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Innovation calling! Building a framework for measuring collaboration effects in software development: The influence of leadership through organisational and team mediating effects on initiative and learning during COVID-19.

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# AUTHORIZATION OF THE DIRECTORS OF THE THESIS FOR SUBMISSION

Prof. Dr. Laura Campoy and Prof. Dr. Mandy Nuszbaum as Directors of the Doctoral Thesis "Innovation calling! Building a framework for measuring collaboration effects in software development: The influence of leadership through organizational and team mediating effects on initiative and learning during COVID19." by Mrs. Laura Sophie Aichroth in the Programa de Doctorado en Ciencias Sociales, **authorizes for submission** since it has the conditions necessary for his defense.

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Destruction is essential to construction. If we want to build the new, we must be willing to let the old burn.

*Glennon Doyle*
*Untamed*

# ABSTRACT

Building on the co-evolutionary model of team research and the findings on team collaboration in Germany during the COVID-19 pandemic, this dissertation project focuses on leadership and its effects in the area of software development during the pandemic. For this purpose, comprehensive literature research was carried out, and two consecutive studies were conducted. The first study examined the role of perceived transformational leadership on organisational initiative and the mediating effect of organisational psychological safety. In addition, the moderating effect of positive leadership in the first stage was analysed. The second study focused on the effect of team-level transformational leadership on individual learning and the mediating effect of Teamwork Quality (TWQ) and the High-Performance-Team (HPT) model. In addition, the moderating effect of team interventions was investigated in the second stage. Specifically, data were analysed using Partial Least Square (PLS)-Structural Equation Modeling (SEM) for data collected from 121 employees for the first study and 224 employees for the second study through convenience sampling in one-wave approaches to capture the current perceptions in this unique collaboration situation. For the first study, the results point to transformational leadership partially effecting organisational initiative through organisational psychological safety. The the second study results do not support team-level transformational leadership influencing individual learning through TWQ, although the results do support partly influencing it through HPT. No moderating effects were found in either study. This research project is among the first to examine the perception of the role of leadership and effects via organisational and team mediators on individual behaviour in software development in Germany, particularly during the disruptions caused by the COVID-19 pandemic. Partially in line and partially in contrast to previous findings, lessons can be derived from the findings for leaders and all individuals working in software development, as well as for leadership, organisational and team development. In addition, the results point to avenues for future research efforts in the area of software development, which is an increasingly growing and important feature for economy and society.

*Keywords*: software development; transformational leadership; organisational psychology; COVID-19

# RESUMEN

Basándose en el modelo coevolutivo de investigación de equipos, así como en los hallazgos sobre la colaboración en equipo en Alemania durante la pandemia de COVID-19, este proyecto de tesis se centra en el liderazgo y sus efectos en el ámbito del desarrollo de software durante la pandemia. Para ello, se llevó a cabo una exhaustiva investigación bibliográfica y se realizaron dos estudios consecutivos. El primer estudio examinó el papel del liderazgo transformacional percibido en la iniciativa organizativa y el efecto mediador de la seguridad psicológica organizativa en este efecto. Además, se analizó el efecto moderador del liderazgo positivo en la primera etapa. El segundo estudio se centró en el efecto del liderazgo transformacional a nivel de equipo sobre el aprendizaje individual y el efecto mediador de la calidad del trabajo en equipo (TWQ) y los niveles de equipo de alto rendimiento (HPT) sobre estas vías. Además, en la segunda etapa se investigó el efecto moderador de las intervenciones del equipo. En concreto, los datos se analizaron mediante un modelo de ecuaciones estructurales de mínimos cuadrados parciales (PLS-SEM) para los datos recogidos de 121 empleados para el primer estudio y 224 empleados para el segundo estudio mediante un muestreo de conveniencia en enfoques de una ola para captar la percepción actual en esta situación de colaboración única. Para el primer estudio, los resultados apuntan a que el liderazgo transformacional influye parcialmente en la iniciativa organizativa a través de la seguridad psicológica organizativa. Los resultados del segundo estudio no apoyan que el liderazgo transformacional a nivel de equipo influya en el aprendizaje individual a través de la TWQ, mientras que sí lo hace parcialmente a través de la HPT. En ambos estudios no se encontraron efectos moderadores. Se trata de uno de los primeros estudios que examina la percepción del papel del liderazgo y los efectos a través de los mediadores organizativos y de equipo sobre el comportamiento individual en el desarrollo de software en Alemania, especialmente durante las perturbaciones causada por la pandemia COVID-19. En parte en consonancia y en parte en contraste con los hallazgos anteriores, de los resultados se pueden derivar lecciones para los líderes, pero también para todos los individuos que trabajan en el desarrollo de software, así como para el desarrollo del liderazgo, la organización y el equipo. Además, los resultados señalan vías para futuros esfuerzos de investigación para el área de desarrollo de software, que está creciendo cada vez más y es importante para la economía, pero también para la sociedad.

