The people I was most worried about were the young people who lived alone and did not have a roommate. And one of the things we started doing in week one was that the five principals split the office up into five groups. Everyone took a part of the office every week and reached out and talked to them individually." (MP)	Engagement

11.3.3 Organizational factors

Because the office's main tasks were creative and interdisciplinary, a need for psychological safety existed independent of the COVID-19 crisis. I found that the organization's structure and culture supported such an environment, which will be elaborated on in the following.

Work setting.

A part of the new work setting was having all meetings digitally. At the start, the office had morning office meetings every day, with voluntary participation. They also continued their structure of a series of Monday planning meetings with the different levels of leaders. Office lunches were an arena where employees were given the opportunity to broaden their horizons as they became exposed to others' thinking. The morning check-ins were an opportunity to give and receive support. Creating these arenas cultivated safety and closeness in the relationships. Also, insisting on using cameras during these meetings helped employees be present and contribute.

After enduring those first weeks and months of the pandemic, management began to consider the benefits of having home offices. The MP stated that he wanted to unshackle from their bad habits and that the learning process they were going through was an opportunity that he would like to exploit. For example, a principal described the possibility of a larger collaborative network in which offices no longer worked in "silos," but employees were dispersed over many KPFF offices. Still, it was not an option to be fully digital, as they appreciated the strong office culture that they had developed over the years. As pointed out by a principal:

> "I just think you lose a little bit of a cascading effect of knowledge throughout the office if you are isolated at home. Now granted, if you're working with a set team and have a lot of team collaboration calls, you're well connected to that team. But I think what you lose is connectivity with other people within the office because there's no avenue of seeing someone in the kitchen and saying, 'hey, Nick, what are you working on?' versus me trying to force everyone to talk. It just happens naturally and organically when you're in an office." (Principal 4)

It was especially the younger engineers that the leaders mentioned being critical to have at the office, as they needed more guidance. Consequently, senior employees also needed to mentor those with less experience.

History.

An explanation of why the office managed the transition was that they had been through tough times before and were prepared for other disruptions to the office environment:

> "We did it overnight, literally. I think the main reason is that we have been planning for years for business continuity issues associated with natural disasters and disaster recovery scenarios. And well, this wasn't really the type of disaster we were ever

> planning for. We have a lot of the parts and pieces in place to be able to respond. An earthquake comes with no notice, and they pretty much shut you down right away. More instantaneous than COVID-19 did. So, this was just a great fire drill for the big one." (MP)

Organizational values.

Another important finding of contextual effect on psychological safety was the supportive organization and how it guided leaders during the crisis. The corporate structure of the PBO was based on a decentralized, supportive business organizational model. Findings showed that the MP and the supportive functions of the SFO had chosen to follow the model in great length. Hence, the corporate model's mission and values significantly impacted the PBO's structure and culture.

After having gone through crises and deciding to learn from them, KPFF in 2001 defined a set of cultural values, summed up as stability, relationships, passion, trust, and excellence. The mission of the firm was expressed as "perpetuation" in 2001, which stresses that people come first, not the profit. The faithfulness of the office to the supportive business organizational model's values seems to make the leaders more sensitive to the "right" aspect of the situation, in contrast to getting stuck with certain aspects. The mission of perpetuation and the organizational values created a leader capacity for a people focus and not an immediate concern about financials.

Structure.

Another aspect of the PBO was the inclusive and horizontal structure. In 2002, the leadership strategy changed due to growth from being "self-organized groups" to "breaking down silos." This change meant separating the principals from groups and letting the middle leaders administratively assist employees. During my observations, I saw that the organization's structure and culture supported such an environment where middle leaders were crucial in how the office coped with the different challenges. As a principal commented:

> "The POD structures are set up such that if someone in the POD says, 'Hey, I have this situation', theoretically, the pod leaders should know what the other pods are doing so that they can reach out to one of the other pods." (Principal 4)

Table 11.4 lists direct quotations and my observations from meetings that are indications of the role the organizational factors played in the office's level of psychological safety. History and organizational values support guided leaders to create a learning environment despite the crisis. However, a transition to virtual meetings was not without challenges.

Table 11.4: Quotations and observations reflecting organizational factors, Case 3

Excerpts that capture organizational factors' effect on psychological safety		
	Effect examples: (+) positive, (-) negative	Effect on
Work setting	(-) "The challenging thing about the virtual meanings is you can't get a read of the room. You can't really get people's expressions, the same as you do in 3D-life or 4D-life. You can't see that someone's having a side conversation." (Principal 6)	Collaboration, engagement
	(-) "If we're in the same room, we can pull up the drawing on a monitor, and we're all in the same room looking at each other, talking about it. Then if we want to, somebody can get up and start sketching on a whiteboard. That's the part that we don't have now. We don't have the ability to just start doodling." (Principal 5)	Creativity, experimenting
	(-) "I believe a lot of work gets done based on relationships. If you're sitting next to someone who is involved in a project, you are much more likely to get pulled into that project. And you're much more likely to rely on someone to help you. I don't think those mechanisms can be adequately replaced in a virtual environment." (ITM)	Collaboration, seeking help/ feedback
History	(+) "So what we've been talking about in San Francisco for more than a decade is what happens if there's an earthquake. And we've had many conversations about what we would do, how we would handle it, and how we would define ourselves. So, to the degree that we've had those conversations for a very long time, it wasn't a surprise. But what we did not do enough is get the particulars down of how that would look." (ITM)	Collaboration, learning, flexibility
Org. values	(+) Document analysis revealed the position of the organizational values within the PBO. Through emails, the management reminded employees of the mission of perpetuation and that they were both concerned for and supported their employees. I observed leaders follow the relation-based organizational values of putting employees first.	Engagement
Structure	(+) "There are supposed to be separate meetings going on with the group leaders. That group of people is to make sure everyone is doing okay. The principals are also reaching out sporadically to employees to do one-on-one check-ins to see how they're doing. But, it's an office of 70 people, and checking in on them is difficult doing on a weekly basis." (Principal 4)	Collaboration, seeking help/ feedback
	(+) "So we let them go first thing Monday morning over Zoom, one by one. And then told all the [middle leaders] in a meeting. Then we asked all of the [middle leaders] to have a meeting with their groups by the end of the day to let everyone know that those individuals had been let go to stem any rumors or gossip or anything." (MP)	Improvement is a collaborative effort
	(+) I observed that the meetings were collaborative and transparent, allowing middle leaders to get an overview of the office's resources and thereby assist the management in using them as efficiently as possible.	Collaboration, improvement

Part 4
Cross-Case Discussion

Notes

The preceding chapters discussed the findings from my within-case studies and how design team members' digital mindsets are related to, and even coexist with, their perception of psychological safety.

In this part, I will compare and integrate the within-cases into the literature. The theory is used to interpret the similarities and differences between the cases, explaining why this is so and illustrating how psychological safety may serve as the foundation for digitalization and, potentially, digital transformation. Thus, theory and findings are used to evaluate Figure 1.1 and provide guidance for expanding on current research.

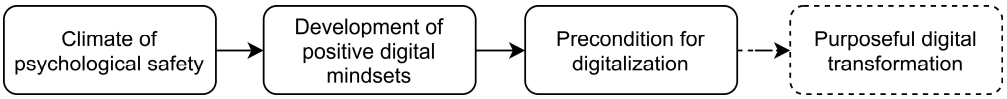

Figure 1.1: Research framework (from section 1.4)

The following chapters are organized around the overarching research questions. Cases 1 and 2 findings cover all discussions, and Case 3 covers RQ1 and RQ2.

Chapter 12 – Development of psychological safety	*RQ1:* How do workplace practices influence what norms matter for the development of psychological safety? *RQ2:* What are the contextual factors impacting psychological safety?
Chapter 13 – The relation between psychological safety and digital mindset	*RQ3:* To what extent do a high level of psychological safety and a high level of digital mindset occur together? *RQ4*: What characteristics of psychological safety are associated with mechanisms that enable a digital mindset?
Chapter 14 – Foundation for digital transformation	*RQ5*: Can the two phenomena secure that the preconditions for digital transformation are in place?

Chapter 12
Development of Psychological Safety

This chapter exploring the development of psychological safety is structured into two sections. The first section covers the discussion of RQ1, and the second section focuses on the discussion of RQ2. The discussion of RQ2 is further divided into subsections that first delve into the barriers and then facilitators of psychological safety.

12.1 Norms and psychological safety

I thoroughly explored and documented psychological safety in the within-case analysis in the former chapters. In this section, I will simplify the findings from Cases 1 and 2 into a synopsis of what transpired within the teams. Because Case 3 was a different type of organization, the data shed new light on research questions 1 and 2. In this section, I aim to discuss *RQ1: How do workplace practices influence what norms matter for the development of psychological safety?*

RQ1 responds to Edmondson and Lei's (2014) request for research on how psychological safety differs in various types of teams or workplaces. Edmondson (2004) hypothesized that psychological safety varies according to team features such as size, complexity, and whether the team is remote or dispersed. The comparison between Case 1 and Case 2 is intriguing as the teams are similar in project type, but Case 2 operates in a fully digital environment, while Case 1 emphasizes physical collaboration. Case 3 presents a unique setting as a traditional office that has been transformed into a virtual organization. In theory, different types of norms would be expected to be more critical for the development of psychological safety in Case 3 than for Cases 1 and 2.

Case 1 scored slightly lower than Case 2 on the psychological safety items in the face-to-face survey. Furthermore, the qualitative analysis of Case 1 revealed that there was greater variation in individuals' perception of psychological safety than was indicated in the survey. Case 3 evidence is based on observations of the team and leaders' perspectives. In Table 12.1, I

compare the behavioral characteristics (norms) related to psychological safety, aiming to find differences and similarities.

Table 12.1: Cross-case analysis of norms characteristic for psychological safety

Norm	Case 1	Case 2	Case 3
Speaking up	Speaking-up culture with openings for everyone to contribute. Nonetheless, some had to be addressed to speak up, and some were more vocal than others.	Team members challenged each other's ideas. Still, there were no clear structures encouraging equal voice among team members, and many remained silent in meetings.	After the transition, few spoke up about general office-wide issues. There did not seem to be a need to speak up due to the information flow.
Seeking feedback/help	Team members rarely asked for help but often for feedback. During meetings, some responded negatively when they were posed with inquiries, which caused difficulties for the team.	Most disciplines had to request feedback from the team, leaders, and project owner to move forward with their work.	The project work required employees to reach out to each other within the office. Also, middle leaders had smaller groups where employees sought help on projects or work-related issues.
Engagement/ collaboration	Engagement was salient, and there was collaboration across role and discipline boundaries. Still, collaboration among the different disciplines was challenging.	The collaborative norm was so strong that team members changed their behavior during the crisis to accommodate the need. The team was not working in silos.	Turning to a virtual environment brought the office closer together, increasing collaboration across the smaller groups within the office.
Flexibility	Being flexible was important as solutions were constantly changing. Team members were flexible in adjusting solutions requested by other actors.	Team members were flexible in adjusting their solutions for it to fit with the other disciplines. By being flexible, they took on extra responsibility.	Employees were flexible, as seen in the successful transition to a virtual office environment. Also, there was flexibility in the way they approached and planned work.
Experimenting/ creativity	The project implemented new and experimental solutions, which required interdisciplinarity.	They often had to be creative to find solutions, and experimenting was tightly connected to flexibility. They were more protective of their unfinished ideas when presenting them to the larger group.	Employees were seen experimenting with new ways of connecting and keeping up the office culture.

Norm	Case 1	Case 2	Case 3
Improvement is collaborative	Improving the project was a collaborative effort. After they learned from a struggle, they worked better together.	When turning virtual, team members actively found new ways of collaborating. When finding issues with solutions, they collectively tried to fix them instead of blaming each other.	Employees connected on their own initiatives through Teams and by hosting social events.
Knowledge sharing	Vocal team members often shared knowledge in meetings outside their role responsibilities.	The team offered suggestions even when it was beyond their designated role and with the potential of receiving a rejection.	Knowledge sharing on the economic status of the PBO was an important support function. Also, sharing knowledge on how to cope with the virtual office environment.

As Table 12.1 shows, I did not identify any negative norms; some were problematic and ambiguous but not immediately a barrier to a climate "with a shared belief that the team is safe for interpersonal risk taking" (Edmondson, 1999a). Individuals speaking out, seeking and giving feedback, and their engagement were critical in identifying errors that required rework or could be costly later on in Cases 1 and 2. As discussed in the following, practices of coordination and collaboration and work practices influenced by industry expectations influenced norms that matter for the development of psychological safety.

Coordination and collaborative practices.

The design teams relied on cooperation to progress. In Cases 1 and 2, both management and team members were aware of the need to collaborate across role and discipline boundaries. It was part of the ideal cultures' espoused values and beliefs, "how things should be done" (see Figure 4.1, p.51). Nonetheless, how collaboration played out in Case 1 and Case 2 was significantly different.

Case 1 members were clear about their aim to have tight collaboration, and they had been through initial phases where they had met and talked about what they would like their team culture to be like (Figure 8.3, p.112). As a result, the norms were openly acknowledged and addressed. As the expectation set by the project was to be collaborative, they had more face-to-face interaction than in Case 2, but the team also had more relational conflicts.

At the time of observation of Case 1, conflict did not seem to harm team members' perceptions of psychological safety significantly. According to Bradley et al. (2012), conflicts' negative effects may be mitigated by psychological safety. When they encountered a situation that required an interdisciplinary solution, they handled their activities collaboratively, which Edmondson (1999a) explains requires psychological safety. Nonetheless, the friction between

project actors impacted behaviors, such as being flexible to adjust their work or being creative to accommodate another project actor. Crossing knowledge/profession boundaries created tension, which I shall explore further when discussing RQ2.

In Case 2, they had to collaborate, but the "soft" aspects of it were not a matter that was explicitly addressed or formalized in writing. Instead, they had a more traditional approach to design work. They managed their tasks and reached out to team members when they required feedback or coordination. In other words, they worked in a semi-silo manner; notably, this was not found to be negative for their perceptions of psychological safety. The finding contradicts Casciaro et al.'s (2019) argument that when employees cooperate outside of their "silos," they learn more and Edmondson and Mogelof's (2004) argument that it should improve the climate of psychological safety.

In the scenario described as Case 2, the actions of the team members reflect the concept of psychological safety in the use of collective intelligence as outlined in the literature by Edmondson (1999a). The team members demonstrated this by reaching out to each other for coordination purposes when necessary. Their tendency to work within silos may explain why they did not ask for help, as the challenges they faced were specific to their tasks and areas of expertise. Despite prioritizing their own responsibilities, the team members in Case 2 showed a greater willingness to offer assistance by proactively asking if anyone needed help compared to the team members in Case 1.

Trust was essential for the success of the semi-silo work style in Case 2. Interconnected responsibilities required team members to rely on each other's skills and knowledge. As McKinney (2020) stated, trust means that you are confident in another person to do what is best for you. In Case 1, similar reliance existed, but due to the close collaboration and transparent processes among team members, they had greater exposure to each other's knowledge and more easily questioned ideas and work presented. Hakanen and Soudunsaari (2012) describe that trust-building requires, among other things, respect. When abilities are recognized and appreciated, respect follows, and this respect leads to trust in the willingness and ability to share knowledge (Martin, 2006).

In Case 3, trust did not serve the same purpose as for the two design teams; however, as the leaders expressed, they trusted their employees to perform their job despite them being dislocated. I did not find signs of micromanagement, and I observed that most team members engaged in their own work and the well-being of their co-workers. This finding supports Kahn's (1990) notion that individuals who feel psychologically safe will promote active and full-role performance.

In Case 3, the establishment of intergroup collaboration was an organized process. An interesting finding from the case study was that when the office responded to the crisis, the

barriers between office groups were further broken down. In this example, I believe Edmondson and Mogelof (2004) accurately defined what occurred: “when cross-functional relationships among peers are encouraged and enabled by organizational norms and structures, this should increase the general climate of psychological safety.” Team members were flexible and adapted to their new work environment. Employees, in my opinion, had a shared understanding that it was expected of them to engage and assist management in dealing with the new work environment. The shared norms of the workplace brought them closer together, as seen by greater communication among the project-based organization’s (PBO) workgroups.

I also found that the PBO had a learning culture. As Schein (1993) observed, supportive groups, assist individuals in overcoming anxiety when confronted with change, allowing them to learn. Several factors can induce anxiety during a crisis, but the attitude of “standing together” strengthened employees’ perception of improvement as a collective commitment. Management expected employees to explore how the new virtual work environment suited them and report on any required improvements or modifications. This argument is supported in the case-based article in Appendix B, focusing on employees’ resilience (Tvedt et al., 2023).

Industry formed expectations.

At first sight, it appeared like taking interpersonal risks was the norm for both design teams. Their profession required them to collaborate across boundaries in meetings and on their own initiatives. Theoretically, when team members are engaged in a temporary project organization (TPO), they have certain expectations since the team has a time-related conditional state when the TPO is collectively expected to end (Lundin & Söderholm, 1995; Packendorff, 1995). Furthermore, project actors or team members are chosen based on their knowledge or competence, with the understanding that they will need to interact across discipline boundaries to complete the task for which they have been employed (Lundin & Söderholm, 1995). As a result, individuals have implicit beliefs and expectations about how teamwork should be carried out.

I believe requesting feedback in Cases 1 and 2 was a necessity rather than an extra-role behavior. Extra-role behavior refers to actions that are outside the formal job description or duties of an individual but, nonetheless, contribute to the organization or its goals. According to Lundin and Söderholm (1995), in the realm of temporary organizations, there are rules of ethics and behavior that team members are aware of outside of the context of the specific project. These beliefs are rather similar to what Schein (2010) described as “basic assumptions from past experiences of success.” I found that the team norms that form psychological safety may be taken-for-granted assumptions from the construction industry’s culture. For example, being creative and flexible when facing challenges, sharing knowledge, and seeking feedback on their work. These shared industry-level norms contributed to shaping the norms and climate for psychological safety that I observed in Cases 1 and 2.

Cases 1 and 2 did not show obvious situations in which team members reported mistakes. Reporting errors is a form of speaking up. For Case 1, I saw that their collision control meetings made it evident when something went wrong, and there was no need or possibility for team members to detect these problems. They did not have automatic clash controls in Case 2. Therefore, the repercussions for mistakes could be greater.

According to Google's Aristotle project experts, norms, where employees listen to each other and show empathy through conversational turn-taking, are characteristics of feeling psychologically safe (Duhigg, 2016). I found how conventions of voice were applied to be the most difficult in all three case studies. Therefore, I'll look more closely at the role of team members and employees' voices.

12.1.1 Silence or interpersonal fear?

In my analysis, I discovered that the most challenging norm for leaders and management to comprehend and establish in the various cases was the speaking-up behavior. Neither of the cases studied suffered from what Edmondson (2018, p.86) refers to as a culture of silence, in which errors and mistakes occur without team members' knowledge. For example, in Cases 1 and 2, members described multiple situations when they spoke up despite the fact that it could negatively influence other disciplines. Simultaneously, leaders in all cases acknowledged that it was difficult to get team members and employees to speak up in meetings.

As described in section 2.3, people may not speak up for a variety of reasons (Bisel and Arterburn, 2012; Dyne et al., 2013; Edmondson, 1999a; Schein, 1985), and as Edmondson (2018) stated, only the person who did not speak up would know why. Thus, whether silence is the result of a lack of psychological safety or a situation in which the individual does not have anything to say cannot be determined solely via observation. Still, in the following, I will discuss possible reasons and the consequences of the observed absence of voice.

Neither cases practiced equal time to speak, in some situations because it was not practical due to larger meetings or because engaging employees did not pay off. In Case 1, vocal personalities often spoke up as an extra-role behavior. Whereas in Case 2, there were individuals within power positions that often took up time in meetings, and on these occasions, the group remained silent. In Case 3, the Managing Principal (MP) actively invited employees to speak up; however, in larger meetings, employees tended to choose silence. Findings by Google's Aristotle project may explain what I observed: when team members are given roughly equal time to express their voice, then they perform better, as it creates a sense of togetherness (Duhigg, 2016).

Equal time to speak can influence individuals' sense-making processes, as it provides evidence of how speaking up is received by leaders and others. Bisel and Arterburn (2012) found that

employees justify their decision to refrain from speaking by their expectations about how speaking up may unfold both negatively and positively, thus uncertain projections. Also, subordinates (employees, team members) use their identity provided in the hierarchy to absolve their responsibilities and put it on their supervisors. Work climates where voice is expected may mitigate these sense-making processes leading to decisions to engage in silence.

I found that having virtual instead of physical meetings increased the effect of the absence of voice. For Case 1, the team was sitting physically together and having meetings. In my observations, it was clear that non-verbal cues such as body language and facial expressions were present with those who were silent. Often one could read their reaction despite their silence, which showed disengagement due to the larger team meetings. This observation indicates that team members were not intentionally withholding information, supported by the arguments made by Dyne et al. (2003) about silence not needing to be negative.

Cases 2 and 3 transformed into virtual work environments, making silence harder for the teams, leaders, and management to understand and handle. They did not get access to individuals' use of words, the tone of their voice, gestures, eye contact, and facial expressions that co-occur with speech acts (Dyne et al., 2003). Still, the PBO of Case 3 had a significant information flow for the first weeks of the transition to a virtual environment, both through emails and in meetings, and therefore it could be that employees did not need to speak up in the period that I did my observations.

An important finding was that the other norms that fostered psychological safety were evident in employees' language. In Case 2, team members were cautious thanking each other and expressing that they were thankful and that "it was a collaborative effort." Thus, in Case 2, the language mirrored perceptions of psychological safety, the mix of trust and respect, more than what I encountered in Case 1.

Edmondson's (2014) research has shown that the perception of taking interpersonal risks influences team members' or employees' voices. The survey results from Cases 1 and 2 showed that taking interpersonal risks was more difficult for team members than the other psychological safety items; still, it was quite high. Interestingly, Case 2 scored higher than Case 1, which can mean that their silence was due to other contextual factors. I will look into this in the next section.

To sum up, I found that the described norms were critical to employees' perceptions of psychological safety. As displayed, the norms for the two TPOs served different purposes than those of Case 3. The TPO's characteristics needed norms for boundary-crossing to establish a psychologically safe team climate, whereas Case 3, as a permanent organization, required norms for adhesion. Even though respect and trust characterized the attitudes of "how things are done" in all cases, contextual mechanisms affected the described norms in different ways.

The following section will explore the challenge of diversity and boundaries when discussing contextual effects on perceived psychological safety.

12.2 Contextual effects on psychological safety

In this section, I will distill findings from Cases 1, 2, and 3 into a description of what affected the teams' sense-making of the espoused cultures and how it impacted norms that facilitated psychological safety. Although most studies have focused on the role of leaders in establishing psychological safety, this type of climate can be supported by all team members. As a result, I have included a discussion of individual, team, and organizational factors, some of which are unique to the construction industry. As a result, I intend to discuss research question RQ2*: What are the contextual factors impacting psychological safety?*

This section first presents an overview of contextual effects, followed by a discussion of factors that create barriers and then factors that facilitated psychological safety.

Some of the observed contextual effects were beyond the control of the leaders, team members, and employees. Cases 2 and 3 were affected by the COVID-19 pandemic and were located in San Francisco, where state regulations mandated that they were confined to their homes using technologies to interact. It may take years to fully comprehend the impact of the abrupt shift to virtual work on people and organizations. Still, it was not long before researchers and practitioners questioned the impact of virtual environments caused by the pandemic on psychological safety (Feitosa & Salas, 2021; Lechner & Mortlock, 2022; H. Lee, 2021). Thus, the pandemic provided an opportunity to study how a virtual work setting impacted psychological safety. Other case study locations may yield different findings.

Another example is that today, various sorts and versions of project delivery models (PDM) determine how actors are contracted and, as a result, how they work together as a design team (Miller et al., 2000). Knowing how the contextual attributes are linked can aid in determining which delivery model is best suited to the project's objectives, as the models commonly shape or prohibit particular norms and work practices.