*Palabras claves*: desarrollo de software; liderazgo transformacional; psicológica organizativa; COVID-19

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# 1. INTRODUCTION

'No crisis in recent history has shaken the world the way coronavirus has' (Bapuji et al., 2020, p. 1067).

The pandemic has sped up digital transformation, taking place at an unprecedented pace throughout all industries (George, Lakhani & Puranam, 2020). Not only recently, but especially since the beginning of the COVID-19 pandemic, organisations and team constellations have had to become increasingly flexible, changing team compositions and forms of collaboration at shorter notice to deal with changing conditions (George, Lakhani & Puranam, 2020; Kozlowski & Ilgen, 2006). With this, all organisations face highly competitive and dynamic environments (Newman et al., 2020). However, in the technical environment, the socio-emotional aspects of collaboration have rarely been given any attention (Poth, Kottke & Riel, 2021).

From a market or customer perspective, not only over the last decade but especially since the pandemic began, there is an increasing need for digital solutions in all areas to handle non-personal contact and solve problems with digital solutions (George, Lakhani & Puranam, 2020). This goes alongside a call for more people to work in software development, which was already a challenge before to the pandemic (Venkatesh et al., 2020). However, the urgency has become more present since the pandemic started, and people in all areas have been working from home (George, Lakhani & Puranam, 2020). In a nutshell, and especially since the pandemic began, teams have become the fundamental components of today's organisational design, with the result that the research literature in this field has grown rapidly over the past two decades (e. g. Bapuji et al., 2020; Mathieu et al., 2019; Mathieu et al., 2017; Mathieu, Wolfson & Park, 2018). As a result, the gap between the number of work to be done and the amount of people to get the job done has started growing, especially in software development, making skilled people a core resource for organisations. In addition, the urgency has intensified because many software development projects continue to fail despite increasing knowledge on the technical and collaborative side (Venkatesh et al., 2020). Therefore, it has become essential for organisations to adapt to become self-organised structures, collaborating through agile methods that enable faster delivery of special software with higher user satisfaction and lower costs (Rashid & Khan, 2018). In meeting customer needs in a timely and appropriate manner, the organisational structure in software development has been adapted from a process-oriented, Tayloristic organisational structure to a more people-oriented organisational structure (Poth, Kottke & Riel, 2021).

With this, organisations have implemented team-based practices to make more effective use of their human capital. This means that team set-ups must enable organisations to design and reconfigure their team composition flexibly to match people's skills with team task requirements. Over time and in different contexts,

teams and team members go through a constant cycle of forming and adjourning (e. g. Bapuji et al., 2020; Mathieu et al., 2019). Within this cycle, they collaborate and interact with others within the team and with others outside of the team since handling complexity requires more inter-team collaboration (Cha et al., 2015). All these experiences of collaboration change team members, teams, and their context in a manner that is more complex than a 'simple cause-and-effect perspective' can grasp (Ilgen et al., 2005, p. 519).

Focussing on the working method to handle complexity, as well as changing from waterfall to agile software development approaches, was a response to the needs of developers who were confronted with increasingly diverse challenges and increasing customer demands (e. g. Birgün & Çerkezoğlu, 2019; Highsmith & Cockburn, 2001; Hoda, Salleh & Grundy, 2018; Stoica et al., 2016). The business environment has become and continues to become more flexible and offers multiple business opportunities, so companies need to be adaptive and take advantage of these opportunities. This rapid adaptability is only possible when companies use agile business architectures built on flexible solutions (Stoica et al., 2016).

From an individual leadership perspective, leaders require specific competencies and practices to deal with the global crisis and seek best practices to use scientific insights in their daily lives post COVID-19, due to sustainably changing working habits (Dirani et al., 2020). The challenge for leaders is high, especially in the area of software development with self-organising structures and so-called agile working methods to deal with complexity and speed of change. For a successful software development project, coordinating or at least bringing together the experts working in a team and supporting them when required is essential. The fact that many leaders are no longer technically able to survey technical details means a need for clear goal orientation and habituated behaviours, such as showing initiative or learning continuously and making use of the learnings right away (Dingsoyr et al., 2016).

From an individual team member perspective, in over 50 years of software development, the discipline has moved to increasingly complex processes, tools, measurements, management, and documentation. This goes alongside some individuals having felt or who are feeling detached in software development. In addition, a common tool is a shift from classical to agile collaboration methods. These methods preserve the strictness of technical processes and best practices while helping both stakeholders and software developers create, deliver, and maintain complex software (Hoda, Salleh & Grundy, 2018). In addition to business-relevant and technical improvements, the use of agile methods goes hand in hand with less work overload for software developers. To maintain long-term workability and employability of their developers, traditional organisations can also use agile methods in their projects, at a minimum to certain applicable tasks (Venkatesh et al., 2020). The importance of healthy, motivated people is relevant since many software development projects require the knowledge and experiences of the team members choosing the most appropriate implementation solutions for achieving the project's targets and meeting customer needs (Stoica et al., 2016).

Due to the COVID-19 pandemic, the current situation is challenging for all parties – customers, organisations, leaders, teams, and individuals. Satisfying all parties starts with the need to study the current perception of people already working in the field of software development. The individual perspectives of people working in software development is especially important since the COVID-19 pandemic has also taught us that people perceive situations differently and deal differently with change (Bapuji et al., 2020). Due to the fluidity of collaboration in general, and precisely the speed of changes in agile software development, this dissertation project focuses on the perception of individuals on behaviours instead of nesting data to compare teams or organisations. However, the generalisation of results is the target. Additionally, people perceive leadership behaviour differently, and leaders unconsciously behave differently in their interactions with different employees (Clarke, 2012).

Therefore, the overall question of this dissertation project is:

How do employees in software development perceive leadership behaviour, their work environment, and individual effects in the German labour market during the COVID-19 pandemic as an example of disruptive change?

This chapter introduces the context and challenges for this dissertation project and outlines the relevance of and for (agile) software development. It describes the chosen problem scope and the derived research questions. With this, this chapter summarises the scope of this dissertation project and gives an overview of the structure of the dissertation.

## 1.1. CONTEXT AND CHALLENGES

This section briefly introduces the context of this dissertation project and gives an overview of the current related challenges. It is structured as follows: First, it describes a need for change and action, followed by the need for new measures and evaluations, and the need to embrace complexity.

### 1.1.1. Need for Change and Action

Following the pandemic's beginning at the end of 2019, the spread of the COVID-19 virus has grown exponentially. In general, there are catastrophic impacts when an exponential system clashes with a system with constant, limited capacity like the health care system (George, Lakhani & Puranam, 2020). The impacts of the current crisis for individuals, businesses, and society are huge, and everyone is still trying to make heads or tails of the crisis and adjust to it as it progresses (Bapuji et al., 2020). Even though there were inequalities or different perceptions and experiences of situations before, the pandemic guided awareness to those differences, primarily due to the disproportionate consequences for individuals (George, Lakhani & Puranam, 2020).

Due to the COVID-19 pandemic, not only has social life changed but also work life (Neumann et al., 2021). With regards to organisations, the pandemic has challenged their agility and resilience, and the need to fundamentally transform the digital infrastructure has become obvious. George, Lakhani and Puranam (2020, p. 1754) called the pandemic a forced shift to Work From Home (WFH); probably the most significant organisational 'design shock of our lifetimes', which goes alongside several further challenges. Information technology is an irreplaceable part of applications in today's global society and economy. Besides contemporary management practices, hardware and software is also of the utmost importance to ensure an edge over the competition if a company aims to keep pace with market demands. A crucial prerequisite for this competition is to be agile and innovative as a company (Birgün & Çerkezoğlu, 2019).