Figure 12.1 summarizes the identified contextual effects on the perceptions of psychological safety in the three case studies. As the figure illustrates, some were shared, while others were specific. I have marked the shared contextual factors (in white) as the factors I will focus on. The findings in the figure will be discussed in the following subsections. I first take on the barriers, then the facilitators.

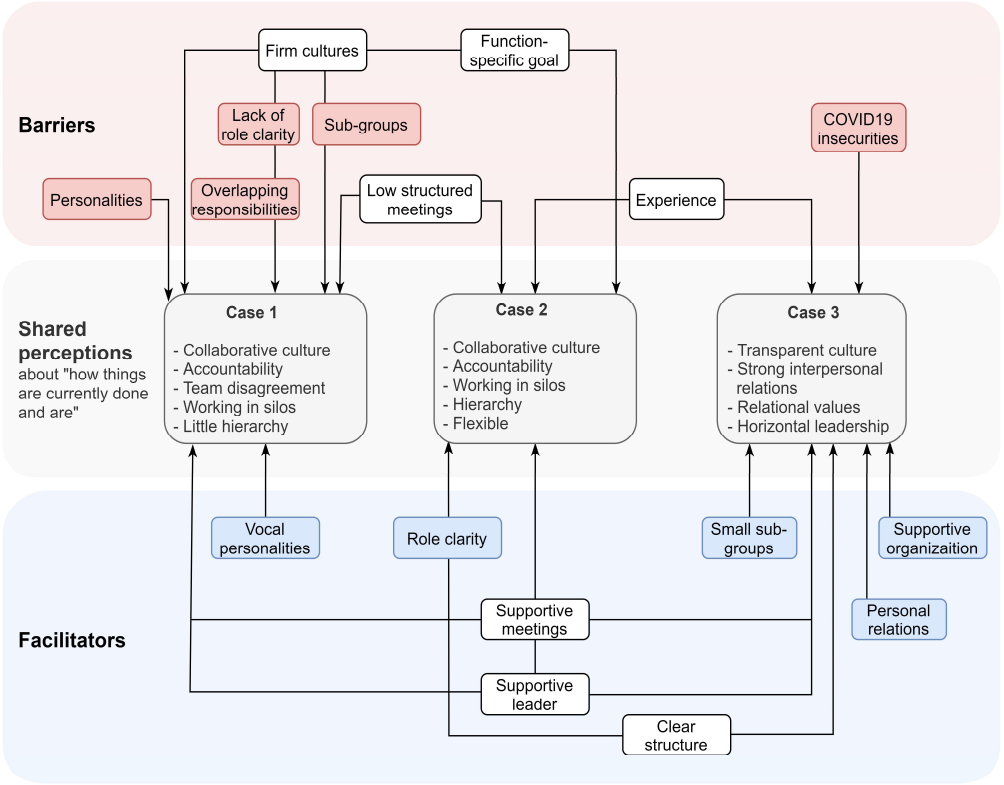

Figure 12.1: Contextual barriers and facilitators for psychological safety

To explain the differences and similarities between the cases, I have used theories of diversity, supportive leadership, organizational support, and social theoretical perspectives in this chapter. All are explained in Part 1, Theoretical Framework. I have chosen to use these perspectives in the following discussion to theoretically anchor and strengthen the arguments about the contextual effects on psychological safety. The underlying argument comes from climate development, explained in section 4.3, describing that team members' and employees' perceptions of aspects of the organizational context evolve based on sense-making as they assess their interactions and observe peers and the environment for clues about acceptable behavior and organizational values and norms (Weick, 1995).

12.2.1 Diversity causing barriers

The relationships between different team members in Cases 1 and 2 were typical for construction projects that require collaboration between different disciplines to achieve success (as noted by Knotten, 2018; Lundin & Söderholm, 1995; Packendorff, 1995). However, having teams made up of members from various disciplines also led to a variety of diversity issues, as explained by Ankrah and Langford (2005). Case 3, a permanent organization, displayed

diversity in different ways, as Harrison and Klein (2007) defined in subsection 4.3.1. However, this diversity resulted in different challenges to effective collaboration.

The challenge in Cases 1 and 2 was figuring out how to incorporate diversity. Figure 12.2 shows the different types of diversity that created barriers to psychological safety. For example, in Case 1, having several firm cultures created sub-groups, ambiguous roles, and overlapping responsibilities. Furthermore, experience posed challenges in Cases 2 and 3 to developing individuals' perceptions of psychological safety. I will further describe the effect of the diversities using Harrison and Klein's (2007) definition of disparity, variety, and separation diversity, as explained in subsection 4.3.1.

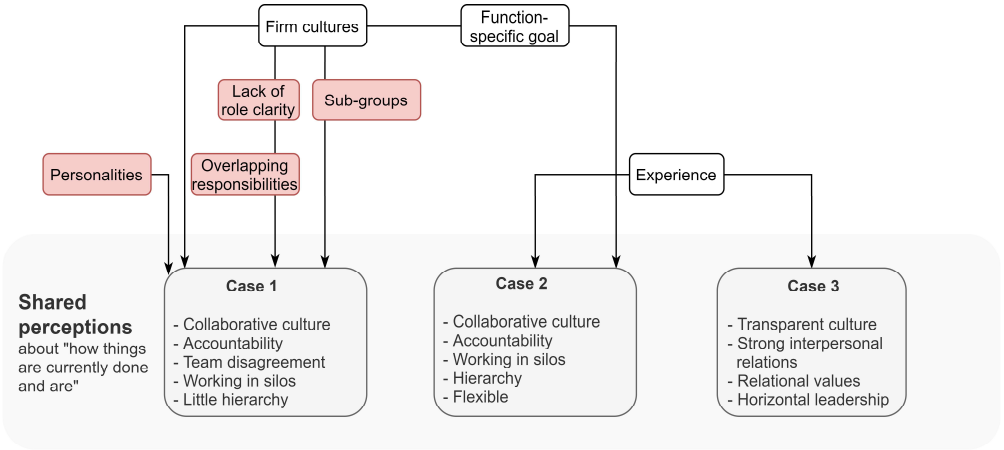

Figure 12.2: Contextual diversity barriers to psychological safety

Disparity diversity.

In Case 2, there was a noticeable hierarchy in meetings. Such power or status differences are covered by disparity diversity (Harrison and Klein, 2007). Edmondson (2004) highlighted how team members' ideas about the repercussions of speaking up or requesting feedback are influenced by such formal power dynamics. This could be the source of the described team silence in subsection 10.2.2, in which team members considered the consequences of speaking up if a leader saw it as criticism.

Disparity diversity was low in Cases 1 and 3, not because the team and organization did not have power positions but because supportive leadership and a supportive organizational structure mitigated the effect by lowering the power distance. These findings are supported by O'donovan and Mcauliffe's (2020) review of enabling factors for psychological safety.

Variety diversity.

In both Cases 1 and 2, there was a need for disparate specialized engineering. Thus, there were many discipline-specific roles from different companies. Variety diversity covers what I observed as differences in experience, knowledge, expertise, and education (Edmondson, 2012a; Harrison & Klein, 2007). This diversity was seen as an asset in both TPOs, and team members were able to adjust and harmonize their objectives.

However, in Case 1, I noticed that the variations in meanings across the different disciplines (such as work practices and task correctness) created friction between actors. Some did not feel understood or prioritized, resulting in more task conflict than in Case 2. Edmondson (2012a, p.200) described what I observed in Case 1 as a common issue with variety diversity when knowledge boundaries arise and are not crossed due to misunderstandings and mistrust. In both cases, collaboration happened at times in silos, which hindered utilizing collective intelligence (Edmondson, 1999a). As is typical in the construction sector, Cases 1 and 2 dealt with the effects of knowledge barriers through legal contracts instead of working around them.

At the same time, Case 1 had what they described as a collaborative PDM, where the contractor had entered the team early on in the design phase but still later than other central actors. Theoretically, including central actors early in the project creates a high-level inclusive structure, which can help team members understand goals and thereby support decisions or change (Carmeli & Gittell, 2009; Edmondson, 2012a, p. 201). Still, a lack of understanding and facilitation of the different work processes could harm knowledge sharing as individuals withdraw themselves from interaction across role boundaries (Kahn, 1990). It could be that the collaboration intensity made team members in Case 1 more aware of existing knowledge boundaries and created more task conflicts than in Case 2, where it was expected that contracts handled the possible lack of trust between actors.

Experience is also a case of variety diversity (Harrison & Klein, 2007). As seen in Figure 12.2, I found less experience to be a barrier in Cases 2 and 3. According to Google's studies on effective teams (Duhigg, 2016), those with less experience were more fragile to have low perceptions of psychological safety. This could explain why less experience was frequently mentioned as a challenge in Case 2. Those who are fresh out of school or newly hired are less confident in their expertise since they have less or no experience with situations that could corroborate their knowledge.

Furthermore, because they were working in virtual environments, Cases 2 and 3 had a combination of knowledge boundary and distance boundary. Being dislocated provides fewer social cues (Weick, 1995) for less experienced team members and employees, and thus the knowledge barrier may increase. Edmondson (2012a, p.17) described that employees might not be aware of the importance of sharing "taken-for-granted" knowledge, and therefore social

cues are essential to make sense of a situation. Therefore, individuals' perceptions of psychological safety are fragile in virtual environments.

Several researchers have questioned and researched whether or not the variety of personalities matters for psychological safety (Detert & Burris, 2007; Duhigg, 2016; Edmondson & Mogelof, 2005; Newman et al., 2017). As variety diversity refers to how group members differ qualitatively on a categorical attribute (Harrison & Klein, 2007), it covers personality traits (e.g., extroversion, vocal personality, and shyness). Case 1 had a wide range of personalities, which team members described as difficult – so difficult that the PM stated that the team's progress depended on a few vocal individuals. In Case 2, there was also a mix of personalities that I defined as extroverts and introverts. However, in Case 2, the teamwork did not suffer from this inevitable diversity.

In Case 1, introverts were also identified as unfit for the collaborative delivery model. In theory, when team members do not engage, it is detrimental to the individual's and the team's psychological safety (Gong et al., 2012). An explanation is that the frequency of knowledge sharing can give others the perception of being included in a relational network (Edmondson, 2004) and that taking risks, such as speaking up, is safe. As a result, it produces a domino effect.

Detert and Burris's (2007) finding on prosocial personalities can help explain the differences in the case study findings. Proactive personalities, or people open to change, are more likely to have a lower threshold for taking interpersonal risks (Edmondson & Mogelof, 2008). Remtulla et al.'s (2021) findings explain the notion in Case 1, where some individuals seemed to help improve climates of psychological safety. Their study of care teams found that shy personalities create barriers, whereas vocal personalities emerged as facilitators of psychological safety.

Conversely, Edmondson and Mogelof (2005) reported that neuroticism was the only personality variable influencing psychological safety. Also, Google's initiative Aristotle observed that interpersonal relationships, not personalities or intelligence, distinguish good teams from dysfunctional ones (Duhigg, 2016). Successful teams assess social sensitivity. That is, they intuitively recognized how others felt based on nonverbal and spoken cues. They also discovered that how the team figured out their dynamic, regardless of experience, was not as significant as everyone being allowed the same time to speak. This research contradicts my above discussion, which may indicate that the diversity of personalities did not severely impact psychological safety.

Nevertheless, psychological safety has been found to increase with the frequency of knowledge sharing (Edmondson & Lei, 2014; Siemsen et al., 2009). Thus, boundaries to knowledge sharing provide a threat to the establishment of such an environment.

Separation diversity.

As defined by Harrison and Klein (2007), separation diversity encompasses physical distance. Cases 2 and 3 worked in virtual environments and interacted across team and organizational boundaries through technology. Having remote work settings directly impacted psychological safety due to a lack of informal dynamics and dynamic information flow. Even though the cases were distinct types of organizations (PBO and TPO), they both faced similar challenges working on maintaining positive climates when turning virtual.

It was apparent in both cases that large virtual design meetings were challenging for speaking-up behavior and engagement. Having the same meeting structure virtually in Case 2 was not optimal. In Case 3, new meetings were implemented, but leaders noticed it became too much after a while. Holding extra meetings to compensate for less face-to-face interaction seemed to work against its purpose. Similarly, Lee (2021) found that constant text messages and virtual meetings created irritation and tension, which generated less psychological safety. Monitoring behaviors with extra meetings are easily adopted during a crisis; however, it removes the flexibility for employees and their sense of being trusted.

Simultaneously, communication and interaction technology did provide interaction possibilities for both cases, which is essential for psychological safety (Simensen et al., 2009). The functions of the interaction tools allowed individuals to provide social cues beyond their voices. This nonverbal communication was essential to their sense-making and their continuing perception of psychological safety. Why it facilities psychological safety was described by Edmondson (2004) – individuals will monitor their actions to protect themselves if not provided with a context they can interpret as safe.

Separation diversity also describes differences between group members regarding values, attitudes, or beliefs (Harrison & Klein, 2007). As Figure 12.2 (p.242) shows, it was Case 1 which struggled the most with the consequences of several firm cultures. A perspective that often is used to describe the outcome of such diversity is social identity theory, used in the following.

12.2.2 Development of barriers through a social identity perspective

Social identity theory can further explain some differences in the effect of contextual barriers for establishing norms that facilitate psychological safety of Cases 1 and 2 and why they differ from Case 3, a permanent organization. In the following, I will discuss the finding by exploring the consequence of salient identity, intergroup comparison, and the effect of cultural values.

Salient identity and permeability of team membership.

According to social identity theory, salient identity decides which intergroup relationships direct individuals' behaviors (Hogg, 2000; Terry et al., 2001). In Case 3, employees were from the same office and, therefore, benefited from a shared organizational culture, as Schein (2010) described and discussed in-depth in the case-based paper in Appendix B. Even though the office was divided into workgroups, belonging to the PBO seemed to be the salient identity for most.

In contrast, Cases 1 and 2 were made up of people from diverse organizational cultures working together to produce a product. As a result, team members had several groups they could identify with: their employee firm, their trade, or the design team.

Most team members regarded the boundaries between the actors in Cases 1 and 2 as fixed, as they identified with groups of their profession where the majority were from the same firm. As Terry et al. (2000) described, it was not a situation in which people changed their identities by joining another group. Instead, the strength of the identification was responsive to intergroup relations where boundaries were perceived to be impermeable. I found that a consequence was that the design team identity was not salient, in contrast to Case 3.

Intergroup social comparison.

In Case 1, the internal cultures of the various project actors were complicated, creating separation in the common group (the design team), leading to strong in-groups (e.g., the architect actor and the contractor). So much so that it resulted in an unresolvable disagreement between two design managers, who were forced to resign because of the problems resulting from the contractor's merger into the established design team. As explained in subsection 2.2.1, in-groups are groups that an individual identifies with and feels a sense of belonging towards, defined by a common social category (Tajfel & Turner, 1986). These groups shape an individual's self-concept and behavior and tend to be viewed more favorably than out-groups (other in-groups).

The contractor wanted to get ownership of the project by going through what the design team already had developed emotional ownership of. The existing design team was well integrated after working together for a long period, and the contractor was a newcomer, which changed the intergroups' statuses. Research has shown that self-conceptual uncertainty may arise when organizations merge (Hogg, 2000). Previously, the members of the architect actor were the highest-ranking group within the common design team group, with both leadership and influence. Following the merger, there would be two design managers, one from the architectural in-group and one from the new group (the contractor). The new organization challenged the current status, forcing the old in-groups to defend their work and value.

The impact of intergroup tensions from the unsuccessful merger appears to have impacted team norms. It was clear that team members in the same in-groups sat together in meetings and during breaks. Even clothing could categorize team members according to the group with which they identified. According to social identity theory, team members exaggerated disparities between groups and similarities within the same group because of their strong identities (Terry et al., 2001). Creating a shared identity proved difficult. For the psychological safety items, the two members of Case 1 that responded negatively were either from a smaller firm or the only one from a particular firm and, therefore, naturally struggled to identify with the team's multiple sub-groups.

In contrast, the PBO of Case 3 had made a considerable effort to "tear down silos" to diminish the barriers between smaller workgroups. Casciaro et al. (2019) expressed that when employees can work outside their "silos" to collaborate, they "learn more, sell more, and gain skills faster." By removing the principals from workgroups, the office built bridges for collaboration to happen. Edmondson and Mogelof (2004) also note that when cross-functional relationships are encouraged and facilitated by organizational norms and structures, it leads to an increased sense of psychological safety. Additionally, leaders observed that the division between groups became less pronounced when the office transitioned to a virtual environment. This finding shows that the physical aspect of the work environment clearly impacted employees' classification and comparison of groups.

Case 2 had the same constellation of various project actors as Case 1. However, there was not the same level of intergroup conflict. As for Case 3, the design team did not have a physical interaction, which seems to diminish the strengthening of in-groups. As Weick (1995) described, individuals' perception of the work environment evolves through their sense-making, as they assess their interactions and observe peers and the environment for cues for how to behave. Therefore, the virtual environment likely impacted the intergroup social comparison process.

The effect of cultural values.

Social identity theory does not consider cultural values' effect on intergroup relations. However, what I believe happened in Case 1 was that in-groups became more substantial due to team members' existing organizational values that they brought with them from their employee firm.

A plausible reason for the misalignment between design team members' behavior and the leaders' desired culture is that team members' behavior is under the strong influence of the norms of their employer organization. These norms may be distant from the norms desired by the team leaders, such as speaking up and collaborating. The groups that dominantly influence

design team members' sense-making direct their behavior. The social identity theory supports this interpretation of the data.

In contrast, for Case 3, the support and actualization of organizational values brought the office closer during a crisis and mitigated the growth of intergroup conflicts and barriers to psychological safety. An explanation is that strong social capital is an antecedent of psychological safety, where social capital is "a web of quality relationships and interactions among members within a social collectivity (internal social capital) and between members of a collectivity with other participants in a network (external social capital) aimed at acquiring and creating useful knowledge" (Carmeli, 2007). Thus, intergroup relations have an important contextual impact on individuals' perception of psychological safety, and organizational values may strengthen it.

Notably, the finding in the article based on Case 3 (see Appendix B) showed that the capability represented in the organizational values influenced the choice of situation-appropriate leadership styles to support employees (Tvedt et al., 2023). This supports the notion that leaders play an important part in social learning.

Given the multiple and temporary nature of design team members' identities, these findings imply both a challenge and an opportunity to improve psychological safety in such groups. Team members' perception of psychological safety will be better aligned with the project's desired collaborative behavior if they have a salient project identity or diminish the strengthening of in-groups due to the group members' need to protect their self-esteem.

12.2.3 Supportive leadership behaviors

Given the earlier discussion on leadership behavior in the theoretical framework and how the leadership played out in the different case studies, it is not surprising that research supports the leader role as crucial in creating psychological safety.

As Figure 12.3 shows, all cases showed a form of supportive leadership. Leadership is a part of the explanation of why all three cases indicated the presence of psychological safety despite contextual barriers. Leaders can promote psychological safety by consciously implementing behaviors such as framing the situation, as Edmondson (2018) described. Framing involves setting the stage for a learning environment.

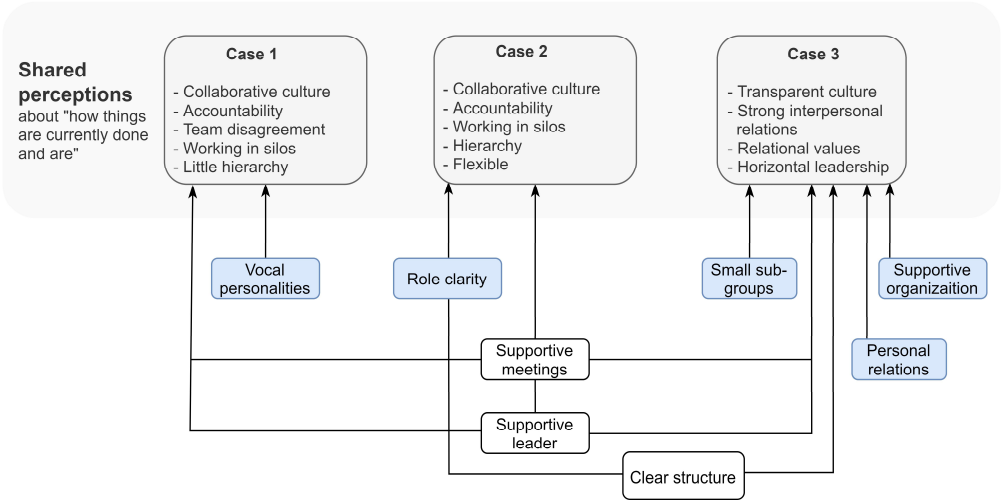

Figure 12.3: Contextual facilitators for psychological safety

Several leadership styles have been found to facilitate psychological safety (e.g., servant leadership, transformational leadership, ethical leadership, and change-oriented leadership). The Case 3-based article (see Appendix B) discusses the transformational leadership style's impact on employee resilience (Tvedt et al., 2023). These findings are related to the arguments made in the following.

As the leaders of the three case studies had different contextual situations and teams to lead, I will focus on the positive effects of their many supportive leadership behaviors – leader inclusiveness, coaching behavior, and participative leadership. These have been noted as key antecedents of psychological safety (Edmondson, 1999a; Edmondson, 1996; Hirak et al., 2012).

Leader inclusiveness.

As described in section 2.2, leader inclusiveness is a means to reduce power distance and thereby overcome disparity diversity. In Case 3, I observed the management actively practicing inclusive leadership, as defined by Nembhard and Edmondson (2006). Especially notable was the Managing Principal's (MP) attempt to ensure that all employees had the opportunity to be heard. Because they were dislocated, the leaders decided to introduce morning check-ins and call employees to invite them to voice their concerns. Leaders provided members the perception that their efforts to improve their strategy in facing the situational crisis were essential and that their suggestions for improvement were valued, although the office's current performance was undesirable.

In addition to accessibility and inviting input, Edmondson (2004) highlighted modeling for openness and weakness as an important leadership behavior to reduce status boundaries. By openly admitting to not knowing the answers, the MP of Case 3 showed that errors and concerns could be aired without the fear of repercussions. Furthermore, by being humble about the situational crisis, the MP became more available, lowering power distance, which Kahn (1990) emphasized as vital for reducing the anxiety of speaking up.

In Case 1, following the contractor merger, a new design manager entered the project with a fresh mindset, which altered the team's climate. One explanation, among others, is that team members observed how the new leader demonstrated openness and weakness rather than authority. This may have altered their perceptions of taking interpersonal risks. The design manager (DM) was humble and asked for help from the team when he needed it. Leader behaviors demonstrating openness and weakness can encourage team members to seek assistance themselves (Edmondson, 2004), which the team members were observed doing. I did not observe the same level of inclusive leadership in Case 2.

To achieve a learning orientation towards mistakes and failure, leaders must promote a culture tolerant of speaking up about concerns (Hirak et al., 2012). The two TPOs had a time pressure and need for decisions that differed from the PBO, which impacted leaders' prioritization of giving all time to speak, for example, in design meetings. My impression, especially for Case 2, was that asking for input was limited and out of necessity for the teamwork to progress.

Coaching behavior.

As described in subsection 12.2.1, variety diversity created barriers to the development of psychological safety. Kim et al. (2013) described how coaching behavior aid in handling such diversity. To mitigate the effect of the multiple roles and actors, the two TPOs needed clear assumptions about responsibility and roles.

Team members in Case 2 perceived clear role responsibilities, as shown in Figure 12.3, but role ambiguity produced tension and promoted in-group behaviors in Case 1, as shown in Figure 12.2 (p.242). It was not a matter of accountability but of whom to contact for feedback and collaboration due to overlapping responsibilities.

One source of role ambiguity in Case 1 was the leader's lack of structure. Uncertainty about one's role and responsibilities in a team can harm learning behaviors (Kahn, 1990). A climate of psychological safety is not free of structure; however, it is one in which commitment feels safe since failing and seeking help is perceived as acceptable. A structure that encourages people's participation might improve their sense of safety by making it transparent to everyone what is expected of them.