New working habits that emerged to cope with the pandemic, like WFH or working in virtual and distributed teams, are rarely new to software development. However, studies have shown that not working in a co-located environment affects team performance. Moreover, working from home entirely since March 2020 not only changed enablement and willingness to change behaviours but also led to a confrontation with problems of distributed work (Neumann et al., 2021). Nevertheless, the challenges in the area of software development for remote collaboration were and are the same, such as a need for reducing dependencies, rearranging real-time social contact and dialogue, or rethinking business monitoring or governance techniques. Questionable and simultaneously comprehensible developments accompany the speed of necessary change. There is a move to prioritise the collective welfare over personal privacy or a greater willingness to hand over power and control to the government. These trends not only reflect a need to newly negotiate balance upon the role of technology and government in everyday life, but these newly adopted behaviours also point to fundamental shifts in society's attitude (George, Lakhani & Puranam, 2020).

Already prior to the pandemic, the question arose on the need and role of leadership in self-organised collaboration structures (Lee & Edmondson, 2017). This is also true for software development. Not only obstructive and missing leadership but also insufficient collaboration with the client can have negative consequences for the self-organisation of software teams (Hoda, Noble & Marshall, 2011). With regards to the special situation of the pandemic, the literature has distinguished between an extreme event and a crisis, depending on whether there is time for response following an extreme event or little to no time to respond to a crisis. Crises are characterised by the uncertainty of cause, effect, and solution options (e. g. Hannah et al., 2009; Pearson & Clair, 1998).

Hannah et al. (2009) researched extreme contexts and leadership behaviour. As a prerequisite, they recommended that for leadership research in extreme contexts, it is first important to have a clear definition of the internal and external context. They described the internal context as the type of organisation and the characteristics of the job. The external context was outlined as the surroundings in which the organisation

navigates in extreme contexts. Moreover, an extreme event was defined as 'a discrete episode or occurrence that may result in an extensive and intolerable magnitude of physical, psychological, or material consequences to – or in close physical or psychosocial proximity to – organisation members' (Hannah et al., 2009, p. 898). For firefighters, a normal context was a standard workday at the fire station with, for example, drills or report writing. The extreme context was described as the moment when an emergency call comes in and the team goes out to the scene, not knowing what to expect (Geier, 2016). To derive an example for software development, a normal context can be a routine working day coding or testing software products, while an external context can be the moment when a security gap or hack happens, with teams not knowing what to expect.

Following this definition, the COVID-19 pandemic can be categorised as a crisis. For this dissertation project, in line with Hannah et al. (2009), the external and internal contexts are understood as the following:

- The internal context is the area of software development in the German economy (see more in chapter 2).

- The external context is the COVID-19 pandemic (George, Lakhani & Puranam, 2020).

At a team level, Neumann et al. (2021) conducted a multiple-case study project, examining the effect of the COVID-19 pandemic on software development teams in Germany using agile methods. The results indicated that the majority did not perceive a reduction of their team performance due to the current situation. To enlarge these insights with regards to leadership, this dissertation project contributes to the need for change and action and seeks empirical results on the role of leadership when working in software development during the COVID-19 pandemic. Furthermore, these insights were assessed as necessary for organisations to successfully navigate the changing environment, which will be outlined in the next section.

### 1.1.2. Need to Embrace Complexity

Mathieu, Wolfson and Park (2018) stated that, following the start of workgroup research with the Hawthorne studies in the 1920s and 1930s, the progress in science and practice has been enormous. Research has grown significantly since the 1990s with a movement from concentrating on teams only to focussing on broader systems of teams (Mathieu et al., 2017). Mathieu et al. (2017) understood those work groups as the linkage between individuals and organisations. Regarding frameworks for team research, Mathieu, Wolfson and Park (2018) stated that the popular Input-Process-Outcome (IPO) approach was very helpful in the past but has become a limitation due to its tendency to oversimplify reality. Therefore, there is a demand for future research to approach new theories, methodologies, and tools for modelling the dynamics of team properties. Additionally, they pointed to a need for more appreciation of suitable team task environments, as well as concepts for understanding teams as entities in a

multilevel environment (i.e. individuals, teams, leaders, organisation). Due to the need to adapt to change, the necessity to model dynamic team relationships in their context came up as a key area for research, as well as the need to consider operations in complex systems (Mathieu et al., 2017).