In contrast, leaders in Case 2 had strong task orientation. According to Gottfredson and Aguinis (2017), when leaders establish clear goals and objectives, psychological safety is more likely to develop since followers understand their expectations. This explains why separation diversity became more challenging for Case 1 than for Case 2.

Relatedly, the MP in Case 3 saw a need to connect employees, a behavior that Edmondson (1999a) expresses as essential to avoid the threshold of speaking up. The MP's way of structuring meetings gave employees a platform to express their concerns and a place for the management to inform. Thus, it was a necessary change to mitigate separation diversity, as defined in subsection 4.3.1. The effect of the adhesive leader behavior seems to be collaboration happening without the managers' assistance (Casciaro et al., 2019), as seen in the peer support initiated by the employees.

Transparency is essential for effective coaching. Leaders must clearly communicate their decisions and be receptive to feedback. In a highly virtual setting, exchanging information can be difficult (Feitosa & Salas, 2021). Transparency was evident in Case 3, which helped employees better understand the new virtual work environment that the company faced.

Transparent leadership behavior was proven to be substantially different in the TPOs than in the permanent organization. There are various reasons for this, including consideration of stakeholders, contracts, and economics. In Case 1, there were intergroup conflicts, and I believe that one of the reasons why in-groups were arguing was because they had differing expectations of how the temporary organization would appear following the merger. Differences in expectations may be the result of leaders' lack of transparency despite their desire to adopt an "open book policy."

Participative leadership.

In Case 3, participative leadership was one of the essential behaviors in fostering what I observed to be an organizational climate of psychological safety. There were multiple levels of leadership to ensure that employees were taken care of and that ongoing projects were followed up on. Importantly, there was trust between leaders and middle leaders regarding information sharing. Furthermore, management actively included employees in decisions about changes made to work processes. To keep up with the changing market, leaders clearly formulated that all employees needed to do this. Including employees in planning has been found to increase their perceptions of psychological safety as individuals may have control over their work (Kahn, 1990).

Regardless of where they are in the hierarchy, leaders are disadvantaged in facilitating psychological safety because of their positional power (McKinney, 2020; Nembhard & Edmondson, 2006). Therefore, it was equally critical that middle leaders modeled inclusive

and coaching behaviors. Upper management indicated trust in the various levels of leadership, even during the crisis, when both their organizational culture and the industry were changing.

Participative leadership was crucial in Case 3 but not so much in the other two TPOs because it is a time-consuming method that is not suited to quick turnarounds. Both design teams had levels of leadership, but participative leadership was more visible in trusting the various actors and team members to perform their responsibilities and respecting their expert opinions.

12.2.4 Supportive context

The contexts in which interpersonal and intergroup relations played out in the PBO and the two TPOs were quite different. As shown, the team composition and task design caused more severe barriers to the development of psychological safety for Case 1 than for Cases 2 and 3. Support can come from peers and the organization (Frazier et al., 2017); thus, perceived support may be influential in both types of interpersonal climates, despite Edmondson's (1999a) findings that it has a limited effect.

The explanation as to why contextual support impacted psychological safety in the cases may be found in section 4.4, concerning the development of perceptions. To summarize, psychological safety is a function of people's sense-making of a situation and a shared perspective because people are exposed to the same experiences (Edmondson, 1999a). Employees and team members' perceptions of aspects of the organizational context evolve as they assess their interactions and observe peers and the environment for clues about acceptable behavior and organizational values and norms (Weick, 1995). According to Weick's sense-making theory, individuals are sensitive to how an organization treats them.

Peer support.

I found peer support to be more requested in the virtual work environments for Cases 2 and 3. A plausible explanation is that peer support helps employees network with each other, increasing resources (Singh et al., 2018) despite them being dislocated. Especially accountability and accessibility, which are important components of peer support.

For team members to feel safe about taking interpersonal risks when working remotely, they needed to feel a sense of working together, where everyone pulled. Similarly, Weiner et al. (2021) found that individuals with high psychological safety also reported receiving clear messages about accountability as it promoted adaptability. Accountability in itself has been argued to be the mediating effect between psychological safety and productivity and incompatible with psychological safety (Edmondson, 2012a, 2014, p. 129). However, McKinney (2020) found that it also promotes psychological safety. I found it to be closely related to trust in Cases 2 and 3. While being dislocated, accountability evolved from a means of maintaining cooperation to a tool for supporting progress and providing information.

Furthermore, being available and being accountable were inextricably linked. In Case 2, team members stated that their peers needed to be available, as it provided trust and allowed them to be included in the information. Psychological safety is a team feature, and some team members may be able to help it thrive. This argument implies that it can be accommodated in a virtual work environment since it can be assisted by those who have the capacity to do so by being available and accountable.

In Cases 2 and 3, I found that employees' already-established relationships helped them when being dislocated. In Case 2, they had already spent a considerable amount of time working on collaborating with technology, which appears to relieve some of the pressure when it was the only alternative. Nonetheless, Case 3 profited more from pre-existing peer networks than Case 2, which is elaborated on in the case-based paper in Appendix B. This discrepancy is naturally caused by the temporary character of the TPO, as opposed to the permanent nature of the PBO (Packendorff, 1995). A PBO is impacted by having a history and a future, whereas this influence is minimal or nonexistent in a TPO.

According to social learning theory, employees must observe their environment to determine how to behave according to expected norms (Bandura, 1977). Having already been through phases of getting to know each other may have created the norms that mitigated the lack of social cues in a virtual workspace. In comparison to Case 2, employees of Case 3 used digital platforms to facilitate their relations during the crisis. Such behaviors that increase organizational identity have been proven to facilitate psychological safety (McKinney, 2020; Singh et al., 2018). The finding strengthens the notion that personal relationships and trust facilitate psychological safety, as Carmeli (2007) found.

Perceived organizational support.

The supporting business organization's assistance of employees and leaders throughout the COVID-19 epidemic was a key finding in Case 3. The organization had a set of cultural values as well as the purpose of perpetuation, which guided the management and leaders to prioritize its people over profit. The perspective of how organizational values influenced the choice of situation-appropriate leadership styles may be found in the article in Appendix B.

The office culture had been put to the test when the company faced prior difficulties, but the cultural ideals persisted. Thus, the deeper cultural layers of values and basic assumptions (Figure 12.3, p.249) offered stability for employees and leaders in Case 3. The theory of perceived organizational supports what I observed as contextual support for psychological safety. As described in section 2.2, Singh et al. (2018) findings support the notion that organizational practices supported the development of psychological safety.

Based on social exchange theory and the principle of reciprocity, explained in subsection 4.4.3, individuals will adopt attitudes and behaviors expected by the organization when feeling

supported by the organization (Sun, 2019). I believe this happened in Case 3, where employees started to improve their work situations and connect on their own initiatives.

Schein (1985) posed the question of what role culture plays in the group. I believe that the stable culture in Case 3 supported employees, and as a result, they behaved in accordance with organizational values that encouraged psychological safety from the bottom up. Thus, an explanation for the perceived resistance of the organization during the crisis was employees' perceived organizational support and how it created a safe environment for interpersonal risk-taking.

Although the TPOs lacked the stability of deeper-layered cultural values and assumptions, team members could sense and assess how the organization chose to handle disputes. For example, when the collaboration in Case 1 became unsatisfactory, it was determined to bring in a new design manager. From the team members' view, the corrective action may have created a scenario where perceived organizational support positively affected their psychological safety. As described in section 2.2 and explained by Rhoades & Eisenberger (2002), individuals tend to humanize organizations; therefore, leader behavior may be attributed to the organization. Nonetheless, the new design manager was engaged by the contractor, which might be detrimental to team members in other in-groups' perceptions of being treated equally. This could be one of the explanations for the aftermath of the merger.

In Case 2, leaders displayed concern for team members during the crisis and took more time in meetings to learn how everyone was feeling, demonstrating an interest in team members' well-being, which may have helped team members connect with the design team.

Despite the fact that both TPOs had an acceptable communication process and employees felt they had access to the information required to complete their tasks, team members had a weaker link to their teams than observed in Case 3. One possible explanation for this is that diversities cause boundaries in the social network and, thereby, less cross-disciplinary peer support. As described in section 2.2, peer support may help employees network, which increases resources and therefore has a more substantial effect than organizational support on psychological safety (Singh et al., 2018). The need to belong to the team may not be as high for design teams as for a permanent organization. Nevertheless, interpersonal relations and group dynamics are central for psychological safety to develop (Frazier et al., 2017; Kahn, 1990).

Project delivery model.

Both design teams struggled to create trust among project actors, which could be attributed to how delivery models formed the social network. The argument is that delivery models regulate how actors interact and whether there are shared risks and profits (Lahdenperä, 2012).

Case 1 was designed to have close collaboration among the main actors. The mismatch between the expectations of collaboration and the way the delivery model evolved by employing a main actor later than the rest created tension. Also, because of the timing of their involvement, certain actors were more closely related. Case 2 also had contractual structures that directed their collaboration. However, compared to Case 1, the design team did not have visible intergroup disputes or struggle to establish trust.

TPO culture, including norms, often reflects the delivery model (Packendorff, 1995). Perceived organizational support may be more difficult to build in TPOs since team members may not have the time or resources to build strong ties to the design team, and there are limitations to what can be done to improve that due to how the construction industry network works. For instance, reward programs and promotions (Rhoades & Eisenberger, 2002)

According to the literature on psychological safety, structural components, as represented by PDMs, may only indirectly impact psychological safety. However, as demonstrated in the discussion of how intergroup relations challenged psychological safety owing to diversity and boundaries, there are lessons to be learned about increasing perceived organizational support in TPOs. If Case 1 had developed stronger policies and strategies that contributed to positive beliefs and attitudes about the teams, as Rhoades and Eisenberger (2002) recommended, the merger might have gone differently. Thus, there must be some constellations of TPOs that optimize perceived organizational support. Even if the goal is not to emotionally commit design team members to the project, there are advantages to showing support through approval, respect, access to information, and other forms of assistance in carrying out tasks.

Chapter 13
The Relation between Psychological Safety and Digital Mindsets

This chapter exploring the relation between psychological safety and digital mindsets is structured into two sections. The first section covers the discussion of RQ3, and the second focuses on the discussion of RQ4. The discussions that follow are limited to Cases 1 and 2 because Case 3 did not cover this research purpose.

13.1 Shared facilitators and barriers

Both cases showed a high level of psychological safety and positive digital mindsets. Thus, in this section, I will compare the results and discuss *RQ3: To what extent do a high level of psychological safety and a high level of digital mindset occur together?*

Many of the contextual influences that I described as impacting psychological safety also directly impacted team members' digital mindsets, as demonstrated by the within-case studies. In the following, I discuss the differences and similarities regarding the impacts of diversity, supportive leader behavior, and a supportive context.

Diversity.

In theory, digital tools are resources that connect and enhance collaboration. However, as for psychological safety, team composition challenged the support of different types of digital mindsets, especially expandable-sum beliefs, in using tools.

Variety diversity, individuals' different digital expertise in this setting (Harrison & Klein, 2007), was evident in both cases as disciplines used different technologies to perform their tasks. Working differently and having varying degrees of skills may strengthen the in-group behaviors described in social identity theory (Dragoni, 2005), as it was another characteristic that differentiated identity groups.

The consequence was reciprocal; team members with a fixed*expandable-sum mindset had to seek assistance from those working in the same tools, which generally were team members

from the same firm or discipline. Thereby, resources in the design team as a common group were perceived as limited, accentuating the distinctions between identity groups.

Furthermore, as explained in social identity theory (Tajfel & Turner, 1986), intergroup relations can turn into a zero-sum game about resources, where the gains by one in-group would come at the expense of another (Stefaniak et al., 2020). For example, changes in power or access to resources would disrupt the current social network, where in-groups see a need to compete. Sirola and Pitesa (2017) found that this can decrease employees' help-giving behaviors. In Case 1, the contractor's merger disrupted the design team's established network. Some team members felt their way of working and technology were not understood or appreciated. I believe it stemmed from in-group tendencies that strengthened zero-sum beliefs, an "us vs. them" mentality, as illustrated in Figure 13.1. The team's decision not to utilize the hotel project provided by the contractor suggests that members who were part of the team before the merger were sticking to their original approach to technology usage.

Despite the intergroup tension in Case 1, there were no competing behaviors due to technology. In Case 1, it was clear that team members saw the advantages of technology. What was happening was that help-giving behaviors were less present, similar to the findings of Sirola and Pitesa (2017).

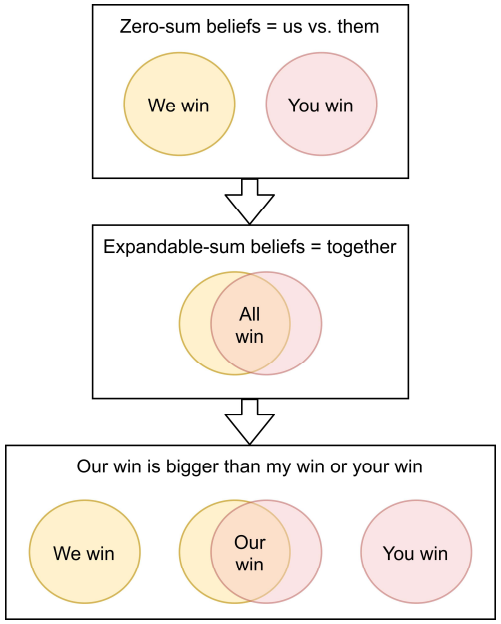

Figure 13.1: Combination of zero-sum beliefs and expandable-sum beliefs

The opposite would be an expandable-sum game where positive perceptions of intergroup relations should lead team members to believe that gains for one group are not harmful to the

rest of the team (Stefaniak et al., 2020). Holding expandable-sum beliefs about technology makes individuals more likely to support digitalization strategies, and it manifests in action that aims to change the social system, such as collective action to aid others in handling the technology (Sirola & Pitesa, 2017; Solberg et al., 2020). This is similar to what happened in Case 2, where there was less in-group tension than in Case 1. Case 2 came to the last step in Figure 13.1, where collaboration could happen, although actors had different digitalization ambitions. Team members experienced that technology was a resource, which mitigated the effect of location barriers on the team's productivity and collaboration.

Therefore, beliefs about resources may partially stem from in-group identification, which explains why diversity had a negative impact on the shared positive digital mindset in Case 1 but not in Case 2. This reinforces my point that creating a psychologically safe environment can reduce intergroup tension and enhance the idea of expandable-sum beliefs.

Supportive leader.

The supportive leader behavior was one of the explanations as to why Case 2 handled technology variety diversity. What distinguished Case 2 leaders from Case 1 leaders was their approach to framing technology as a learning opportunity. According to Dragoni (2005), leaders can influence followers' sense-making by setting priorities and modeling behavior. This, I believe, occurred in Case 2. The two design team leaders set clear expectations for how the team should interact with technology, which assisted team members in aligning their perceptions of the situation with the actual technological objectives. It may also have avoided circumstances in which team members thought their skills were being tested, which can confirm and strengthen fixed mindsets (Dweck, 2007). As mentioned, individuals tend to fill in the blanks when there is not enough information to decide how to behave (Kim et al., 2013; Weick, 1995). In contrast to Case 1, leaders of Case 2 outlined how actors worked digitally and adjusted the strategy thereafter.

Framing is also about being a role model (Edmondson, 2003; Solberg et al., 2020). For example, the DM in Case 2 was enthusiastic about using the collaborative program Bluebeam and provided team members with guidance to master it. The effect was that team members were supportive, and through the project, several learned how to use it. The finding is similar to Dragoni's (2005) finding that leaders with a learning goal orientation influence followers' preference for learning and mastery, equivalent to a growth mindset. Again, social learning theory supports this notion.

Case 1's ambitions for the team's digitalization level were higher than Case 2's and expected sophisticated collaboration with BIM usage. Individual mindsets are influenced by the framework created by leaders' expectations and team goals (Solberg et al., 2020). The DM and the PM were supportive of the digitalization strategy but lacked the necessary skills to assist

team members. Because they were inept at aiding team members with digital technologies, they were aided by BIM managers with learning-oriented mindsets, which I believe were perceived as a resource and part of the organizational support.

Supportive context.

For both Cases 1 and 2, team members displayed fixed mindset tendencies. Having team members with fixed mindsets did not seem to be a problem in itself in Case 1; however, it was challenging when seeking help was limited to in-groups and did not happen in the intergroup.

Even though it may be challenging to facilitate, I witnessed resources in both cases that alleviated situations where team members were challenged with their beliefs about the need to prove themselves. For example, in Case 1, BIM managers were hired to modify files and help team members so that all drawings could be assembled in the same digital model. The BIM managers were considered a resource available to design members to achieve the project's objectives. This is one viable alternative for assisting team members with fixed mindsets.

Furthermore, active use of the BIM model in Case 1 taught team members about cross-disciplinary solutions, and the majority expressed support for the digitalization approach. Learning about various disciplines can also aid the development of psychological safety since it allows for a better awareness of the contributions of others, which can lead to greater respect (Carmeli & Gittell, 2009). However, some believed that technology created barriers to information access. The circumstance caused a perceived lack of organizational support and exacerbated the tensions between the project actors.

In contrast, for Case 2, the use of Bluebeam and the digital review process provided information while facilitating collaboration through transparency. In this case, digital collaboration seems to eliminate some of the traditional effects of silos that produce knowledge vacuums, minimizing the effect of diversity. Also, access to resources and information is essential context support for developing psychological safety, as it may diminish insecurity and defensiveness in a team (Edmondson, 1999a).

When comparing the two TPOs to the literature on digital mindset, I found that the team constellations did not provide opportunities to benefit from team members' positive digital mindsets fully. To benefit from individuals with growth*expandable sum mindsets, Solberg et al. (2020) suggested that there should be opportunities for them to act as change agents. As Case 1 had tight collaboration, several occasions were provided for team members to assist peers. Some with growth*expandable-sum beliefs behaved as change agents, but these behaviors were also connected to their role, such as BIM managers. The findings of both cases speak in favor of team members relying on their own beliefs about their capabilities to follow the projects' digitalization strategies.

In summary, both psychological safety and positive digital mindsets are challenged by the diversity seen in TPOs. The consequence of the team composition is that leaders have little flexibility to provide resources, and thereby there is a lack of perceived organizational support.

13.2 Psychological safety antecedent to digital mindsets

As described above, several similar contextual factors create psychological safety and positive digital mindsets. The question remains whether psychological safety may facilitate the development of positive digital mindsets. In this section, I intend to discuss RQ4*: What characteristics of psychological safety are associated with mechanisms that enable a digital mindset?* To answer the question, I will circle back to individuals' sense-making of the context, described by social theoretical perspectives.

As Edmondson (2003) described, individuals will interpret the benefits and challenges of digitalization differently, as they did in Cases 1 and 2. I cannot say how much it was due to the project or other individually related reasons. Nevertheless, individuals' sense-making of digitalization is impacted at several stages in developing organizational culture and team climates, according to Weick (1995) and Schein (2010). This is because digitalization does not happen in isolation but in interpersonal relationships and social networks (Schallmo & Williams, 2018). Therefore, as proposed in the introduction and Figure 1.1 (p.6), if a team climate inspires collaboration and learning behaviors, there will be possibilities to enhance positive digital mindsets.

Having perceptions of being safe to take interpersonal risks was proven to aid positive digital mindsets in both case studies. For Case 1, characteristics of psychological safety (norms) such as collaboration, engagement, and experimenting were important facilitators for team members' digital mindsets. Case 2 showed the same results, but also help-seeking and flexibility were essential to change their work processes when the pandemic altered their work situation.

Facilitation of both growth and fixed mindsets.

Individuals with a growth mindset are more likely to believe in their ability to learn new technologies and be prepared to face challenges during the learning process (Solberg et al., 2020). As a result, it is reasonable to think that individuals with a growth mindset and who are exposed to a climate of psychological safety are more supportive of new challenges posed by digitalization.

According to the data, there were also team members in both cases who displayed evidence of fixed mindsets, despite having an above-average level of psychological safety. Fixed individuals tend to regard a situation as either successful or unsuccessful (Dweck, 2007,

p.11). Thus, fixed mindsets rely more on a support system to avoid turning away and not seeking help, as seen in both design teams.

For example, the coaching team climate of Case 2 aided team members in learning how to work together with software that was new to most team members. They showed support for digitalization because they felt they could seek help from the DM, and that insight from peers helped them master the program. The expectation of needing to use the software and the knowledge that the team considered it a learning opportunity may have aided the learning process. It was noteworthy that team members described going through a learning process, learning the tool, and then supporting it.

Compared to Case 2, Case 1 had high digitalization objectives, but the sense of mastery was not as strong. The BIM managers offered assistance, but there was minimal training and support to encourage growth mindsets. Learning technology appeared to be on the side of the learning climate that was evident in the team. As previously stated, in-groups hampered collaboration and influenced how team members perceived learning.

Facilitating expandable-sum beliefs.

Team climates also provide clues that either enhance zero-sum beliefs or expandable-sum beliefs. Individuals with expandable-sum beliefs tend to seek collaboration, as they see success as being achieved through collaborative networks (Solberg et al., 2020). I observed this in Case 2 when team members were forced to transition to a virtual work environment, and some had to adjust their way of working. It was a form of disruption, as tools became more essential than before to facilitate the interdependent team network, and they had to learn new ways to collaborate. As they could not meet physically, they were even more dependent on trusting the work and skills of their team members. It did not come without hurdles, and some felt that they were left out of receiving information. Still, the coaching culture aided expandable-sum beliefs, seen in their help-giving behavior. The fact that zero-sum beliefs did not strengthen during the use of home offices strengthens the arguments that there were perceptions of psychological safety with trust and respect.

Similar to the findings of Case 2, Sirola and Pitesa (2017) found that economic downturns created zero-sum beliefs leading to employees withdrawing from providing help to peers. They further suggested that managers should restructure organizational support to enhance collaboration and help-giving and not competition. The interesting part of their study was that they suggested that the expandable-sum beliefs of success will go beyond the specifics of the situation. This means that when there actually are limited resources, team members will tend to collaborate for the benefit of the team. Beliefs play a vital role when one lacks the knowledge to deal with a situation correctly. This is why having expandable sum beliefs also plays an important part in developing and reinforcing psychological safety.

Facilitating positive digital mindsets.

Thus, my findings propose that social interaction (e.g., speaking up, collaborating, seeking feedback) enables social cognition (individually held digital mindsets). The argument is displayed in Figure 13.2, which has been supported by, for example, De Jaegher et al. (2010). They revealed that interactive processes play a more significant role in social cognition than just providing context; they can enhance and even substitute for individual mechanisms. The figure supports the three first assumptions posed in the introduction (p.6) and illustrated in Figure 1.1; that psychological safety serves as a foundation for creating support for digitalization through positive digital mindsets, which is a precondition for successful digitalization.

The strengthening of growth*expandable-sum mindsets is highly related to having a climate of psychological safety from the case study findings. The findings mean that a climate of psychological safety where individuals speak up, experiment, and collaborate will impact team members' beliefs about their ability to learn and that collaboration expands success. The opposite would be a competing and judging climate, as found in Sirola and Pitesa's (2017) study.

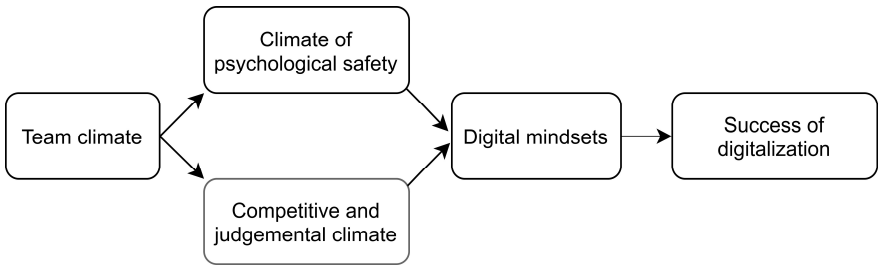

Figure 13.2: Team climate's effect on digitalization success

Even though Figure 13.2 illustrates what happened in the case studies, the presented findings suggest that the relationship between psychological safety and positive digital mindsets is more complex than shown. As described, psychological safety strengthened the positive sides of team members' digital mindsets (growth mindsets and expandable-sum beliefs) because it is a learning- and innovative-oriented team climate (Edmondson, 2004). However, according to implicit theory and social cognitive theory, team members had different levels of growth vs. fixed mindsets and expandable-sum vs. zero-sum beliefs before they were engaged in the projects (Dweck, 2012; Solberg et al., 2020).

Reciprocal relationship.

I found that there is a reciprocal relationship between the two concepts. As described in the theoretical framework, learning from failure is one of the most researched outcomes of

psychological safety (Newman et al., 2017). For learning from failure to happen, team members must have perceptions that they and their peers can learn and alter their minds, or else the motivation for taking interpersonal risks disappears. Positive digital mindsets are not the same as being proactive, but individuals with growth*expandable-sum mindsets are more open to change and have a collaborative motivation (Solberg et al., 2020), which will lower the barrier to developing psychological safety (Edmondson & Mogelof, 2005).

For example, in Case 2, team members rapidly changed their behaviors when the pandemic changed their work situation. Their success in doing so depended on their technologically expandable-sum beliefs. Based on these findings, I will go as far as to claim that expandable-sum beliefs impacted team members' perceptions of psychological safety. This argument is similar to Edmondson's (2004) description that equal resources can reduce team insecurities and defensiveness and positively impact psychological safety. Essential for my argument is that the beliefs about, and not actual resources, impact psychological safety according to sense-making theory (Weick, 1995). For example, the case studies demonstrated that team compositions impact how resources are perceived, and it was not necessarily the correct representation of the situation. Similarly, according to social theoretical perspectives and theories about culture and climate, individuals' perceptions guide their behavior, not the actual situation.

Similarly to this reasoning, Detert and Edmondson (2011) found that implicit theories supplement psychological safety in explaining the variance in voice behavior, which brings me to the next argument. In accordance, I argue that implicit theories about learning and perceptions about resources support psychological safety to explain why individuals behave as they do toward digitalization. If there is no belief about success being reached through collaborative networks, then why should individuals tend to speak up and seek collaboration in the first place?

Kane et al. (2017) suggested that an organizational digital mindset is equivalent to an organizational climate supporting digitalization. I found the same tendencies in the two TPOs. The findings from the within analysis indicate that a growth*expandable-sum oriented climate is much similar to that of a climate of psychological safety. That is why the same contextual effects on individuals' beliefs about handling and learning technology are similar to those that impact psychological safety. Both concepts rely on supportive leaders and perceived organizational support. Therefore, both concepts could have high levels due to what Edmondson (2003) describes as framing teamwork as a learning situation.

Solberg et al. (2020) described that leaders can frame digitalization as a learning opportunity and emphasize opportunities that activate growth mindsets and expandable-sum beliefs. Through role modeling, leaders transmit their priorities and mindsets to team members (Dragoni, 2005). In Case 2, the DM's positive digital mindset impacted team members' digital

mindset and psychological safety. By being positive and coaching oriented, he gave members the impression that he believed that they could learn. More importantly, he gave them the resources to do so through training and being approachable. Being approachable and sensitive to team members' needs are also supportive leader behaviors that lower power distances and increase psychological safety (Edmondson, 2004). This finding suggests that leaders' digital mindsets may be more significant for directing digitalization than individually held mindsets. Social theoretical perspectives, such as social learning theory and social exchange theory, confirm this notion.

Based on the presented reasoning, I have combined the findings of the relationship between psychological safety and digital mindsets (Figure 13.2, p. 263) with the logic of how culture and climates develop (Figure 4.1, p.51) into Figure 13.3. The figure illustrates some limitations to the initial assumptions behind the two first steps in Figure 1.1 (p. 6).

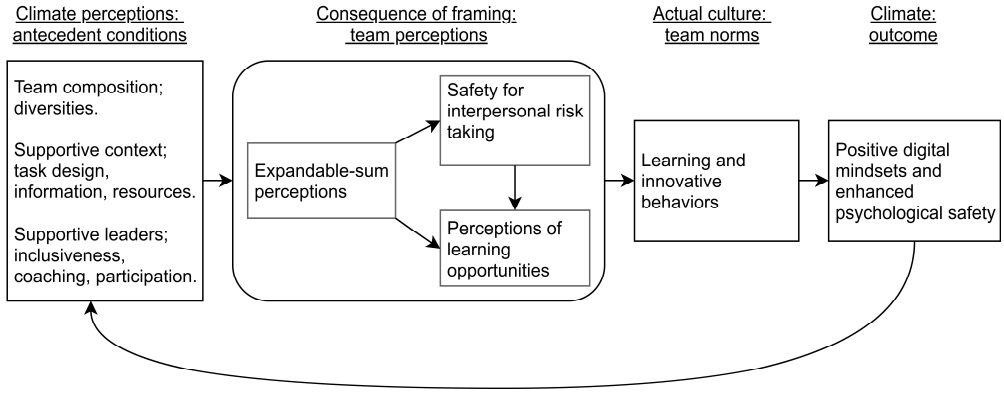

Figure 13.3: Psychological safety and digital mindset from a climate perspective

Thus, the most significant antecedent for positive digital mindsets was shown to be framing the setting as a learning environment. Notably, as Schein (1996) stated, change is managed learning, and according to Frazier et al. (2017), perceptions of safety can lead to learning and innovative practices. In the case studies, psychological safety was a catalyst for positive digital mindsets and, thus, for learning and collaboration. This is shown by the arrow pointing back to the antecedent conditions in Figure 13.3. Social learning theory supports this argument.

Solberg et al. (2020) emphasized the importance of creating a unified approach or a common mindset among team members to deal effectively with digitalization. Based on the findings of the reciprocal relation and the parallels of contextual impacts, I argue that psychological safety facilitates the development of positive digital mindsets and that individually held beliefs are not as severe as team climate.

Even though Higgins et al. (2020) identify psychological safety as a catalyst for learning behaviors, it is driven by the antecedent conditions, as illustrated in Figure 13.3. More than just the correct climate and beliefs are required for behavior to occur; conditions must also encourage action and accountability. In Case 1, the diversity of mindsets paired with team composition increased the barriers to psychological safety by strengthening intergroup tension. The two case studies demonstrated, as with psychological safety, that there are limits to what leaders working in TPOs can do to allocate team members with more negative digital mindsets. This notion strengthens the arguments for providing a frame through supportive leadership and perceived organizational support to develop psychological safety.

In Case 2, there was a tendency to support the project's digitalization, but they opposed the industry's digital transformation. This finding supports the notion that team climates have an impact on individuals' digital mindsets and that there is value in promoting psychological safety in the interests of the specific project.

Chapter 14
Foundation for Digital Transformation

This chapter presents the discussion of the thesis's final question, RQ5: *Can the two phenomena secure that the preconditions for digital transformation are in place?* In the discussion, I extend the findings from chapters 12 and 13 to an industry level to explore if and why psychological safety and digital mindsets may serve as a foundation for a purposeful digital transformation of the construction industry.

In this chapter, I begin by addressing some limitations to the research question discussion. Then, I delve into a discussion of the research question through the lenses of STS. Finally, I examine the question through the perspectives of loose and tight couplings.

Notably, the two case studies on the relationship between psychological safety and digital mindsets are insufficient to answer the proposed research question fully. The study was limited to the design phase of the project life cycle; other phases will present other challenges. Nonetheless, this thesis gave detailed accounts of how two TPOs that appeared to be comparable on the surface faced the same challenges in ensuring a shared team digital mindset due to industry differences that generated collaborative boundaries. Therefore, it provides insights into possible facilitators and barriers to an industry transformation. Still, the discussion of this last assumption of Figure 1.1 proposed in the introduction (section 1.4) is an abstract theoretical discussion with the purpose of reflection.

In this thesis, I purposefully chose not to focus on specific digital tools, such as information and communication technology. This is because digitalization also includes leveraging several technologies, digitalized data, and processes (Schallmo & Williams, 2018). Furthermore, when considering the digital transformation of the construction industry, it also implies an entirely new manner of cooperating with other social networks (Bowersox et al., 2005), different from the current situation in the construction industry. As a result, knowledge about the mindset of the situation is crucial when placing it in the more abstract framework of digital transformation.

14.1 Socio-technical system perspective

The arguments as to why the two phenomena may be a piece of the precondition for purposeful digital transformation are discussed through STSs theory, explained in section 5.2. STS thinking is relevant to the discussion about the effect of psychological safety and digital mindset in the context of digital transformation because the theory focuses on the reciprocal relationship between technical and social conditions of work to reach optimization and development (Ropohl, 1999).

I have followed Trist's (1981) three leveled description of STSs to develop Figure 14.1 on the next page. The figure illustrates the construction industry as an STS, and it is based on the arguments that psychological safety and digital mindsets are preconditions for digital transformation. As Figure 1.1 (p.6) proposed, the foundation provided by the two phenomena may contribute to a purposeful digital transformation because it values technology and human factors equally. The inner circle represents design teams, the next level is PBOs and TPOs, and the last level is the industry network.

The design teams I have studied may be described as socio-technical systems at the micro-level, as illustrated in Figure 14.1. According to STS theory, the interaction between people and technology is a defining factor for the overall system's function. Psychological safety would be part of the social aspect of the socio-technical system. Digitalization and digital transformation would be part of the technical aspect of the system. Psychological safety is essential because using new technology is translated through learning, impacting individuals' digital mindsets as well as micro- and meso-level digitalization. Therefore, psychological safety is a vital group phenomenon in socio-technical systems.

Ropohl (1999) described that an STS could not completely be described at one level of hierarchy. Based on that argument, digital industrial transformation requires understanding its effect at any of the three levels, both technically and socially. Similarly, since a project organization or design team is tied to its environment, digitalization initiatives will only be fully successful if the impact on the whole system is considered. For example, changes to technology impact individuals' cognitive structures, which change parameters for organizational design and, in the end, alter society.

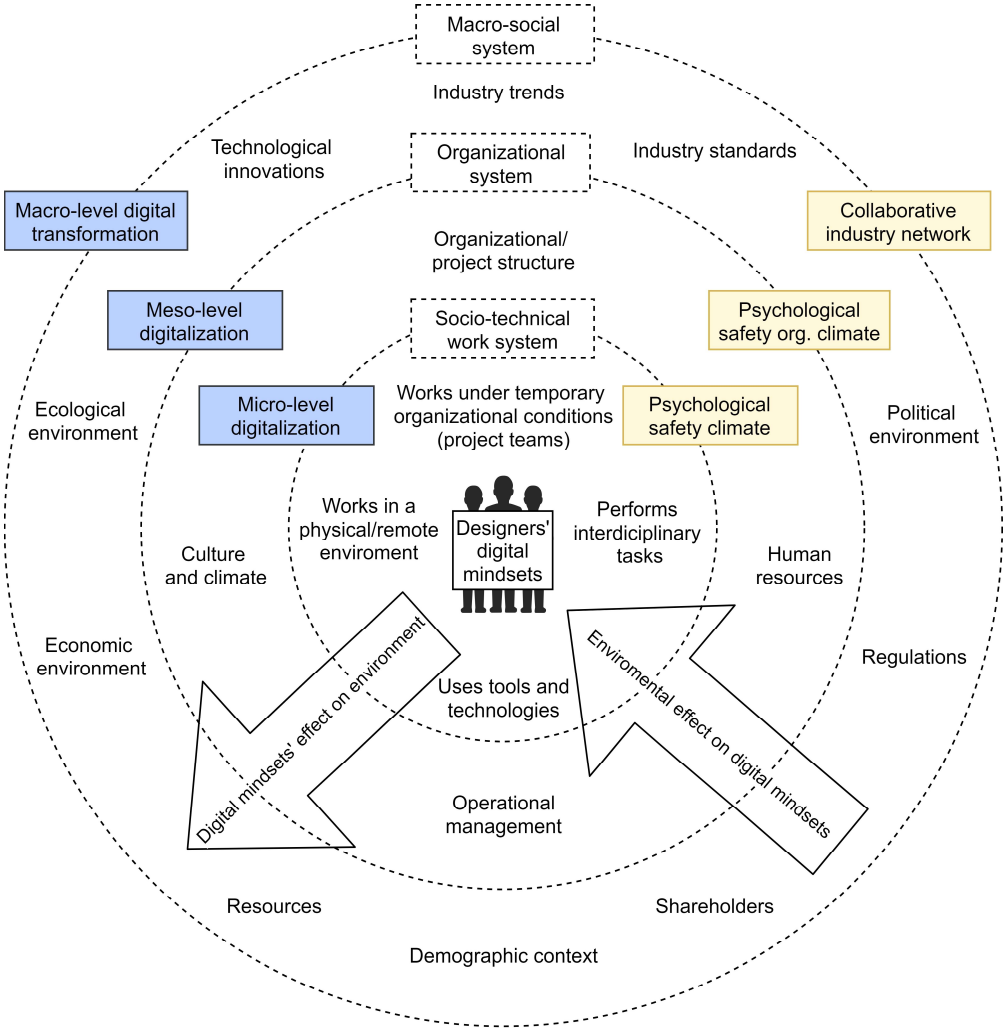

Figure 14.1: STS of research findings, inspired by Vorraber et al. (2019)

STS thinking implies that when we overemphasize the technical aspect of the system, we may end up with individuals feeling excluded and disengaged, similar to enhancing zero-sum beliefs and a lack of contextual support (Solberg et al., 2020). This may develop digital mindsets that encourage competitive and technologically avoidant behavior. For example, I found that age and experience impacted individually held digital mindsets in chapter 13. If new technology for the design phase implies all users to be digitally savvy, then a group may be discriminated against. When these individuals feel that technology threatens their sense of meaning, they feel powerless in a situation of complexity.

Davis et al. (2014) stated that people are too often ignored in STS. Similarly, despite the many listed benefits of psychological safety, Baer & Frese (2003) described that psychological safety

is often neglected in process innovation, causing the human side of socio-technological systems to be lost. This may lead to technologically driven implementations failing. Based on STS thinking, my argument is that when digitalization and psychological safety are equally prioritized in the system, the output of the socio-technical system would be optimized.

Digitalization is only the first step toward digital transformation (Schallmo & Williams, 2018), as described in the theoretical framework in section 4.2. In Cases 1 and 2, digitalization benefited from psychological safety, as it framed a climate for positive digital mindsets. The findings support Kane et al.'s (2017) claim: that mindsets are critical for an organization's digital maturity, considering team members expressed support for digitalization strategies. This knowledge has great benefits, as it creates guidelines for leaders to avoid negative consequences of disruptions in social networks (Edmondson, 2003) due to changes caused by digitalization.

Even though psychological safety creates a learning environment for digitalization within the work system, TPOs are still a system of actors where the salient employer identity (social identity theory) makes the balance between the human and technology, as shown in Figure 14.1, challenging to achieve. Also, as shown in the figure, a macro-level digital transformation requires a socio (human-related) and technical (nonhuman-related) industry-level system, and there must be a common industry goal (Sony & Naik, 2020), which means a collaborative industry network.

14.2 Loose and tight couplings perspective

The explanations as to why the creation of STS on several levels is challenging in the construction industry may be further discussed through the theory of loose and tight couplings, explained in section 5.3. The theory complements the arguments made from the lenses of social identity theory in subsection 12.2.2.

According to loose and tight coupling theory, TPOs and design teams are tightly coupled, whereas PBOs are loosely coupled. Gadde and Dubois (2010) stated that the loose connections in the industry determine the actions of firms. Furthermore, research has shown that there are limited interactions between firms beyond TPOs, which is a major obstacle to the digital transformation of the industry, as defined in section 4.2. Schallmo and Williams (2018) argued that digital transformation is likely to alter institutional boundaries, requiring firms to have a closer relationship than they currently do, as depicted in Figure 14.2. With the present situation, introducing boundary-changing technology to the industry without considering its impact on behavior could lead to social complications.

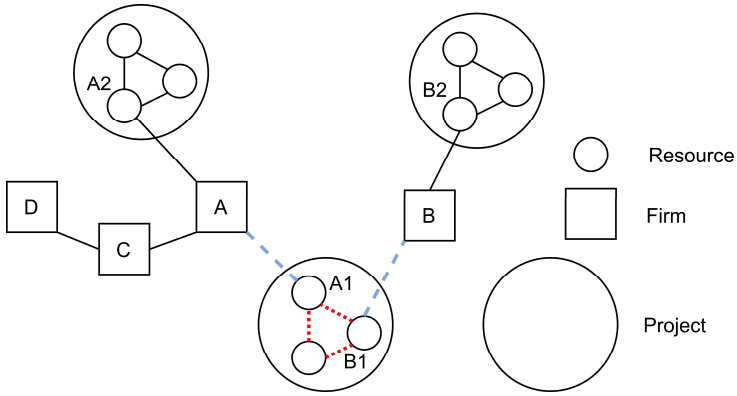

Figure 14.2: Couplings in the industry system, based on Gadde and Dubois (2010)

Another important consequence of loose and tight couplings is their impact on the formation of project climates. Going back to the team-level analysis in this thesis: social identity theory shows that individuals conceptualize themselves as members of a group that they find most salient (Tajfel & Turner, 1986). I found that design team members' strongest social identities most often were connected to their employer, as shown in the blue dashed lines in Figure 14.2. Team members' tight connection to their employers created barriers to developing team climates of psychological, thereby a barrier to developing positive digital mindsets. Therefore, the effect of couplings within the design teams did not pay off as much as it theoretically suggests, as shown by the red dotted lines in Figure 14.2. The problem occurs when the salient group identity is preserved but at the expense of the purpose of the common group (design team).

Furthermore, how the industry operates limits what leaders can do to facilitate different digital mindsets in design teams, for example, locating employees in different positions, providing mentorship, or creating common frames by working in the same programs. Assisting those with more negative digital mindsets is limited, as learning is not translated into nor connected to the industry network (Gadde & Dubois, 2010). As long as the industry continues to have the combination of loose and tight couplings, this will continue to be an issue.

As I mentioned, leaders need to strengthen intergroup ties to develop learning climates within design teams. This logic is similar to what Gohary and Karrbom Gustavsson (2012) explained about boundary action in day-to-day project activities. As shown in the discussion about STS, for the industry to benefit from technological advancement, there is a need to increase industry cooperation. Collaborative delivery models are a way to deal with the industry fragmentation that hinders the development of positive team climates in the design phase (Tvedt, 2019). Still, according to the theory of loose and tight couplings, it would be limited to the project and thereby not advance digital industry transformation.

The COVID-19 pandemic brought about consequences for society, one of which was that organizations had to adapt to remote work and transform their practices, similar to the changes seen in the digital transformation of the industry. When I asked informants in Cases 2 and 3 about what they would like their work to be like after the pandemic, they were reluctant to change too much. The differences between the cases illustrate the differences between a PBO and a TPO in digital change and open system theory. The management of the PBO had more possibilities to envision broader learning opportunities and therefore had a more optimistic view of the consequences of the digital disruption.

To sum up - when placing my findings in the context of loose and tight couplings, it becomes clear that providing psychological safety for design teams and the support that this climate serves for individual attitudes toward digitalization may not aggregate in the overall industry. The problem with mixed couplings is that it negatively affects the industry because project interactions do not provide long-term orientation or learning.

Because projects are STS, a closer connection must occur between a project and its environment to better link change to the workflow. Couplings are tightened in projects that use IPD, even though temporality still makes it difficult to establish long-term relationships (Tvedt, 2019). From this, it is evident that psychological safety is not enough for macro-level digital transformation, as shown in figure 14.1. For this to happen, there is a need to strengthen collaboration to enhance learning in the industry network. However, this is outside this thesis's scope to explore further.

Part 5
Conclusions

Notes

This thesis aimed to improve awareness of digitalization in the design phase of construction projects, particularly as it relates to creating team climates that prioritize support for digitalization strategies through positive digital mindsets. In order to do so, I set out to answer the following five research questions:

> *RQ1:* How do workplace practices influence what norms matter for the development of psychological safety?
>
> *RQ2:* What are the contextual factors impacting psychological safety?
>
> *RQ3:* To what extent do a high level of psychological safety and a high level of digital mindset occur together?
>
> *RQ4:* What characteristics of psychological safety are associated with mechanisms that enable a digital mindset?
>
> *RQ5:* Can the two phenomena secure that the preconditions for digital transformation are in place?

This part has one chapter divided into five sections. I begin by answering the research questions. Then, I detail this work's primary contribution to theory and practice. Following this, I outline limitations and then suggest avenues for future research based on the conclusions drawn in this thesis. Lastly, I share some personal insights from my Ph.D. journey.

Chapter 15
Conclusions

> "What is research but a blind date with knowledge?"
>
> Will Harvey
> American software developer

15.1 Answers to research questions

In the following, the answers to the five research questions are presented, adhering to the same structure as the prior discussion part of the thesis. The answers to RQ1 and RQ2 concerning the development of psychological safety are presented first. Subsequently, the answers to RQ3 and RQ4, which examine the relation between psychological safety and digital mindsets, are provided. Finally, the response to RQ5, addressing the foundation for digital transformation, is presented.

15.1.1 Development of psychological safety

Section 12.1 answered research question 1 – *How do workplace practices influence what norms matter for the development of psychological safety?* Based on the literature on psychological safety, I explored how norms evolve in the context of two design teams as part of TPOs and a PBO.

I found that design teams in construction projects have distinct workplace characteristics that influence what matters to the development of perceptions and climates of psychological safety. As they get involved in a project, team members' expectations influence their sense-making; for example, knowing that work relations are set for a short time affects the degree to which norms are expected and formed. Knowledge sharing, seeking, and providing feedback were discovered to be expectations that evolved into norms. As a result of how the studied TPOs were structured, working in a semi-silo manner did not result in negative perceptions of psychological safety, which contradicts existing literature. This is because when trust and respect between actors are present, the influence of silo work on psychological safety is mitigated, and when they are not, the negative effects are amplified. In contrast, there is more

need for adhesive behavior in PBOs, where closer peer relationships are expected to develop. Thus, norms that facilitate care for peers are more critical in PBOs.

I found that tight collaboration in TPO design teams is subject to conflict due to intergroup tension, which may promote norms that do not favor the development of psychological safety. A team climate with tight collaboration does not necessarily create a climate with learning behaviors like speaking up and innovative behaviors like experimentation, improvement, and creativity.

Speaking up was difficult in all cases, but it was discovered to be more vulnerable in virtual environments due to a lack of social cues that individuals employ in their sense-making of a situation. Large virtual meetings may be more harmful to psychological safety than physical meetings when equal voices are not structured. In these cases, explicitly displaying behavioral expectations is critical for characteristics of psychological safety to develop and keep their relevance.

In section 12.2, I explored research question 2 – *What are the contextual factors impacting psychological safety?* I compared Cases 1, 2, and 3 to identify similar and different contextual impacts that could explain the results concerning the documented climates of psychological safety.

I found structural elements such as task design, team composition, and context supports such as adequate resources and information positively impact the development of psychological safety. The main barrier to psychological safety in design teams was found to be the challenges caused by variety and separation diversity because it caused intergroup tension and, thus, knowledge barriers. Notably, I found that individuals' accountability and accessibility were critical for employees and team members in virtual work environments to guarantee that work was progressing and that they were included in the workplace.

Because TPOs lack the stability of deep cultural layers, which may aid the development of a superordinate common identity group, delivery models must be chosen and managed with caution because they have an impact on social structures. For example, when a central actor is hired months after the team has created a culture and hence a climate, it creates a new circumstance in which team members must engage in new sense-making processes. According to social identity theory, team members will then want to safeguard their existing identity by strengthening their in-group, leading to competition and prejudiced behaviors, as seen in Figure 15.1. The figure also illustrates what leaders may do to mitigate these effects through contextual interventions to achieve behaviors such as collaboration and knowledge sharing when the structural elements as part of the contextual impact are already set. To enable communication across identity barriers, the setting, organizational structure, and leaders must

encourage intergroup ties. This prevents the processes that strengthen the differentiation of in-groups and out-groups, which I found to impact psychological safety negatively.