This dissertation project adopts the team definition and understanding by Kozlowski and Ilgen (2006, p. 79) as:

- two or more individuals,

- who socially interact (face-to-face or, increasingly, virtually),

- possess one or more common goals,

- are brought together to perform organisationally relevant tasks,

- exhibit interdependencies with respect to workflow, goals, and outcomes,

- have different roles and responsibilities,

- and are together embedded in an encompassing organisational system, with boundaries and linkages to the broader system context and task environment.

Mathieu et al. (2019) emphasised the need to conceptualise teams as dynamic networks and small complex systems. This is in line with the understanding of Mathieu et al. (2019, p. 17), who defined 'organisational teams as dynamic systems evolving in response to their environments'.

Kozlowski and Ilgen (2006) described that ever since the start of human history, the centre of social organisations of all kinds have been people working together in teams for a shared purpose. Nevertheless, in the late 19th and early 20th centuries, this work within organisations was understood more as a collection of individual jobs and became an ongoing issue for organisations over the last two decades. Several global developments have forced organisations around the world to 'restructure work around teams, to enable more rapid, flexible, and adaptive responses to the unexpected' (Kozlowski & Ilgen, 2006, p. 77).

Regarding the developments during and after the pandemic situation, George, Lakhani and Puranam (2020) summarised two imperatives for the upcoming years and challenges: *sustainability* and *digital imperatives*. Entrepreneurs have lately contributed to the overall need for innovations by using more digital technologies. Until now, many innovations have needed certain physical infrastructure such as labs, social ecosystems, or certain equipment, which is currently limited in virtual collaborations. Due to the current situation, more aspects of the economy is taking place digitally or needs at least a form of digital capturing, which aligns with an increasing need for digital products (George, Lakhani & Puranam, 2020).

In relation to complex situations and tasks, Avey, Avolio and Luthans (2011) showed that the attitude of employees was affected by the attitudes of the leader, with a contagion in both the positive and negative direction. Thus, employees perceived themselves more positively once they perceived their leader as positive. Managers

should therefore not only be aware of the effect but also adapt both their verbal and non-verbal communications, as well as their behaviours, accordingly, because the positive attitude of employees also has a positive effect on performance. Moreover, George, Lakhani and Puranam (2020, p. 1755) stated that: 'Collaboration and communication drive innovation behaviour'. Furthermore, they added that the digitisation of work may make it more possible than ever to allow workers to be evaluated on outcomes rather than on behaviour. By applying lean and agile approaches to handle these challenges, significant improvements have been achieved in terms of 'cost, time, labour force, quality, internal and external customer satisfaction, speed, reliability, and productivity' (Birgün & Çerkezoğlu, 2019, pp. 1940006–1) (see section 2.3).

With this, this dissertation project aims to contribute to Mathieu et al. (2019) by embracing complexity in research in general and to give insights for the target group of people working in agile software development specifically (see section 2.2).

### 1.1.3. Need for New Measures and Evaluations

Over the last few decades, team research has often focussed on effectiveness as the (only) relevant outcome of collaboration or teamwork processes (LePine et al., 2008; Mathieu et al., 2019). The need for new measures and evaluations includes three aspects: First, to contribute to the need to continuously adapt to changes, which goes along with a need for suitable structures, appropriate leadership, and people eager to never stop learning (Bapuji et al., 2020; George, Lakhani & Puranam, 2020). Within this, there is a need to redefine the selection of indicators measuring success with regards to work. Second, prior research often focused on single teams only, not respecting the context and dynamics of the wider environment (Carter et al., 2020; Mathieu et al., 2019). In recent times, teams have started to act as more open systems cooperating with other teams rather than operating as independent, detached units (Carter et al., 2020). Third, Sarstedt, Ringle and Hair (2021) emphasised the importance of predictive power and the restriction of practical benefits when following confirmation procedures only.

Poth, Kottke and Riel (2021) gave an overview for three aspects of quality of collaboration for different kinds of contexts, which is summarised in Table 1.1.