As shown in Figure 15.1, the establishment of the design team as the superordinate common in-group would impact psychological safety. This is a goal for permanent organizations, as TPOs will have team members where the identity with an employer is more salient than the design team.

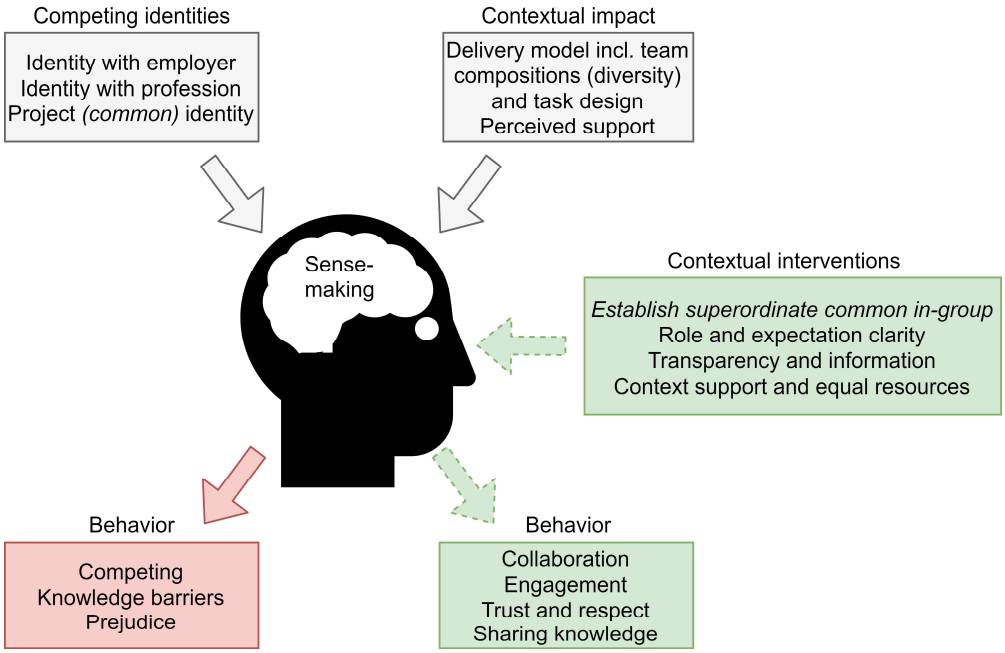

Figure 15.1: Effects on psychological safety in TPOs, inspired by Perera et al. (2021)

We find norms in a culture that tell us "how it is expected or implicitly required to do things". A contextual component that can aid this to enable positive behaviors in TPOs is for project leaders to be aware of how collaboration is played out and enabled. For example, roles are explicitly specified, and expectations are clarified. This can be accomplished through clear dialogue. Also, the way some meetings were structured in the case studies, which did not stimulate equal voice, had a significant negative impact on psychological safety. This is equally true for permanent organizations.

The contextual interventions in Figure 15.1 are management and leaders' responsibility. Both in temporary and permanent organizations, leaders who display inclusiveness play a role in cultivating norms that facilitates psychological safety. Being adhesive creates a sense of belongingness and encourages participation.

15.1.2 The relation between psychological safety and digital mindset

Research questions three and four are tightly connected and describe the relation between psychological safety and digital mindsets as a construct of growth/fixed mindset and expandable-sum/zero-sum beliefs.

In section 13.1, I compared Cases 1 and 2 to find the answer to research question 3 – *To what extent do a high level of psychological safety and a high level of digital mindset occur together?* I found that the existence of positive digital mindsets and psychological safety were interrelated. The explanation is that social cognitive processes impact both concepts. Team composition, supportive leadership, and supportive context had a direct influence on digital mindsets as well as psychological safety. Therefore, based on this study, I argue that high levels of both phenomena would most often co-exist when there are high ambitions for digitalization.

A challenge in TPO design teams is that leaders have little flexibility in supporting team members with less belief in their ability to learn, such as by providing learning opportunities. Individuals with fixed mindsets are more dependent on perceived support from peers and the context to adjust their behavior. In this case, for fixed mindsets and psychological safety to occur together, fixed mindsets must be combined with expandable-sum beliefs about resources.

In section 13.2, I compared Cases 1 and 2 to answer research question 4 – *What characteristics of psychological safety are associated with mechanisms that enable a digital mindset?* I found that a climate of psychological safety where individuals speak up, experiment, and collaborate will impact team members' beliefs about their ability to learn and that collaboration expands success. This is because such an environment inspires beliefs that succeeding will happen through collaboration (expandable-sum beliefs). Also, when individuals with less belief in their ability to learn (fixed mindset) felt psychologically safe, they managed to cope with and support digitalization strategies with the help of others.

Furthermore, I found the relation between the two phenomena to be reciprocal. I argue that implicit theories about learning and perceptions about resources support psychological safety to explain why individuals behave as they do toward digitalization. Individuals with growth*expandable-sum mindsets are more open to change and have a collaborative motivation, which will lower the barrier to developing psychological safety. Especially individuals' beliefs about resources (expandable-sum beliefs) impacted team members' perceptions of psychological safety. This is because believing that resources are expandable reduces defensiveness and insecurity.

An illustration of my findings is shown in Figure 15.2. When psychological safety is high, team members have a collaborative attitude, and vice versa. It becomes a learning zone when individuals also believe in and are aided in learning new skills. Digitalization is innovation, and as Schein (1996) expressed, change is managed learning. Therefore, there is also a need

for structural elements that aid learning and enable performance, expressed as accountability in the digital climate matrix. Psychological safety and accountability are not opposed to each other, but two distinct attributes of a work environment.

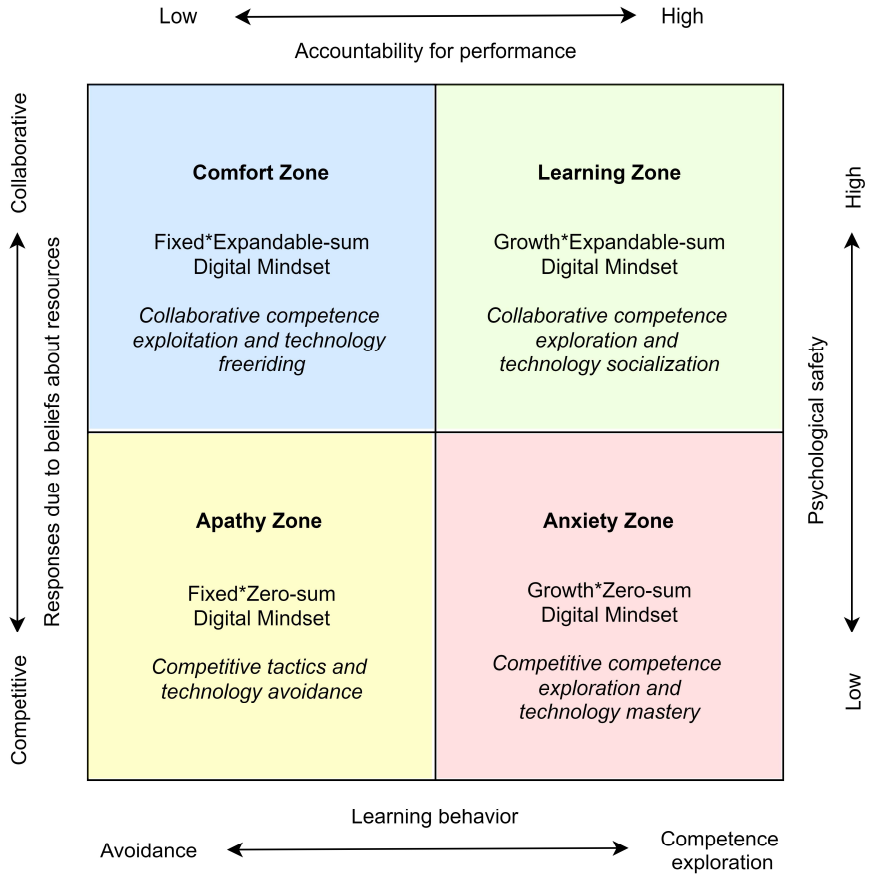

Figure 15.2: Digital climate matrix, based on Solberg et al. (2020), Edmondson (2012a)

Psychological safety was shown to be a catalyst for positive digital mindsets. Figure 15.2 suggests that organizations and leaders may focus on developing psychological safety, as it will aid collaboration (expandable-sum beliefs about resources) and learning (growth mindsets). This finding suggests that a leader's belief in and action towards employees' learning abilities and support in the work environment are powerful for individuals' adjustment to digital changes.

Thus, for leaders of TPOs, I propose an alternative strategy to making individuals aware of their mindsets to facilitate digital mindsets, as Solberg et al. (2020) proposed. My suggestion is to create climates for psychological safety. What makes psychological safety unique is that

it is a team climate phenomenon in which people give you the benefit of the doubt, which means it can support a person's beliefs about change from the bottom up.

15.1.3 Foundation for digital transformation

In the last discussion in chapter 14, I aggregated the team-level findings to an industry level. I viewed the findings through the theoretical lenses of loose and tight couplings and socio-technical systems and discussed research question 5 – *Can the two phenomena secure that the preconditions for digital transformation are in place?*

Viewing the findings through STS strengthened the arguments for psychological safety and digital mindsets as essential conditions of the social aspect of design teams as work systems. A climate of psychological safety cultivates positive digital mindsets, which provide employees and team members with the motivation to adjust their behavior in a situation of digitalization.

The loose and tight couplings theory helped explain how construction industry characteristics complicate the development of psychological safety within project boundaries. Also, I found that loose couplings of firms limit the benefits of learning environments in projects for a future digital industrial transformation.

Thus, the thesis' initial assumptions illustrated by Figure 1.1 (p.6) are partially supported by my findings. Psychological safety is a climate that fosters the required attitudes and support for digitalization, serving as a potential piece of the preconditions for digitalization. However, for the two phenomena to be a foundation for a purposeful digital industrial transformation requires changes to the collaborative network as it is today with loose and tight couplings.

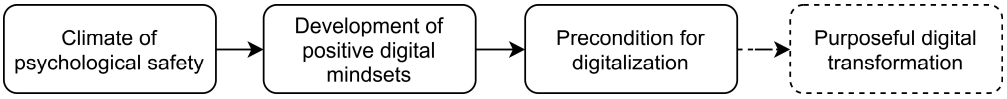

Figure 1.1 Research framework (from section 1.4)

15.2 Main contributions

The overarching goal of this thesis was to examine the relationship between team climates and human responses to digitalization in the design phase of construction projects. I opened up a black box concerning human responses to digitalization in the context of the design teams. I consider the following to be the main contributions of the thesis:

- A strengthening of psychological safety as a team climate construct
- Knowledge of the unique challenges that may arise in design teams in establishing learning team climates
- Guidance for leaders on how to focus on what matters most in framing learning environments
- Knowledge of how digitalization impacts team members, how it directs their behavior, and how mindsets may be facilitated to achieve support for digitalization strategies

In the following, I will elaborate on the theoretical and practical contributions of my work.

15.2.1 Theoretical contributions

RQ1 and RQ2 of the study contribute to the literature by showing how psychological safety is built and impacted by the specifics of design teams in TPOs compared to an organizational context within the construction industry. Findings on the contextual impacts on psychological safety contribute to the theory of the role of perceived organizational support in developing such a climate, which previously has been argued to have a limited effect.

I provided evidence of how a virtual work environment impacted team members' and employees' perceptions of psychological safety. The study is unique in that two of the three case studies happened during the unanticipated COVID-19 pandemic. Findings on the importance of established relationships and peer support in virtual environments are valuable for the field. The knowledge of the development of psychological safety in virtual teams expands the literature on psychological safety and on virtual teams. I argue that the findings are transferable to other occasions of remote teams and organizations.

RQ3 and RQ4 affirm the importance of psychological safety at the group level because of its reciprocal relationship to individuals' digital mindset, which affects digitalization strategies. That positive digital mindsets (growth*expandable-sum) can be enabled by psychological safety, according to my knowledge, has not been investigated before. These findings expand the theory of psychological safety and strengthen the theory of digital mindsets.

The study is unique in that it combines two theories previously unexplored in project management research. The logic of changing climates to succeed with change is widely recognized in organizational culture theory, and referring to this literature supports the

arguments for psychological safety as a tool for facing changes that digitalization brings to the construction industry. It also strengthens the theoretical understanding of construction projects as temporary project organizations.

Findings from RQ5 contribute to construction management literature by showing some larger problematic trends through system perspectives. This is an avenue for further research.

Drevland (2019) claimed that the field of construction management needs a stronger theoretical foundation. In this thesis, I have combined theories from other disciplines to broaden the toolbox for understanding design team climates, extending beyond the purely economic issues of scheduling and contracts. The findings add to the industry's understanding of "soft" management concerns that have received far too little attention.

There is also limited literature within construction management research on how to philosophically base and methodologically conduct studies of complex environments. In this thesis, I have detailed how a researcher's philosophical viewpoint influences methodological choices and how critical realism provides philosophical tools for studying human factors in complex systems like the construction industry. I also gathered data from a variety of sources, including leaders, team members, employees, documents, and observations, to reduce the possibility of same-source bias. This description may guide others in pursuing the same types of research objectives.

15.2.2 Practical contributions

As stated by Drevland (2019), a practical contribution is sometimes used to refer to tools and methods that can be directly applied to a purpose or task. Despite not producing a direct method, I argue that my findings provide guidance for industry practitioners to succeed with digitalization.

This study has practical implications in that project managers and owners must be aware of how team members' perceptions of psychological safety may be impacted, which is valuable in itself, and how the climate lowers barriers to learning and reduces negative conflicts. For example, project delivery models set the structure for the actor-network and what ties will have the benefit of a longer relationship. Whether or not they have high collaborative objectives, interaction within project delivery models must be managed and not just structured to benefit from diverse knowledge.

Relatedly, the thesis has practical implications for how leaders in design teams and PBOs can develop psychological safety. It clarifies that there are consequences for leaders' actions and that they can direct positive perceptions with followers, both in PBOs and TPOs. Based on the thesis, it can be deduced that the role of the leader becomes increasingly important as TPOs are, by nature, temporary and do not allow for the development of deeper-layered

organizational cultures. Also, this thesis suggests that organizations and leaders should inform employees that working remotely or with the assistance of technology is something that can be learned. The focus on framing work situations should be a management priority and not up to individuals, as there are combinations of many mindsets within a team or an organization.

What leaders need to do when framing the work in a complex project environment is to be clear that no one knows everything and that to fulfill project objectives, everyone is needed, and that failing is a part of handling the complexity. Understanding what people are experiencing requires spending time with them. Leaders must understand that those closest to the tasks need to be heard to create the best solutions and changes. Importantly, there is a need for structure to include those not high up in the hierarchy in a group or an organization.

A critical factor in facilitating positive mindsets is feeling supported. As contextual support was found to be an important facilitator, this research also suggests that there should be an emphasis on tutorials and learning opportunities in the programs that team members use. However, considering how the construction industry works, this would be up to each firm to choose for now.

Overall, I hope that the contribution of my work motivates and helps practitioners, especially leaders, to focus on relationships and work climates. Feeling safe in the workplace goes beyond the effect described in this thesis.

15.3 Limitations

The discussion and findings have limitations, which are discussed in the following.

Assessing perceptions and climates can be a complex undertaking and raises questions about the validity of the discussions presented in the thesis. For instance, speaking up is considered a key aspect of psychological safety. However, it can be challenging to determine whether silence is due to a lack of psychological safety or simply because the individual has nothing to say, based solely on observation. To address this, I have incorporated a face-to-face survey, which I believe enhances my arguments regarding psychological safety. Still, the accuracy can be questioned, which is a common challenge with qualitative research.

The discussion of contextual effects on psychological safety includes a discussion of virtual work environments. I argue that the findings of the development of psychological safety in Cases 2 and 3 were impacted by being dislocated. However, both cases did go through an abrupt transformation due to the COVID-19 crisis. The psychological stress that the situation put on the informants may have impacted the results in unknown ways. To maintain the clarity and focus of the thesis, this discussion was omitted as it falls outside the scope of the study.

For Case 3 specifically, this issue is addressed in the case-based article included in Appendix B.

In chapter 4, I selected a select few supportive theories to help explain the evolution of perceptions. These theories were carefully selected based on their prevalence in the literature and the requirement for a framework to discuss the findings as they emerged during the analysis. It is possible that different theoretical perspectives might have resulted in alternative outcomes.

Another limitation is the sample or the case studies of the two TPOs. Despite their differences, they both scored highly on psychological safety and positive (growth*expandable sum) digital mindsets. I used the framework in Table 7.3 p.80 to narrow the contextual variations in my search for cases, but I did not set out to find a design team with a low level of psychological safety. It would have been possible to be more certain about the facilitators and barriers to psychological safety and digital mindset if there had been more cases with varied sorts of climates. Based on two individual cases, I cannot say for certain that a team with low psychological safety would have negative (fixed*zero-sum) digital mindsets.

In the discussion, I also presented the argument that PDMs have a contextual impact on psychological safety. To explore this relationship, I compared the differences between Cases 1 and 2, which had distinct structures. However, it was challenging to determine the extent to which these differences were attributed to PDMs versus other factors, such as leader behavior. This challenge is a recurring issue in construction management research, as even though PDMs may be applied consistently, they can vary significantly due to a range of contextual factors.

Notably, while I identified diversity and knowledge boundaries as the most significant challenges to psychological safety, this does not imply that there are no other factors in the construction industry that pose equal difficulties. Given my philosophical stance within critical realism, I prioritize a deep understanding of the subject matter and acknowledge that the results are context-specific. Therefore, this limitation does not make the findings less accurate or valuable for knowledge development.

Lastly, Case 3 was designed to capture what happened to the office climate in the first months of the COVID-19 pandemic. Unfortunately, the time constraints of creating such a case study and the stress placed on management and staff limited my ability to include employees' perspectives of the changes to the work climate. Psychological safety is the sum of individually held perceptions; therefore, the dataset's consequences may be that I do not fully describe employees' experiences.

This thesis does not provide the full answer to the concept of digital transformation within construction. And I do not claim that it does. Looking at a moment of time in the design phase

does not provide the complete picture as to why the human-technology relation is challenging within construction projects.

15.4 Implications for future research

In this section, I will present what I consider important future work, following the presented findings in this thesis.

As indicated by (McKinney, 2020), it is hard to say which comes first out of psychological safety and work climate. I have tried to distinguish between norms, climate, and perceptions in my research. However, in a complex system, it is hard to tell which is the condition for the other or if the relationship is reciprocal. Research that strengthens this understanding in the context of TPOs would be of great value, for example, for evaluating project delivery models.

Theories from fields such as psychology and sociology have been argued not to be a fit for construction management, as it is conceptualized in a manner that is not meaningful for the field (Drevland, 2019). This is mainly due to a focus on the individual as opposed to the collective. I believe that neglecting people as individuals who make up groups has resulted in systems that may not be conducive to industry cooperation and learning. The individual, technology, and context must all be given equal weight in the human-technology relationship. To produce better systems, more studies are needed to integrate social psychology, organizational behavior, and behavioral economics theories into the project management field. Individuals drive the construction sector; therefore, it is no different from any other aspect of society.

For example, the study outlines how tight collaboration in TPOs must be handled with high consciousness, as there is a fine line between collaboration and an “us vs. them” situation. Knowledge of how to avoid strengthening intergroup tension in design teams is needed, as it is the main barrier to psychological safety and, therefore, also a hindrance to gaining from diversity. At the industry level, perspectives other than the theory of loose and tight coupling should be applied to explore this issue further.

The notion of leaders as essential in developing psychological safety and framing digital mindsets strengthens the shift in philosophy from command and control to dynamic and inclusive leadership behaviors. Research confirming the outcome of leaders’ softer behaviors in construction is needed, as it is an industry with high complexity and many actors, which may trigger leaders’ urge to control. Furthermore, understanding the boundary conditions for leader behavior for assisting project members facing digital change is important today and in the future for the construction industry. In this thesis, I would argue that I have shown that industry characteristics limit what a leader of design teams can do to facilitate individually held beliefs about technology, such as training and shift of roles. A digital mindset is an abstract concept,

and providing guidelines to leaders on managing followers' implicit beliefs about learning may be a psychological aspect outside what can be expected in temporary teams. Thus, as proven in this thesis's work, more research is needed to explore how team climates may provide the frame in which support for digitalization may develop. There is a need for research to broaden the knowledge of how project and design managers may tackle this.

Furthermore, understanding how employees' mindsets and beliefs affect responses to changes in their work would be highly beneficial for future digitalization and digital transformation, not only for the construction sector. Other lenses than implicit theories may be used to shed light on this matter. This research will benefit organizations by providing the option of remote work without sacrificing productivity or causing psychological harm to employees. For example, engineering consultants might employ geographically distributed offices to access broader knowledge networks. The Covid-19 pandemic created a unique circumstance in which people's resilience was put to the test, and we learned that change is possible. What is certain about the construction industry's future is that it will become increasingly digital.

15.5 Personal reflections

Four years of work provide reflections on what I have learned and what could have been done differently. This section aims to reflect upon and share my experiences concerning the research process. The reflections focus on the intangibles that do not necessarily belong to the scope of scholarly conclusions but are nevertheless important to discuss. My personal experiences and opinions are formulated below in a subjective manner, divided into three main topics: the research topic, developing research skills, and research exchange.

The research topic.

I have learned the hard way that exploring psychological safety through qualitative approaches requires a great amount of data and iteration in the analysis process. Exploring such a sensitive and subject-dependent topic with qualitative means could have been a thesis in itself. Similarly, with digital mindsets, implicit beliefs about learning are hard to identify and explain from qualitative data. Also, having a complex research setting, such as the construction industry, added to the amount of data needed to capture the most accurate explanation of the phenomena. Still, if one wants to bridge between theories, one must be ready to handle the gray zones and go where the findings lead you. Therefore, I would not say that I would have chosen an easier path, but knowing the difficulties and the number of unanswered questions one is left with would have eased the personal process.

The research topic also made me realize how vulnerable team climates are. A possible option for the cross-case comparison strategy would have been to conduct a longitudinal study of one design team, gathering data at three different points in time. Instead of looking for demi-

regularities in diverse cases, I would have analyzed how the phenomena changed over time and better-comprehended team members' experiences. For my strategy, I needed to devote a significant amount of effort to the sampling strategy and become acquainted with the research settings. With only one research setting, I could have been more focused on the research phenomena.

Developing research skills.

At the same time, in many ways, a Ph.D. is much more than the subject you chose. Case study research was a learning experience for me. The COVID-19 pandemic altered my intended research strategy, and I was forced to abandon my planned third case study in Australia. I wish I could have done a third case study with my initial case study design to enhance my skills in qualitative techniques like interviews and observations. Importantly, to further develop my reflexivity skills. Objective self-reflection is not easy and requires time and practice. Understanding that I am a part of my research at every stage of the project, including when interpreting theories, speaking with case participants, and analyzing data, is critical because my perspectives and experiences do show in my work. Reflecting on my position as a researcher is a process that I have only just begun, and I hope to have the opportunity to continue.

Research exchange.

A crisis cannot be foreseen, and the COVID-19 pandemic's regulations required me to be agile in my research process. My stay at UC Berkeley changed from six months to two. The work put into such an exchange, both administratively and psychologically, required a lot of hours. Even though I highly recommend scholars to pursue exchange, they need to know the time and effort needed to make it happen.

At the same time, in hindsight, I recognize that while being a visiting scholar at different universities for the majority of my Ph.D. was valuable, it also presented challenges. Not being around academics in the field of project management made it harder to identify the "right" conversations to join. I learned that, unfortunately, in academia, there are politics and strong traditions that are hard to understand as a fresh Ph.D. student. Luckily for me, I had a good relationship with my supervisor, who could bring me back when I got lost in the jungle of theories and concepts.

Still, great collaborations and work have come from my exchanges. I learned new ways of thinking, working, and expressing research. Also, broadening my network in academia will be of great value for my further work situation. As I mentioned in my work, social capital is essential for developing, being creative, and feeling a sense of belonging in the world.

Reading my original Ph.D. proposition from 2018, I smiled at who I was and my thoughts about what research is. Doing a Ph.D. is not for everyone, and the process shapes you. I have learned to have the utmost respect for my informants' stories and how they also develop my thoughts about reality. I will say that I am not the same as when I first started, both professionally and personally.

Part 6

Bibliography and Appendices

Chapter 16
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Chapter 17
Appendices

Appendix A – Case study protocol

The cross-case study protocol lists the set of guidelines used to structure and govern the case research projects. The protocol aims to ensure uniformity in the results.

Appendix B – Case 3 article

The purpose of the article is to describe how resilience unfolded in the project-based organization with the support of organizational values through changing leadership styles. The finding presented compliments those of the thesis as both emphasizes the human aspect of technological change.

Appendix C – Research process model

The process model of the research strategy, which informs Figure 7.1 in section 7.1.

Appendix D – Interview protocol

Appendix D served as an introduction to Appendices E and F. The document informed interviewees about the researcher, the research, and the interview. It also contains a list of concept explanations for informants to familiarize themselves with before the interview.

Appendix E – In-depth interview guide

Appendix E is the interview guide for members of the design team. The researcher followed a semi-structured interview process using the guide. The intention of the questions asked is to learn about the team culture and the digitization of design work.

Appendix F – Explorative interview guide

Appendix F contains the researcher's interview guide for design managers and project leaders. The goal of this interview is to learn about the case project and the design team from the perspective of the managers.

Appendix G – Face-to-face survey

The face-to-face survey was given and filled out by informants after an interview. It includes Edmondson's psychological safety items and Solberg et al.'s digital mindset items. The survey aims to obtain descriptive results of the teams' psychological safety level and digital mindsets.

Appendix H – Meeting observation guide

The researcher used the guide during meeting observations to take notes and compare them in order to assess actual behavior in a structured manner.

17.1 Appendix A – Cross-case study protocol

The cross-case study protocol, including the steps for Cases 1 and 2's strategy, is displayed in the table below. The protocol is used to ensure methodological trustworthiness, particularly the dependability of the cross-case findings.

Table: Cross-case study protocol

Step	Activity	Purpose
Defining	- Formulate proposition - Establish the theoretical framework - Define research questions	Focus on the effort and the scope of the study. Provide credibility as theory provides the framework for the research.
Designing	- Design case study strategy - Multiple qualitative data collection methods	Define the setting and study objects. Use multiple data sources for greater reliability through triangulation.
Singular case study		
Selecting cases	- Establish contact with a firm/ project - Send case project request - Follow-up meeting	Establish contact with a firm. Provide sufficient details about the researcher, the research topic, and the procedure to ensure informed consent. Obtain approvals for document reviews, observations, and interviews during the follow-up meeting.
Initial data collection	- Send interview protocol to informants - Explorative interviews of leaders	Get information about the project, the design team (history, culture, digitalization level), and relevant documents to review. Identify active design members and decide the process of scheduling interviews and meeting observations.
Document analysis	- Analyze documents provided from explorative interviews	Review relevant documents to obtain information about project specifics, team diversity, and organizational factors.
Evaluate observation strategy	- Modify observation strategy	Analyze information from interviews and documents and adjust the observation strategy to the particular case to ensure that the observations needed are possible.

Step	Activity	Purpose
Prepare data collection	- Schedule interviews - Send interview protocol - Get invites to meetings for observation	Schedule interviews to make sure that all relevant team members are available to ensure the findings' confirmability. Send interview protocol for them to prepare and to get consent to record and use information that may come up. Get approval and invites to attend relevant team meetings.
Focused data collection	- In-depth interviews with team members - Face-to-face survey - Observations	Interviews with team members, including the face-to-face survey, are the primary source for understanding their perceptions of psychological safety and digital mindsets. In addition, observations of behaviors in meetings are essential for confirming understanding from other sources.
Cleaning of data	- Transcribe interviews using NVivo - Import observation notes to NVivo - Analyze survey data in SPSS	Familiarize me with the data. Having all data on the same platform minimizes the possibility of biased analysis and makes it possible for a third person to audit the coding process.
Within-case analysis	- Thematic synthesis - View findings through data - Theorizing	Abstracting raw data to describe events in light of the theory through thematic coding in NVivo. Iteration between data and theory to find the most probable explanations.
Reaching closure	- Conclude case study questions	Ending process when the effect of improvements becomes small.
Cross-case comparison		
Cross-case analysis	- Matrix-based comparison - Theorizing	Look beyond initial interpretations from within-case analysis, and identify demi-regularities by comparing case themes. Identify interesting similarities and differences—iteration between results and theory to find the most probable explanations.
Reaching closure	- Narrative representation	Bridge summaries of perceptions, which is the foundation for the conclusions.

17.2 Appendix B – Case 3 article

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Organizational values in support of leadership styles fostering organizational resilience: a process perspective

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Abstract

Purpose – The purpose of this paper is to describe how resilience unfolded in a project-based organization with the support of organizational values through changing leadership styles. The rapidly announced restrictions on businesses during the coronavirus disease 2019 (COVID-19) provided an opportunity to observe and study resilience unfold.

Design/methodology/approach – The process-perspective case study approach of a structural and civil engineering design firm in San Francisco, California, USA, integrates interviews, observations, document analysis and information tracking via email and Microsoft Teams. The researchers adopted a leadership perspective, where the units of analysis are the internal management and the employees' behaviors.

Findings – In the case examined, the capability represented in the organizational values influenced the choice of situation-appropriate leadership styles to support employees. The values of relationship, passion and trust influenced the dominant choice of a transformational style, where stability and excellence facilitate a transactional style – all equally important for the balance and resilience of the project-based organization.

Originality/value – This study demonstrated that when organizational values support leaders in cultivating a learning environment, those values provide stability for leaders to promote resilience. To the best of the researchers' knowledge, no previous work described how situational-, transformational- and transactional leadership styles evolve in response to a crisis and together facilitate organizational resilience.

Keywords: COVID-19, Resilience, Project-based organization, Organizational values, Leadership styles

Introduction

The outbreak of coronavirus disease 2019 (COVID-19) disrupted everyone's daily life and the world economy (Amis and Janz, 2020; Kraus et al., 2020). As the effects of the COVID-19 pandemic grew in early 2020, businesses worldwide shut down, laid off staff or had employees work remotely. For project-based organizations (PBOs), such as engineering design consultants, work pertaining to design could, in theory, proceed remotely. However, projects put on hold and cracks in the supply chain led to delivery delays and insecurities about projects' futures (Parada, 2020). These insecurities put enormous pressure on leaders to support employees while promoting remote work (Tulshyan, 2020). Thus, COVID-19 provided a stress test for whether leaders would "act in contextually appropriate ways" (Snowden and Boone, 2007) to facilitate a true resilient, learning culture.

PBOs handle projects characterized by uniqueness, uncertainty and complexity and, therefore, differ from other business organizations (Ajmal and Koskinen, 2008). These differences extend to their resilience. Although the relationship between crises and organizational resilience has been investigated (e.g. Kantur and İşeri-Say, 2012), little attention has been paid to how resilience evolves in PBOs (Blay et al., 2014). A resilient organization is capable of tackling improbable challenges and emerging successfully when doing so (Duchek, 2020; Southwick et al., 2017; Vogus and Sutcliffe, 2007). Organizations need both flexible and stable elements (Nachbagauer and Schirl-Boeck, 2019) representing a store of capabilities, financial and relational, that build on and foster learning in order to gain resilience (Duchek, 2020). Thus, resilience is particularly complex in PBOs as their main operations are within unique temporary projects and teams. If not managed at the highest level of leadership, these organizations may disintegrate into a set of disconnected projects, which makes it difficult to sustain shared understanding, knowledge sharing and learning (Lindkvist, 2004).

Despite considerable research on the consequences of leadership behavior in crisis situations (Bowers et al., 2017), little has been said about how PBOs organizational values influence leaders and followers to better prepare for future difficulty. Miterev et al. (2017) described a need for studies "taking holistic stance on the design of project-based organizations". Such studies may consider how organizational values lend support to the desired organizational culture which is, according to Slocum (1995), the "taken-for-granted assumptions and deep patterns of meaning shared by organizational participation and manifestation of these assumptions". Clearly defined visions, aims and culture are even more important during a crisis as it can disrupt structures that are already challenging in PBOs (Miterev et al., 2017). Organizational values provide clarity about the overall direction and purposes of the organization (Beer, 1984). When they truly support leaders cultivating a learning environment and a collectively understood vision, they can provide stability for leaders to promote resilience (Southwick et al., 2017).

The research setting of this paper is the structural and civil engineering design firm KPFF Consulting Engineers, a PBO located in San Francisco with many employees working locally and some remotely. When the crisis struck, the first author was present at the research setting and it provided a unique opportunity to observe the organization during the first months of the

crisis. As a result of the Mayor of San Francisco's announcement of "shelter-in-place orders" on March 16th (City and County of San Francisco, 2020), the PBO was forced to transition from a physical to a virtual office in a matter of days. Not knowing the duration of the situation as well as psychological and economic unknowns put enormous pressure on the leaders of the PBO's administrative structure. This study revealed that the PBO provided as a unique research setting to understand resilience due to its organizational values guiding leaders in response to the crisis. Specifically, this paper puts forward the notion that organizational values provide stability needed by leaders to foster a resilient PBO culture.

Given this background, our objective is to share insights based on data describing this PBO that turned its physical office environment into a virtual one overnight, while upholding existing organizational values. Our research question was:

> How did leaders respond to disruptions caused by COVID-19 to ensure organizational resilience?

Next, we present a theoretical framework to explain the lenses through which the data were analyzed. We then describe the methodology, including the inductive deductive approach. We address the research question in the sections with Results and Discussion, followed by Implications, Limitations and Conclusions.

Background theories

Resilient project-based organizations

Resilience plays a crucial role in the survival of organizations during COVID-19 (Giustiniano et al., 2020; Lombardi et al., 2021; Rai et al., 2021). While organizations struggled to survive, some were resilient enough to adapt and recover faster than others.

The concept of "resilience" in organizations is defined by Kuntz et al. (2017) as "system agility and robustness, essential to survival and thriving in increasingly challenging contexts". It defines the capacity to absorb adversity in different forms and learn from it and simultaneously prepare and respond to new challenges (Duchek, 2020; Giustiniano et al., 2018; Southwick et al., 2017; Sutcliffe and Vogus, 2003; Vogus and Sutcliffe, 2007). Nachbagauer and Schirl-Boeck (2019) describe that this necessitates both flexible and stable elements, meaning financial and relational capabilities. According to Duchek (2020), a firm's knowledge base is the essential antecedent for organizational resilience and resource availability, social resources and power and responsibility serve as the primary drivers.

Similarly, Kuntz et al. (2017) suggested that organizational resilience depends on more than risk-management and strategies. It also requires employee resilience, which is fostered through "valuing employees, human-capital development, supporting challenges at work, and fostering learning and collaboration". Thus, a resilient organization's culture has its people come first, then the customer and the product. Southwick et al. (2017) described that resilient organizations make use of employees' knowledge and strengths and facilitate a shared understanding of visions and roles when the unexpected occurs. Related, Rai et al. (2021) found that an organization's resilience capabilities contribute to individual efforts of sustainable

development which, when integrated in a collective approach, leads to overall social and economic sustainability development.

PBOs differ from other business organizations, as does their resilience. Miterev et al. (2017) define PBOs as "permanent structures incorporating multiple projects and project-based enterprises". The main activity of PBOs is to create a solution for various external clients by grouping employees into teams. Generating revenue depends on a continuous flow of projects, requiring organizational management beyond the project portfolio, ensuring a balance between the internal organization and its emergent project management strategies (Müller et al., 2019). Müller and Klein (2020) described resilience as a long perspective capability of PBOs, going beyond the single project.

Even though PBOs have been studied for years, to the researchers' knowledge, how they achieve resilience is not well described in the PBO literature. PBOs are not intentionally resilient in the same way. Some are set up for "hiring and firing", whereas others embrace perpetuating the organization. In a large bibliometric study, Artto and Wikström (2005) identified a practical need to "match the management approach to the environment", rather than the management of mere projects. Otherwise, it would be unmanageable to facilitate organizational resilience as described by Kuntz et al. (2017).

Leadership styles

During a crisis, leaders' behaviors are crucial for the organization to adapt and recover (Giustiniano et al., 2018, 2020; Lombardi et al., 2021; Southwick et al., 2017). Leaders can influence employee behavior toward resilience by being aware of how to recover from adversity. Furthermore, while resilience is not always uniform in an organization, leaders play an essential role in fostering it, as they can facilitate the process of "learning to unlearn and learn" (Giustiniano et al., 2020).

Studies of leadership have been ongoing for over 100 years (McCleskey, 2014), resulting in theories that differ and overlap (Khan et al., 2016). Recently, researchers have focused on PBOs, given the strong degree of "projectification" seen in construction and other industries (Lundin and Söderholm, 1998; Packendorff and Lindgren, 2014). Müller et al. (2017) pointed out the balance between vertical leadership (through roles and hierarchical positions) and horizontal leadership (through influence and relationships). Thus, leadership is seen as more than just the individual filling the role: it also includes the situational and balanced use of leadership styles.

Classical leadership theories have evolved as a result of changing societies. Khan et al. (2016) stated that "situations, contexts, culture, working environment, new laws and regulations, information overload, organizational complexities and psycho-socio developments remarkably impact the leadership concept". The situation of COVID-19 is most definitively impacting leaders' environment on the many aspects they listed. Claus (2021) found that the new demands put on leaders due to the crisis can be summed up in "leading under uncertainty, managing a disrupted workforce and building resilience", which requires humility, caring and supportive behavior. Thus, leaders must not be paralyzed but create a framework to help themselves and

employees move forward (Dotlich et al., 2009; Snowden and Boone, 2007). However, when faced with such challenges, leaders tend to hesitate, wait, or fall back on their training (Nachbagauer and Schirl-Boeck, 2019), that is, they follow the "one-size-fits-all" simplification of leadership (Snowden and Boone, 2007).

In response, resilient leadership has been researched for years and gained attraction during the pandemic (Giustiniano et al., 2020). Resilient leadership necessitates a dynamic combination of opposing aspects such as readiness and improvisation, as well as control and flexibility in the face of change. Thus, the theory of resilient leadership is complex to define and, in the end, describes leaders having to alternate between different leadership styles to handle situations that emerge (Dartey-Baah, 2015).

Claus (2021) found that addressing COVID-19 did not require a novel leadership theory but rather a combination of the already existing transactional and transformational leadership frameworks. Similarly, Dartey-Baah (2015) found that transformational and transactional theories already captured resilient leadership qualities.

The research of this paper follows the insights of Claus (2021) and others and pulls from existing leadership theories to explore if there is a balance to be found that can be described as situation-appropriate leadership. Thus, to understand and learn from the leaders within the researched PBO, the theoretical lenses used are situational, transformational and transactional leadership.

Situational leadership.

Situational leadership theory argues that there is no such thing as an a priori right leadership style for a specific situation (Khan et al., 2016). Situational theorists focus on the impact of the group dynamic and, notably, the situation. They argue that the leadership style should be adapted to the circumstances and balance between task-oriented and relation-oriented leadership depending on the job and psychological maturity of the followers (Hersey et al., 1979). Situational leadership theory can help determine if and when relation-oriented leadership is more needed than task-oriented and vice versa.

Transformational leadership.

For the last 30 years, transformational leadership theory has been widely studied (Dıaz-Saenz, 2011). This theory focuses on followers and leaders setting aside personal interests to benefit the organization (Khan et al., 2016). By understanding and securing the followers' basic needs, such as safety and security, the leader can facilitate higher-level needs such as achievement and self-actualization (Bass and Bass, 2008; McCleskey, 2014). McCleskey (2014) highlighted four components of transformational leadership: (1) idealized influence is the process of impressing through the leader's behavior qualities to be mirrored by followers, (2) inspirational motivation consists of providing shared meaning and challenges motivating followers, characterized by optimism and enthusiasm, (3) intellectual stimulation requires the leaders to invite followers to apply new perspectives on the status quo and (4) individualized consideration involves mentoring and creating a supportive learning environment. The

transformational leader combines these components to reach an organizational outcome through the followers.

Transactional leadership.

Transactional leadership theory was developed in the late 1970s, focusing on the practices of the exchange between leaders and followers (Khan et al., 2016). A transactional leadership style consists of two components: (1) contingent reward is a means to explain the leader's expectations and enhance followers' motivation, such as merit, bonus and recognition; (2) management-by-exception is leader behavior to address deviation from what was expected by providing feedback, blame or corrective coaching (McCleskey, 2014). The transactional leader directs followers' behaviors to reach goals, avoids unnecessary risks, focuses on efficiency and motivates employees to gain organizational outcomes.

Despite the substantial research on organizational resilience and leadership, COVID-19 triggered the need to take a holistic stand to understand the mechanisms that leaders may activate to exercise resilience (Lombardi et al., 2021). The pandemic, particularly its duration and the length of its consequences, will have significant implications for organizational design and practice (Foss, 2021). This necessitates the expression of resilience at several organizational levels and leaders must be capable of cultivating such resilience.

In the next section, organizational values are defined as a fundamental component of facing adversity. This provides preliminary grounding to the presented exploratory research of the PBO during the first months of COVID-19.

Organizational values

Organizational values are defined as a written description representing part of the abstract organizational culture, which includes the expectations, experiences, philosophy and values that guide the members (Slocum, 1995). Shared values and beliefs help individuals understand organizational functioning, thus guiding them to norms and behavior benefitting the organization (Aktas¸ et al., 2011).

Organizational values can facilitate a PBO's resilience if they facilitate the protection of workers' capacity during tough times (Taylor et al., 2019). They are essential as they provide stability in the PBO while employees work on different projects with values and cultures of their own (Miterev et al., 2017).

Methodology

The aim of this paper is to extract lessons learned from analyzing available process data rather than critically reviewing what happened in the research setting during the crisis.

Research team

The crisis erupted while the first author was physically present at the research setting for another research project focusing on psychological safety and digitalization in a project of the PBO. Shortly thereafter and with assistance from two of the co-authors, she refocused her

research to study the crisis's impact on the PBO. An office employee facilitated data collection and joined as a fourth author to help ensure that the paper presented the unfolding situation truthfully.

Process-perspective case study

The research described is based on findings from the qualitative case study of the PBO. The observed challenges that COVID-19 forced upon the leaders of the firm motivated the first author to study how the office persisted during this time, making it an explorative case study. When the crisis hit, the first author had access to the firm's employees, information platform, email and meetings. The richness of the data enabled an intensive case study (Bernard, 2000) with an in-depth description of the situation, following Yin (2003).

When a crisis hits, there are many sequences of events on multiple levels, ambiguous boundaries and changing feelings and thoughts. The events that were studied were non-linear, as is typical for process data (Langley, 1999). Thus the case study takes on a process perspective, trying to understand why and how the office coped in the first months of COVID-19.

While the effect on the office was intense, its level of intensity may not be unusual as far as crises go. For example, informants compared the situational crisis to an earthquake. Even though the findings may be transferable to PBO's facing other crises, the aim is to provide a deeper understanding rather than empirical generalization.

Following the process-perspective strategy, with an inductive start, the choice of the theoretical lenses arises from the analysis illustrated in Figure 1 and explained next.

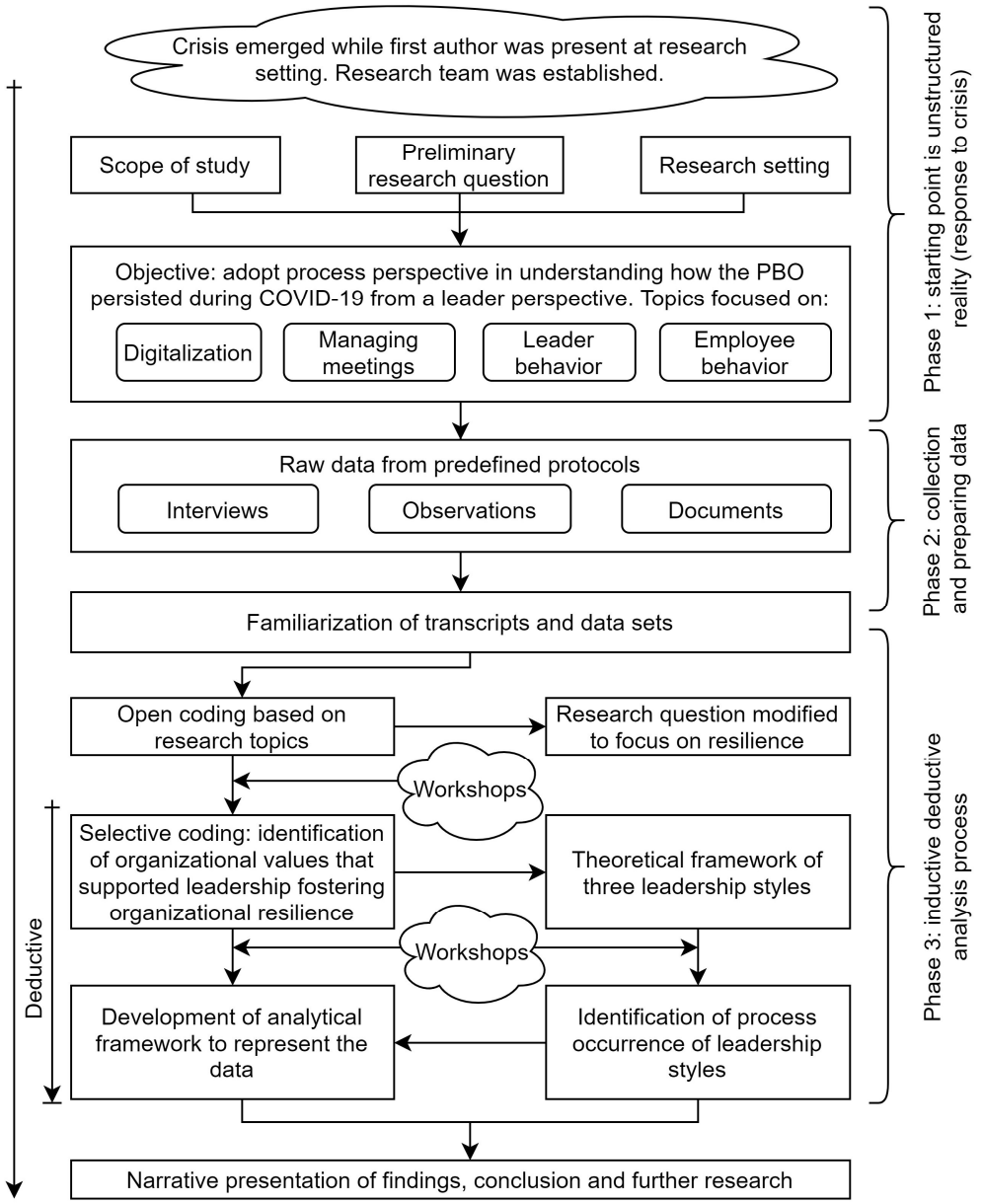

Figure 1: Research strategy development.

Research setting.

The PBO studied, the KPFF San Francisco office (SFO), provides consulting engineering services with a staff size of approximately 75, including about 55 in structural engineering, ten in civil engineering, five in protective design and five in administration. SFO has a portfolio of smaller projects relative to other KPFF offices.

KPFF has offices in more than 20 locations around the USA. Its corporate structure is based on a decentralized, supportive business organizational model (Tawresey and Asher, 2001), and therefore, each KPFF office has considerable independence in making decisions. SFO has chosen to stay true to the business model. Its supportive business organization recognizes a distinction between the project structure and the business administrative structure of the office. The first focuses on providing clients with the appropriate level of consulting engineering service, and the second exists to support project-focused activities. For SFO, this means that the goal of the PBO is not to fulfill projects or maximize profits in the short run, but to perpetuate the organization. The present study focuses on changes within the administrative structure.

The administrative structure is based on the idea of "profession first, business second," and its success depends on values being maintained throughout the organization. The "core values" were established about 20 years ago when about ten owners represented the next generation of the company's leadership. They created an internal program helping the principals (leaders) build relationships when the company's size and geographic extent made it more challenging to know one another. Relationships are good during good times, but they needed stronger relationships that could endure tough times.

Unit of analysis.

The researchers adopted a leadership perspective. The units of analysis are the internal management and the employees' behaviors. Hence, the analysis is on a group level, where the units of observation are the managing principal (MP), the information technology (IT) manager (ITM), the upper-level leaders (principals) and the employees.

Data collection

The data collection strategy was developed prior to the data gathering. Protocols were developed based on the objective to understand how the PBO and its leaders responded to the crisis. The data collection took place over five months, from mid-February until July 2020. All office-wide meetings and management communication in this period were observed or collected by the first author.

In-depth interviews.

Due to restrictions enforced due to COVID-19, interviews were held digitally on Skype for Business. As the research had a leadership perspective, interviews were limited to upper management. Initially, the researcher interviewed the MP and the ITM, considered key informants in accordance with Bernard's definition (2000 p. 170). These interviews were essential to gaining knowledge of where to find information and how to proceed with observations. Next, four interviews were conducted with specialized informants, the principals. All six interviews followed a semi-structured format based on a protocol developed in advance by the research team and the interviews ranged from 30 to 70 min. Based on the situational crisis, four themes were discussed (1) the forced digitalization process, (2) leader behavior, (3) managing meetings and (4) employees' behavior. Examples of questions asked are the leaders' experience of the sudden digitalization, how their role had changed, how they managed to lead

the office through digital meetings and employees' responses to the virtual work situation. Before each interview, a guide based on the protocol was sent out to familiarize interviewees with the topics. Each interview started with a conversation to ensure a common understanding of terms.

Document studies.

The digital sources Microsoft Teams and Email were used for document studies. As is characteristic for project management studies, the documents were viewed through naïve reading with information in focus (Ryghaug, 2002). Bowen (2009) explains this approach is useful to contextualize data from other methods, for example, providing explanations for observed action.

Microsoft Teams is cloud-based team collaboration software including messaging, calling, video calls and file-sharing that makes real-time collaboration possible for remote work. The data collected was the information channeled through Teams and it ranged from IT-related messages to social support. This data provides evidence of what information became important for the office.

The researchers analyzed a total of 53 emails in the office's contact group on Microsoft Outlook, sent to all employees. The emails were mainly sent by the ITM or the MP on behalf of the principals or the company. They did not include communications about client projects.

Meeting observations.

All observed meetings were held virtually. The observation technique was passive, not to interrupt events in unknown ways. Haavelmo (1944) describes passive observation to provide data on what individuals actually do in an event, not what they were supposed to do or thought they did. The success of the active role of collecting observation data, as described by Almklov (2008), rested heavily on contact persons at the office due to the situation.

The researcher observed 30 meetings, described in Table I.

Table I: Meeting observations

Meeting type	Observations	Participants	Length (minutes)
Daily morning check-in	16	13 - 36	6 - 15
Monday scheduling	5	8 - 10	48 - 60
Weekly client management	5	15 - 16	30
Monthly management	2	15	60
Monthly office lunch	2	60 - 65	60 - 90

Most of the observations were of Daily Morning Check-in Meetings. The purpose was for employees to see friendly faces and share information about the situational crisis. In the first weeks in March, meetings were held daily; however, in April, meetings were scheduled every other day, and at the end of July, two times a week.

On Mondays, the office continued with its series of pre-COVID-19 meetings, including the Monday Scheduling Meeting and the Client Management Meeting, restricted to the principals and middle-management leaders. The aim of the Monday Scheduling Meeting was to get an overview of employees' workload and weekly planning. The Client Management Meeting was to discuss project opportunities and industry relations.

Likewise, the pre-COVID-19 Monthly Management Meeting continued. The MP, the principals and the middle-management leaders met to discuss financials, the market and billing projections. Returning to the office post COVID-19 was an added topic.

Further, the pre-COVID-19 Monthly Office Lunch continued virtually: it offered an office-wide platform for the management to be transparent and share information about the future of the office, upcoming projects, finances and social topics.

Analysis

For data analysis, the research team used triangulation to capture the complexity of the events and ensure accuracy (Langley, 1999). Initially, a version of the framework method provided a flexible approach for reducing and analyzing the interview data by the multidisciplinary research team (Gale et al., 2013). Hence, the handling and coding of data happened in several stages, and the strategies for closing the gap between data and theory were inductive and deductive (Orton, 1997). It proceeded as follows.

Stage 1: Preparing data.

The first author carried out the transcription of the interviews in the qualitative data analysis software NVivo. All were checked for errors by listening back to the audio recording while reading the transcripts simultaneously. Activity on Teams and communication by email was categorized into four themes (social, IT, work process and security), that emerged from the observed behaviors, before uploading to NVivo together with observation notes and project documents.

Stage 2: Familiarization with the data.

For collaboration, the research team created a Microsoft Teams group, where all anonymized data were uploaded. After familiarizing themselves with the data, the research team decided that the first author should develop a framework, following an inductive deductive approach seeking data that corresponded with the interview themes.

Stage 3: Open coding.

The first author performed the first stage of the framework method through open coding to summarize the interview data. The researcher followed Polkinghorne (1995) for the narrative sorting of data. The focus was on the context in which the narrative was created, including the relationship between the narrative teller (the leaders) and others in the narrative (employees) and the chronology of events. Resilience was identified as the topic and the research question was formulated, motivated by the researchers' interest in learning about resilience from a

situation that manifests the phenomena. The sudden change from a physical to a virtual office environment was seen as of sufficient intensity to elucidate such a topic.

Stage 4: Selective coding.

The open coding categories were examined and challenged by an additional author while reading the interviews for accuracy. A workshop was then held where codes were clustered to themes, creating a working analytical framework applied in NVivo by the first author. After familiarization with the data, the coding stages and iterations, the proposition of the organizational values support of the evolution of leadership styles facilitating resilience emerged.

Stage 5: Position coding.

To investigate changes in leadership styles, the team adopted a process perspective. This perspective is useful for understanding "how and why things emerge, develop and grow, or terminate over time" (Langley et al., 2013); therefore, it is useful for exploring how leadership evolves in response to a crisis. It may also reveal the dynamic activity underlying the maintenance and reproduction of stability. Following a deductive approach, one author created a framework to view the data through the lenses of three carefully selected leadership approaches. In a workshop, the framework was challenged by all authors. Next, two authors used the framework to scrutinize the data and created two independent timelines of events, similar to a temporal bracket strategy (Langley, 1999). The timelines were then compared and discussed until an agreement was reached.

Results and discussion

The section first describes the evolution of the three leadership styles. Then it describes the impact of the events when COVID-19 caused people to start working remotely and how organizational values affected the occurrence of leadership styles. Finally, it presents an analysis of how the manifestation over time of different leadership styles influenced PBO resilience.

Evolution of leadership styles

We start by presenting the outcome from the authors' analysis of case data, illustrating how situational-, transformational- and transactional leadership styles evolved over time (Figure 2). This is the first step to identifying the impact of organizational values on leadership and organizational resilience.

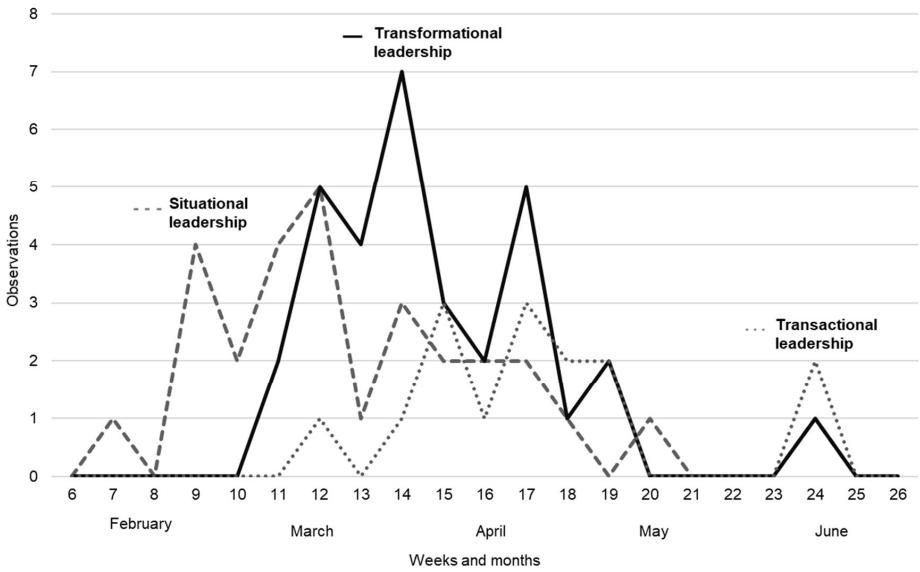

Figure 2: Evolution in leadership styles.

Figure 2 was generated by accumulating data from meeting observations, emails and activity on Teams of three core characteristics for each style (Table II). Initially, 6–8 factors of enacted leadership practices from the literature were analyzed. However, using all factors represented too much overlap. By identifying the most representative factors, the findings were clear from noise. The observations indicate early signs of situational leadership, then a stronger sign of transformational leadership and toward the end of the transition period more transactional leadership.

Table II: Position framework of the leadership styles.

Leadership style characteristics	**Observations**
Situational	*29*
Leaders raising awareness of the situation (what changes and why).	10
Leaders showing high/low levels of relationships/supportive behavior vs. task/directive behavior.	15
Leadership style is shifting (during the observed period).	4
Transformational	*32*
Leaders raising awareness of the importance of values, consciousness.	8
Leaders giving room for self-organizing and distributed decision making.	8
Leaders addressing social and psychological issues explicitly. Inviting to take initiatives.	16
Transactional	*15*
Leaders focusing exchanges between leaders and followers.	6
Leaders focusing contracts and agreements.	5
Leaders focusing payment, and other extrinsic rewards.	4

The discussion forward is what influenced the observed evolution of leadership styles and whether it helped the PBO cope with the crisis (being resilient).

Effects on the occurrence of leadership styles

Figure 3 depicts the organizational values identified in the qualitative analysis (right) and a grouping of external factors caused by COVID-19 (left), both influencing the leadership styles.

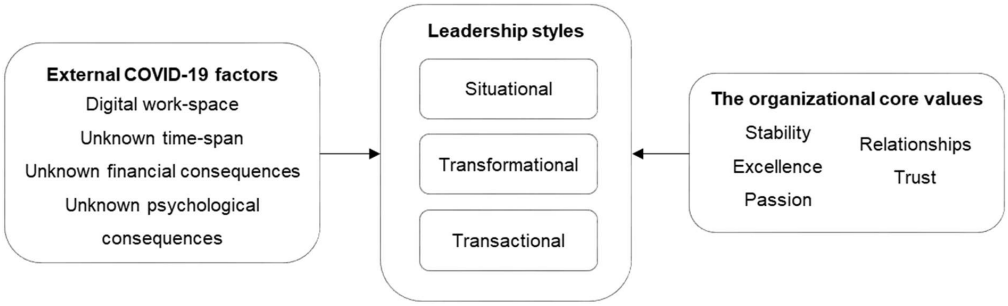

Figure 3: Internal and external effects on leadership orientation.

External COVID-19 factors.

The first COVID-19 case in the San Francisco Bay Area was reported on January 24 (San Francisco Chronicle Staff, 2020). On February 25, the San Francisco Mayor declared a state of emergency and on March 16, announced "shelter-in-place orders" effective the next day (City and County of San Francisco, 2020). San Francisco began to reopen as early as May 17; however, offices for non-essential employees remained closed well past the end of the study on July 17.

The effect of COVID-19 on KPFF came in small drips. SFO's information flow started on March 3, where the MP sent an email describing how the organization was going to accommodate the Center for Disease Control's (CDC) guidance in response to the outbreak. The message was: "Our goal is to maintain a healthy and safe workplace". Notably, the email directed employees to approach their leaders for guidance and support. On March 9, KPFF's president sent a memo expressing the commitment to employees' health and safety, their families and the clients and communities served. The email included a Coronavirus Precaution Protocol Frequently Asked Questions (FAQ) advising to postpone travel and consider virtual meeting options.

In the following days, the practice in SFO went on close to normal. The researcher attended face-to-face meetings, and it was observed that everyone focused on their projects and tasks. This changed on March 11. With the note "effective immediately," all were asked to refrain from physical meetings. The MP signed the email with "We will notify you when we can relax these rules".

The next day, the management group encouraged all employees to work from home. The office was still officially open, with instructions to continue best practices related to hygiene and

social distancing. KPFF started the logistics of setting up home offices, managed by the office ITM. For the work processes, the MP expressed that he still expected a full 40-h week.

On March 15, KPFF's president broadcast a message to remind employees of the organization's core values to remain effective during this unprecedented time. The message was that the management trusted all to do their best and keep their commitment to providing excellence to clients and that it all was achievable due to the relationships, stability and passion existing in the KPFF environment. Attached to this email was the MP's memo describing work process changes. The memo contained practices related to communication and IT functions. Employees were asked to check in daily on an electronic sign-in sheet and have regular contact with their immediate supervisor.

On March 16, the office closed down entirely due to the shelter-in-place order issued for the six Bay Area counties. All employees were technically equipped to work remotely based on the MP's analysis that morning.

Information about the monitoring and the effect of the situation came step by step, but the process of turning SFO remote was sudden. From March 11 to 16, the office changed from a busy physical environment to a virtual one.

Organizational values.

The analysis showed that the MP and SFO's supportive functions follow KPFF's supportive business organizational model. Interviews revealed that the business model's mission and organizational values have had a significant impact on the administrative structure's leadership.

First, the mission of the firm was expressed as "perpetuation of the company" in 2001 by Tawresey and Asher, which stresses that people come first, not profit. Second, after having gone through crises and deciding to learn from them, KPFF in 2001 defined the following cultural values (organizational values):

(1) The importance of open communication without fear of reprisal.

(2) The importance of facilitating information and resource sharing.

(3) The importance of true collaboration as the starting point for creative problem solving.

(4) The willingness to admit that you don't know the answer, or more difficult still, that you were wrong and there exists a problem which must be solved.

(5) The importance of allowing decisions to be made at the level which is closest to the problem at hand, and a willingness to support those decisions.

(6) The importance of using influence as the key management tool, as opposed to power or authority.

(7) The importance of making decisions that are focused on what is best for the client and what is best for the project, in the long term.

(8) The importance of putting ego aside in the interest of all of the above.

Ten years later, the organizational values were summed up as "stability, relationships, passion, trust, and excellence". To evaluate their manifestation in practice, one needs to understand what type of leadership styles the values facilitate.

The values indicate that there must be trust in a *decentralized decision outcome* from the business structure. Muller et al. (2019) describe this PBO structure as the balance between internal organization and the project strategies. If those closest to the projects are to make decisions, then the supportive organization must respect decisions and not interfere or second-guess. Decentralization of decisions is a characteristic of transformational leadership that gives room for self-organization and strengthens followers' consciousness about outcomes and how to reach them (Bass and Bass, 2008). Further, for *open communication* and *true collaboration* to be a reality, transparency is key. In particular, open financial and accounting systems were highlighted by Tawresey and Asher (2001) to ensure employee involvement and passion. Also, the leaders must ensure *financial participation* for the decision-makers to be fully invested in the outcome, and thereby, in the long run, do what is best for the company – these aspects of leadership appeal more to the theory of transactional leadership. In describing the key aspect of the supportive business environment, Tawresey and Asher (2001) explain that a bonus program is a form of financial participation. In transactional leadership theory, motivation through rewards is central to reaching both followers' and the organizational goals (Khan et al., 2016). However, the stated organizational values represent a greater good for the PBO, much similar to the core of transformational leadership theory (McCleskey, 2014). Hence, a dominant culture for transformational leadership existed before the moment of change in March 2020 much due to the organizational values.

The question further is if the organizational values were actualized in practice exposed through the occurrence of leadership styles, supporting a resilient response to the crisis.

Actualization of organizational values through leadership

Occurrence of situational leadership.

The first signals of situational leadership came in February. Both the MP and the corporate manager rapidly updated employees about the situation and changes to keep them safe. In the interview, the MP expressed personal concern and awareness of situational adjustments:

> I'm very concerned about people's health, safety, and welfare. Which I'm always concerned about, but it's a different dimension. It's sort of protecting them against a hidden killer. Taking care of employees in a completely new environment, where the rules have changed.

The situational leadership orientation became unmistakable in mid-March. A digital workspace was no longer "just an alternative" but changes were made to handle the new digital workspace and technical issues were addressed. The behavior is seen as an actualization of the organizational values of *facilitating information* and *resource sharing*. Examples of temporary changes were daily check-in meetings and employee calls:

> The people I was most worried about were the young people who lived alone and did not have a roommate. And one of the things we started doing in week one was that the five principals split the office up into five groups. And everyone took a part of the office every week and reached out and talked to them, individually.

Situational leadership includes both transactional and transformational styles (McCleskey, 2014), but the approach at SFO was dominantly relation-oriented at the start, focusing on unknown psychological consequences. For example, the behavior of raising awareness: "The sharing of information is huge. Because I think it helps with the emotional support".

The adherence of SFO to its organizational values seems to make the leaders more sensitive to the "right" aspect of the situation. Staying true to using *influence as a management tool*, the MP chose to focus on people as needed in a complex setting (Snowden and Boone, 2007). To identify the "right" focus, the MP addressed what Hersey et al. (1979) describe as followers' competence (ability) and followers' commitment (willingness). Due to the office's already established strategy for handling a potential crisis (i.e. a major earthquake), employees were provided overnight with the hardware or the access they needed to perform their jobs, as expressed by the MP:

> I mean, we did it overnight, literally. And I think the main reason for that is that we have been planning for years for business continuity issues associated with natural disasters and disaster recovery scenarios. And while this wasn't really the type of disaster we were ever planning for, we have a lot of the parts and pieces in place to be able to respond. An earthquake comes with no notice. And they pretty much shut you down right away. More instantaneous than what COVID-19 did. So, this was just a great fire drill for the big one.

By the end of April, the seriousness of the unknown time-span and financial consequences dawned on the management. Leadership is now about balancing understanding the situation as a crisis and keeping everyone motivated. The findings show a change to task-oriented leadership. This flexible and situational behavior allowed the MP to also focus on the project portfolio, another organizational value and described by Müller et al. (2019) as an important part of the balance of PBOs. At this point, employees seem to have matured into the new normal and are less in need of psychological support.

Occurrence of transformational leadership.

The findings of situational leadership complement the findings of the choosing and balancing of transformational and transactional leadership. The two styles are not mutually exclusive; they occur in parallel (Figure 2).

However, the importance during the crisis of the transformational style that was dominant before the crisis is apparent in the employees' behavior. Instead of turning to crisis behavior, the MP had the capability (Vogus and Sutcliffe, 2007) to model intellectual stimulation and take advantage of the learning opportunity presented by the crisis. The behavior is seen as an actualization of the organizational value of *influence as a management tool*. The findings indicate that encouraging employees to digitally evolve and inviting them to decide the path

forward allows them to explore new ways of performing their tasks and socially support each other, as is seen in the change of communication on Teams. More importantly, the MP showed that all voices were essential, facilitating *true collaboration*.

Through a transformational style, the MP found new ways of making sure employees were "seen" when they were not physically around. By understanding employees' home situations, the MP could better facilitate their work. Individualized consideration also consists of mentorship, and an informant described this as the most important function of a leader during the crisis: "For me, it's just to provide them with mentorship, provide them with oversight and review. Whatever it is, just being there for them when they need assistance". The quote and behavior of the MP show how the relational-based organizational values such as *manage by influence, facilitating information sharing* and *putting aside ego* were actualized in practice through the transformational leadership style.

Occurrence of transactional leadership.

Even though a transformational leadership style was dominant, the transactional style was observed especially in April–May when more external factors challenged the PBO's financial capabilities. The transactional leadership behavior is seen as an actualization of the organizational values of *making decisions that are focused on what is best ... in the long term*. The MP and the management group stayed true to a horizontal leadership without micromanagement, but the MP saw the need to help employees move forward (Dotlich et al., 2009; McCleskey, 2014) and a centralization of decision-making was analyzed as requested by employees. In meetings, employees were turning to the MP for answers.

The arena for transactional leadership was observed to be different compared to transformational leadership. Despite the crisis, management continued planning for stability to keep their relations and commitment to clients. In management meetings, they focused on reaching performance objectives (McCleskey, 2014), not offering emotional support as they did in office meetings. This differentiation illustrates how the supportive business structure provides a balance (Müller and Klein, 2020) for the PBO.

Staying true to the need for financial security and client relations expressed in the organizational values, the leaders turned to transactional leadership. Keeping clients happy and identifying new projects are the most important issues from a transactional perspective. In the latest period, the transactional signs were focused on financial and contract issues resulting from the crisis. The awareness that this situation will last and pose a growing threat to the business was described by an informant:

> It looks like it could last three to six or maybe even eight months. If there's nothing changed financially, then we have to take action. Which is either we start doing layoffs, furloughs, work reductions, or we need to also then pivot the way we spread work around in the office.

Effect of leadership styles

If the changes in styles helped leaders focus on the right aspect of the situational crisis, it should be evident in employees' resilience (Kuntz et al., 2017). The current discussion brings up the organizational values and external factors visualized as a system dynamics model (Figure 4).

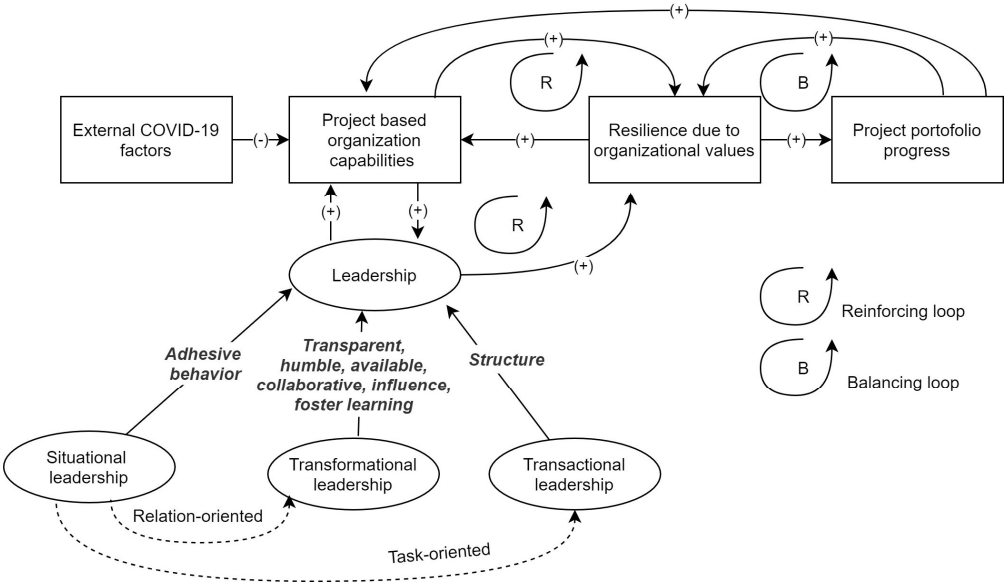

Figure 4: Leadership styles facilitating situation-appropriate leadership and resilience.

Adhesive behavior through relation-oriented situational leadership.

As discussed, situational leadership best describes the leadership in evaluating the employees' maturity to adjust their support. The MP saw a need to connect the employees, which is important to facilitate social resources, a vital component of organizational resilience (Duchek, 2020). Through adhesive behavior, the MP facilitated relationship growth despite the office not being physically together. Office lunches offered an arena where employees could broaden their horizons by exposure to others' thinking. The morning check-ins offered an opportunity to give and receive support. Creating such arenas cultivated safety and closeness in relationships. Encouraging collaboration across groups can also be seen as a transformational leadership style, as it strengthens employees' consciousness about the outcome (McCleskey, 2014). An effect of this relation-orientation was that the silos mentioned, surprisingly for the MP, were further broken down in the new normal:

> I think there's been more connection. Our office has suffered a little bit from a division between the east side and the west side of the office. Just because of the physical division, it sort of took on a life of its own. And that doesn't exist right now.

Also, employees continued their project-related tasks, showing signs of a resilient PBO despite the external challenges. Their knowledge and expertise did not change. However, the question

of willingness refers to employees' motivation, an important aspect of resilience (Kuntz et al., 2017). In the interviews, the leaders expressed that their responsibilities needed to change, more clearly putting the employees first to accommodate the unknowns of the situation:

> I feel it's my responsibility to make sure I kind of get a gauge of how people are feeling. If there are any concerns or struggles with anything, whether it's work or not work-related, I'm always available to them. And that's always been the case, but I feel like I need to be more visible.

An effect of the adhesive behavior seems to be collaboration happening without the managers' assistance as seen in the support initiated by the employees, making them more resilient as a group (Duchek, 2020). An example is the wiki-channel "working remote", created by an employee with the message: "The goal is to work out issues for everyone together. If you have an issue, it's likely someone else also does, and we can share solutions this way". On Teams, employees showed an active interest in each other at a personal level, e.g. creating running- and pet channels. In the weekly newsletter, they shared how to make the situation better: "Are you proud of the [working from home] set up you've established during shelter in place? Then share it with the team!" The employees are observed to mirror the MP's behavior. After the new normal was established in mid-April, they connected by launching their own initiatives, both psychologically and professionally. Duchek (2020) described that such social resources are considered a driver for organizational resilience.

Transparency, speaking up, influence and learning through transformational leadership.

Transparency was a mechanism that characterized the office; one informant mentioned it as a reason for choosing to work there: "I've never been in an engineering company that's as transparent as ours. We share finances with everybody". In a crisis, information can be unpleasant and hard to deliver and how this would affect employees' motivation and engagement was a concern for the principals:

> You got to be careful with how you deliver the message to those with limited experience. The leadership group, which is the principals and associates, all should feel a high level of urgency right now and worry and concern so that this isn't thought of as a vacation.

Despite some employees not being fully prepared for the effect of the situation, the MP chose to be transparent throughout the months of this study which according to Duchek (2020) may foster resilience through social resources. This behavior contrasts with the situational leader, where the maturity of the followers guides the style. The choice of being transparent could strengthen the employees' consciousness about the organizational values and outcomes, in line with the transformational orientation (McCleskey, 2014). An example was when four employees were let go as the workload decreased, one and a half months after the moment of change. Even though it was painful, the principals were transparent and upfront with the information:

> It's probably one of the most difficult things leaders are faced with, delivering awful news. In a situation where there's no way around it. [...] But when we have to let people

> go because there's no work, that's awful. There's little that anyone can do. I mean to do the best we can, we talk to people about it.

During meetings, a behavior practiced by the MP to handle the challenges of being transparent was admitting to not having all the answers. When asked when employees would return to the office in April, the MP replied, "I have no idea. We will not do it before it is safe and will not force anyone". By being humble, the MP became more available, reducing power distance.

Speaking up and asking questions is essential in a PBO like SFO. In virtual meetings, the MP struggled to get people to speak up. One informant expressed that knowledge of the situation was a reason: "I think that a lot of people are not speaking up or asking questions that interest them. Is it because they're scared for their job". The case of employees being scared of losing their job was an internal threat that the leadership needed to address. It was observed that the leaders actively worked to understand the team's engagement to avoid a silent culture through individualized consideration: "The other thing we talked about is checking in with employees, making sure they're getting the mentorship and the training they need". In the meetings, the MP's approach to silence was to shift between open-ended questions, "How is everyone doing today?" and demanding feedback, "I would like to go around the room to hear if any projects are on hold due to the crisis". This behavior is analyzed as a repeating shift from a relation-oriented to a task-oriented leadership style. Nevertheless, through a transformational style, the MP showed an interest in the experiences of the employees, an important aspect of the cognitive dimension of organizational resilience (Duchek, 2020). The MP asked open-ended questions, which gave room for the employees to elaborate on their experiences, for example: "Does anyone have any problems or successes they want to share?"

Influence is related to speaking up. The MP actively sought feedback from employees on what they needed to perform at home offices: "Remember that you can report anything, and we will assist you if we can". Collaborative structure creation was an observed behavior in facing the market changes. As the weeks went by, projects were put on hold or stopped entirely. A principal mentioned that a part of the job was to make employees understand that providing work was no longer only the managers' responsibility. This transformational leadership style is seen to build resilience through valuing the employees and foster learning and collaboration (Duchek, 2020; Kuntz et al., 2017; Southwick et al., 2017).

Foster learning came up as a key theme. When projects were put on hold, informants expressed that the younger engineers did not fully understand the consequences of this external effect. They focused on the work on their plate for the day, rather than what could be done in a month or two. This mindset made the leaders aware of the need to mentor the employees in developing mindfulness about what they were experiencing to enrich their knowledge bank. By learning how to adapt, employees will better understand the market and clients' needs in the future and thereby, in the long run, do what is best for the office in-line with a resilient culture (Duchek, 2020; Rai et al., 2021; Southwick et al., 2017). Also, employees at KPFF needed to find new ways to communicate and facilitate their work situation. With the focus on supporting mentorship, the principals encouraged employees to explore, embracing the possibility of failure:

> If you come to me with a problem, you better have a solution. I'm not going to give you answers. But if you fall down and make a mistake, I'll be there to support you and then take the heat for it if I need to.

Structure through transactional leadership.

To be resilient, decisions are needed (Dartey-Baah, 2015). Sometimes, the MP asked for confirmation, not about experiences. Employees could perceive this transactional leadership behavior as the leader taking for granted that the MP understood their experiences. However, a balance was needed to enforce employees' voice behavior.

Without the resilience already created, the changes in leadership styles would most likely have evolved differently. The actualization of the organizational values created leader capacity for a people focus and not an immediate concern about financials. Early on, the crisis increased the need for a relation-oriented and transformational leadership style, which the MP and the management actively addressed. An organization needs to be resilient, both financially and relationally (Dartey-Baah, 2015; Duchek, 2020; Vogus and Sutcliffe, 2007). The findings show an example where organizational values and the PBO structure realized resilience in practice as they guided situation-appropriate leadership (Snowden and Boone, 2007).

The outcome of SFO differed from other offices within KPFF firm-wide. This is attributed to the firm's decentralized nature, the range of challenges unique to their locale, and differing degrees of achieving the above-stated values. The distinction between other offices and SFO's success in adapting to the new normal supports the argument that organizational values were a key to shaping the PBO's resilience.

Implications for research and practice

The findings have theoretical value so far as organizational values are identified as antecedents for a resilient PBO, both due to SFOs history and their facilitation of situation-appropriate leadership during COVID-19. The study contributes to the growing theory of resilience in project management research by providing indications for organizational values to be the strategy that, through changing leadership styles, facilitates effective resilience in PBOs. Further, this study emphasizes relational values as an aspect of employees' capability to perform despite a crisis. Practically, the study provided a compelling basis for PBOs to further develop their organizational values to support leaders in crisis situations when they are needed the most.

Our empirical insights help advance the theories of transformational and transactional leadership by highlighting how organizational values help foster resilience in a PBO. The researchers are not aware of studies showing how these leadership styles evolve together in response to a crisis and together facilitate organizational resilience.

Limitations

Three aspects of the current study are viewed as limitations. First, although considerable effort went into data collection, concerns about the method remain. The actualization of the

organizational values could have been verified through the perceptions of the employees, e.g. by conducting a post-analysis survey. However, exploratively observing during a crisis provides some limitations to data collection, and therefore, the findings depend on observations and the managers' views. Nevertheless, a qualitative case study as presented here enables an in-depth description of the relations between organizational values and leadership styles. It provides examples of specific leadership actions that cultivate the connections, helping practitioners and researchers understand how the concepts unfold.

Second, the small sample size affects the empirical generalizability of the findings. Further research must compare the effect of different orientations of organizational values. If such studies strengthened the ideas of the current paper, it would have significant managerial implications, as one could better facilitate teams through relational-based values to achieve resilience in PBOs.

Third, the uniqueness of the office in this study creates the possibility of idiosyncratic findings, limiting it to consultant firms in construction. The firm is located in San Francisco and cultural aspects undoubtedly affect how the crisis and leadership is perceived. In many regards, however, the office is like other consultant offices in structure (horizontal leadership and project-oriented) and it is a for-profit organization in a competitive market.

Conclusions

A crisis is an opportunity for an organization to question and revise how things are done, as external factors test its resilience. In the case examined, the capability represented in the organizational values influenced the choice of situation-appropriate leadership styles to support their employees and learn. The values relationship, passion and trust influenced the dominant choice of a transformational style, where stability and excellence facilitate a transactional style – all equally important for the balance and resilience of the PBO.

COVID-19 exposed the reasons why organizational values positively shape leadership as enacted practices, as they influence a resilient learning environment putting employees first. This study provides compelling arguments for transformational leadership to be an antecedent for organizational resilience. The style is different from situational leadership, as it has a longer-term perspective than the specific situation. Notably, transactional leadership is seen to create trust in management and stability, adding to the PBO resilience.

Schein (1985) asked the questions of why certain cultural assumptions survive and what function the culture has for the group. An explanation for the perceived resilience of SFO is the combination of centralization and decentralization, needing both transformational/relation-oriented and transactional/task-oriented leadership. The values were analyzed as both the antecedent for the leadership orientation as enacted practices and the desired outcome of the business structure.

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17.3 Appendix C – Research process model

The figure must be read by following the numbering. An explanation of each numbered step is provided below. Words in italics refer to a step in the model.

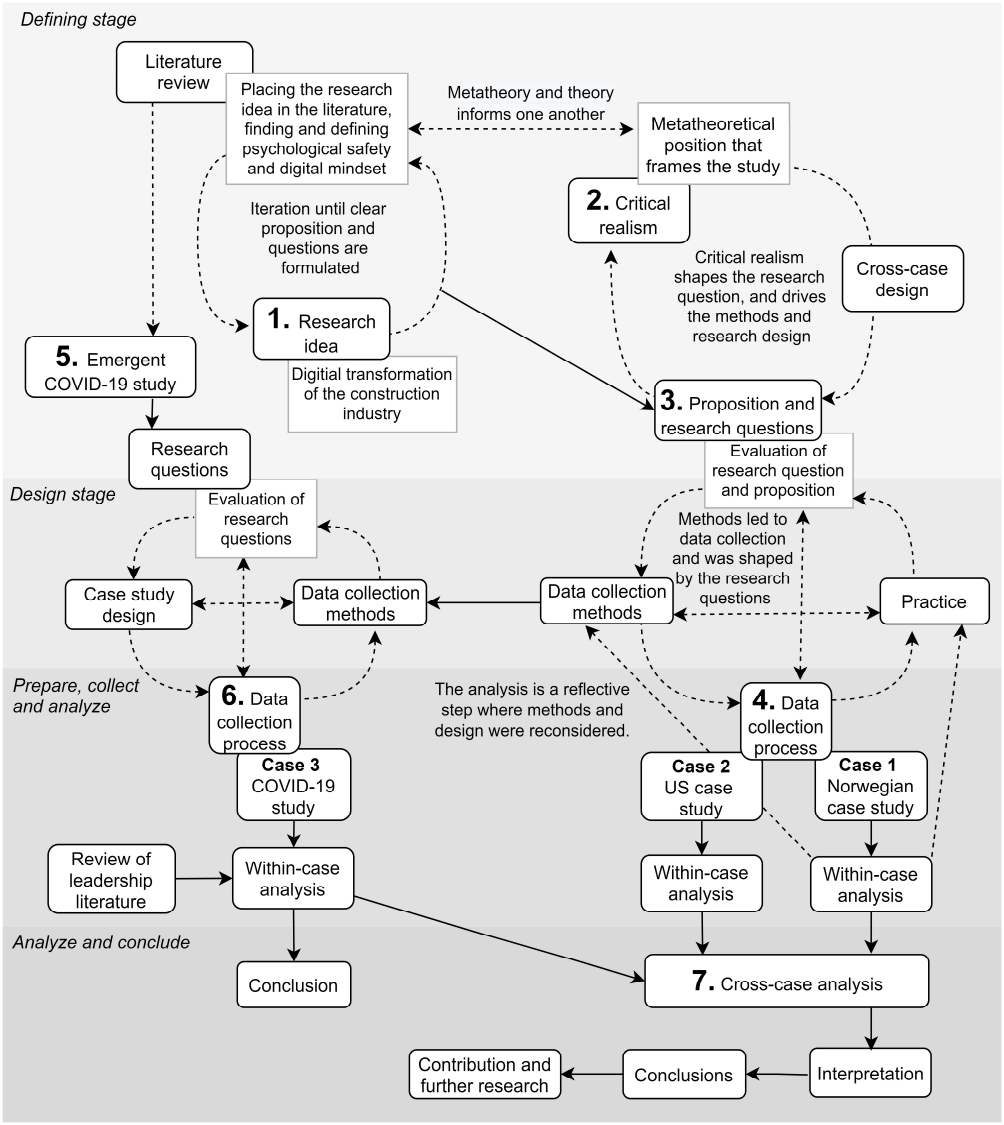

Figure: Process research strategy model

1. Research idea: I first described my overreaching research idea and objectives. This process was an iteration between exploring the given industry issue and finding the theoretical lenses to understand it.

2. Critical realism: Along with defining the research idea, I also established my metatheoretical position, CR. When building the theoretical framework, taking a metatheoretical stance was beneficial because it helped with the design of the knowledge-creation process. The foundation for choosing the cross-case design was theory and metatheory.

3. Propositions and research questions: On the basis of the research idea, the theoretical framework, and the metatheoretical framework, I defined the proposition and the research questions. Iteratively, I went back and forth to make sure I asked the right questions. The next step was deciding on the *data collection methods*. *Practice* in the figure refers to the processes used to conduct research in ethical ways. As seen in the figure, methods, and practice informs one another and cannot be carried out without considering the research questions.

4. Data collection process: The initial data collection procedure was Case 1. As indicated by the arrows pointing back to the *design stage*, the within-case analysis served as a reflective step. This means that I applied the lessons I acquired from the case study and within-case analysis to the processing of Case 2 and, later, Case 3.

5. Emergent COVID-19 study: During case 2, an opportunity for a related case 3 emerged. I went back to the *design stage* and developed an explorative case study of how the office persisted during the first months of COVID-19. As shown by the connection to the *literature review*, the case study was impacted by the *defining stage* of the research strategy.

6. Data collection process: The same methods and procedures were used for Case 3 as for Cases 1 and 2, with interview and observation protocol modifications. The new data collection methods and the research questions influenced the specific case study design. As a result, it was necessary to conduct a separate leadership-focused *literature review* during the *within-case analysis*. Also, the case study served an additional purpose, as depicted in the figure, and its *conclusion* stood independently from the thesis.

7. Cross-case analysis: Findings from all three cases were compared in a *cross-case analysis* to answer the research questions. The interpretations of the findings were presented as a narrative synthesis, which was the foundation for the *conclusions*.

17.4 Appendix D – Interview protocol

Introduction

Background for interviews

This interview is conducted by Ph.D. candidate Ida Marie Tvedt from the Department of Civil and Environmental Engineering, at NTNU. The interview forms part of a case study as a part of a doctoral thesis. Results will be used in a case report and potentially in academic articles.

The topic of the Ph.D. is *psychological safety in digitally advanced teams*. The background for the research is the increased criticism of design management and the fact that construction projects are increasingly digitized. The case study that you are part of addresses the following research questions:

RQ1: What is the experienced/observed level of psychological safety in the design team?

RQ2: What is the experienced/observed level of digital mindset in the design team?

RQ3: Does the team's level of (negative or positive) psychological safety affect the observed digital mindsets?

The case study is designed with in-depth interviews, a face-to-face survey, meeting observations, and document analysis. Also, the case study will be a part of a cross-case analysis with cases from various national contexts.

Use of interview results

This interview is used to gain knowledge of the designers' and design managers' perception of the team culture and their perception of the digitalization of design work. The results will be used in the case study to measure and compare the level of team psychological safety and team members' digital mindsets. A clarification is needed as to whether the interviewee consents to the use of their name, company name, and any quotations in the report. In addition, the interview will be recorded for transcription, where the material will be deleted upon completion of the doctoral degree in 2022. The interview will take approximately 60 minutes. Further, a list of concept explanations is presented, and then the interview with themes and questions. Other relevant information that comes up during the interview may also be used in the case study report.

Concept explanations

Below, the concepts used in the interview are explained.

Developed design is referred to as detailed design in the design process, where the concept design is developed into a dimensionally correct and coordinated design. The objective would be to provide sufficient information for the construction phase.

Design management is the management of the process of launching conceptual ideas and processing the chosen idea into a finished, intangible product in the form of drawings, models, and descriptions.

Productivity in the research refers to the design team's efficiency. Efficiency entails "doing things right" in the design phase.

Digital use in this research is addressed through knowledge of the designers' and the design manager's **digital mindset**. A digital mindset is the set of attitudes and behaviors that enables employees to see and understand possibilities that come from technology, not only their ability to use the tools.

Psychological safety is defined as the designers' and the design manager's perception of the consequences of interpersonal risks. For example, failing, speaking up, and asking for help from the team.

17.5 Appendix E – In-depth interview guide

Opening questions

1. Could I start by getting a 2-minute bio of your career and professional life?
2. What has been your role in the current phase of this project?
3. What are your current responsibilities in the project?

Extended storytelling

Theme 1: Psychological safety

4. Can you share a story about a successful work process that you have been involved in with this team?
5. Can you describe an episode where you were part of bringing an idea or a set of ideas forward to this team?

Theme 2: Productivity

6. Could you tell of an episode where you felt productive as part of this team?

Theme 3: Digital mindset

7. Could you tell of an episode where the use of digital tools was assigned to help you be productive in this team?

Theme 4: The current digitalization of work processes

8. Could you tell me about your experience with the sudden digital transformation of work in this project due to the COVID-19 crisis?

Direct questions

Theme 1: Psychological safety

9. In your opinion, what is the difference between a good and an inadequate work process for a team?
10. What are the needed circumstances for others in this team to benefit from your knowledge?

Theme 2: Productivity

11. In your view, what is the difference between a low level and a high level of productivity?
12. Can you describe the productivity of this team?

Theme 3: Digital mindset

13. When are digital tools an asset or hindrance in this project?
14. How do you feel technology affects collaboration within this team?

Theme 4: The current digitalization of work processes

15. How does the new virtual working process affect the collaboration within the team?
16. In your opinion, what are the essential measures leaders in this project can take to help you with the new working conditions?

Future situation

17. Imagine that a miracle takes place, and all your dreams of how this team's practice looks could take place. How does it look?

17.6 Appendix F – Explorative interview guide

Opening questions

1. Can you please start with a short description of your role in the current phase of this project?
2. Can you describe the design team that you are managing on this project?

Main questions

Theme 1: Productivity

3. Can you tell me about the goals guiding the team's work in the current phase of the project?
4. How would you describe "productivity" as a concept in this phase of a project?
5. Can you describe the level of productivity of this design team?
6. Can you describe the relationship between goal and productivity in the team today?

Theme 2: Digital use

7. From your perspective, what does it mean that design work is digitalized?
8. How would you measure the level of digitalization in a design team?
9. In your opinion, what is the level of digitalization in this team?

Theme 3: The current digitalization of work processes

10. In your opinion, what is the essential measure a leader can take to accommodate this forced digital transformation of work processes?
11. In what way has your role in this project been altered due to the ongoing crisis?
12. How have team members adapted to the sudden change into a virtual team?

17.7 Appendix G – Face-to-face survey

The following surveys shall be answered with **one cross** per statement.

Theme 1: Psychological safety

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
When someone makes a mistake in this team, it is often held against him or her.					
In this team, it is easy to discuss difficult issues and problems.					
In this team, people are sometimes rejected for being different.					
It is completely safe to take a risk on this team.					
It is difficult to ask other members of this team for help.					
Members of this team value and respect each other's contributions.					

Theme 2: Digital mindset

Having in mind the introduction of new technologies at work, please indicate to what extent you agree with the statements below:

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
New technologies introduced at work generally reduce the influence I have in the organization.					
The introduction of new technologies at work generally results in less interesting work for myself.					
New technologies introduced at work generally reduce the opportunities I have to succeed in my current job.					
Resources used introducing new technologies at work generally means fewer resources available for my own support and development.					
I believe that new technologies introduced at work generally will increase the influence employees have in the organization.					
I believe that the introduction of new technologies at work generally will create more interesting work for everyone.					
I believe that new technologies introduced at work generally will enable employees to improve their performance and success in their current job.					
I believe that the investment in new technologies will generally generate more resources in the organization, which can be used to support employee development.					

In general, I believe that:

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A person's level of technological savviness is something basic about them, and there isn't much that can be done to change it.					
Whether or not a person will be quick and skilled at using new technology is deeply ingrained in the kind of person they are. It cannot be changed very much.					
Not much can be done to change how well a person will keep pace with technological change. Everyone is a certain kind of person, and some will fare better with technological changes than others.					
Though people can sometimes learn new things, you can't really change people's basic talent for adapting to new technology.					
Everyone has the potential to develop new technological skills and abilities.					
Everyone, no matter who they are, can significantly improve their level of technological competence.					
No matter what kind of person someone is, they can improve even their most fundamental technological skills with effort.					
All people, regardless of age, gender, or education, have the ability to learn and master new technology.					

17.8 Appendix H – Meeting observation guide

Date:
Time:

Factor	Explanation (either/or)	Observation (fill out)
Team level		
Purpose	Type of meeting and what is discussed	
Invitation	Who sent the invitation	
Location and facilitation	How is the meeting held, and how is it prepared	
"Meeting type"	Traditional/process-structured	
Agenda	The agenda sets the structure for the meeting/dynamic agenda working as a frame for the meeting	
Minutes	The previous minutes are reviewed, and persons with responsibilities are addressed one by one/the minutes are implemented in an updated agenda	
Goal	Manager creates weekly and daily goals to guide the team/the team's and individual's goals help the team to be efficient	
Meeting structure	The leader controls the meeting and does not trust the team to carry out their responsibilities/collective structure where the leader is a facilitator	
Meeting process	The team argues, debates, and concludes/sharing of ideas, views, and experiences	
Effectivity	Efficiency is a constant issue/looking for creative solutions to become more efficient	
Decisions	Decisions are structured, for example, after agenda/decisions are taken based on what is discussed	
Flexibility	Team members hesitate to be flexible / freedom to be flexible when it comes to new challenges	
Time management	There is no time management/team members assist with time management	
Roles	Individuals are not sure about their roles/individuals have clear assumptions of their responsibilities	
Space in the meeting	Roles are engaged when needed/the discussion goes freely, and some are overlooked	

Meeting participants	Some meeting participants are present only to be informed/everyone takes an active part in the meeting	
Preparations	Meeting participants are prepared for a specific presentation/meeting participants are prepared and engaged	
Improvement	The team needs improvement, but it is up to leaders alone/improvement is a collaborative commitment	
Accountability	Team members pull together	
Communication	How do the meeting participants communicate?	
Trust	There is trust between the meeting participants	
Mood	Heated/content mood	
BIM	2D drawings used for visualization/3D models are used actively	
Individual-level		
Awareness	Individuals are focused	
Experience	Individuals have experience with these types of issues	
Innovation/ creativity	Individuals share ideas even though they are not finished	
Knowledge	Individuals able to do their tasks and share knowledge	
Motivation	Individuals are motivated to perform their tasks	
Seek help	Individuals do not seek help/when facing problems; individuals seek help	
Speaking up	Individuals keep quiet despite the possibility of misunderstandings/individuals speak up to clarify	
Failing	Individuals avoid reporting failures/individuals clarify mistakes	
Interdependence	Individuals handle their problems alone/collective intelligence	

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