In general, Rashid and Khan (2018) described agile working as an iterative work process with self-organised teams and organisations (see section 2.3). Since software development includes all three pillars of product, process, and team quality, there is a need for measuring and evaluating all three aspects to continuously improve. Aiming to measure these three pillars goes along with accepting and handling the abstraction from the directly testable product to the indirectly measurable, yet limited observable quality driver of teamwork (Poth, Kottke & Riel, 2021). Moreover, Hair and Sarstedt (2020, p. 6) stated that 'we live in a noisy, probabilistic world in which we can at best make imperfect predictions. In such a world, causal explanation reduces the complexity of the world to make it more manageable and understandable.' This call is followed in the context of this dissertation project to contribute by adding knowledge and experience in measuring and evaluating the perception of working

Table 1.1.: Overview on Three Quality Criteria for Different Work Contexts Adapted from Poth, Kottke and Riel (2021, p. 3)

| Focus | Uniqueness | Repeatability | Createability |
|---|---|---|---|
| Quality criteria | | | |
| | Product Quality | Process Quality | Team Quality |
| Goal | | | |
| | Optimisation for each product. | Optimisation of work flow, tasks, and roles involved in the process for reducing waiting times and increasing throughput for endless process repetitions. | Optimisation of team work with regards to increasing product, process of collaboration, and the skill level of the team continuously. |
| Assessment | | | |
| | Product assessment for striving for unique, perfect products. | Process assessment striving for the most suitable and fastest process. | Team assessment including all responsibilities of product, process, products, releases striving for continuous improvement of all aspects. |
| Work context | | | |
| | Craftsmanship or manufacturing | Taylorism and assembly lines | Agile organisations |

*Note.* Importance for collaboration in agile software development increases in importance and from direct to indirect measurability from left to right.

in the complex context of software development.

Dingsoyr et al. (2016) named software development as an example of knowledge work in an innovative setting that is already working with approaches such as agile methods. This area could be used as a role model for collaboration in complexity and extend knowledge from this study to other areas, such as the results by Neumann et al. (2021) that examined the perception of the team level for software development during the COVID-19 pandemic. In doing so, the results of this dissertation project are designed to contribute to theoretical and practical benefits by providing important insights that are not only interesting but, above all, important (Pillutla & Thau, 2013). By giving a snapshot on people's perception in this special, dynamic, and uncertain situation, the underlying studies aim to provide research evidence for other outcome variables besides team performance and thereby extend the model created by Mathieu et al. (2019) (see section 2.2). The next section puts the spotlight on the relevance of and for software development, especially in the situation of the COVID-19 pandemic.

## 1.2. RELEVANCE OF AND FOR SOFTWARE DEVELOPMENT

The implications of the COVID-19 pandemic have not been the same across different sectors. New business models have arisen and older ones have disappeared (George, Lakhani & Puranam, 2020). An organisation's agility has always been a key element in gaining strategic advantage, including the ability to adapt to change. Having an agile structure at the organisational level can lead to a reduction in the development time for both new processes and adapting established processes (Stoica et al., 2016). During the pandemic, awareness was raised on societal weaknesses and vulnerabilities, which was a boost for companies seeking sustainable outcomes in general and innovations in relation to technology and business models tackling climate change or fostering sustainability (George, Lakhani & Puranam, 2020).

While the situation of the COVID-19 pandemic was particular and new, continuous improvement and adaptation to changing technologies or customer needs, as well as the permanent improvement of collaboration or the ongoing development of skills, were not new to software development but have always been inherent. However, even understanding team performance theoretically in an environment aiming to adapt to market or economic changes in real time can be challenging. Moreover, working in highly dynamic contexts and taking responsibilities can be described as even more challenging. Certain characteristics have been needed and working methods to give guidance with both enough structure and support to adapt and improve continuously (Fagerholm et al., 2015). In addition to increasingly technological complexity and social challenges, working in virtual, distributed teams located around the world in different time zones adds even more complexity to working in software development (Noll, Razzak & Beecham, 2017).

In need of fast development cycles and deep problem understanding, software products are often developed mainly in self-organised teams, which requires all

individuals being willing to accept responsibility and being able to cope with it successfully (e. g. Dingsoyr et al., 2016; Hoegl & Gemuenden, 2001; Maneva, Koceska & Koceski, 2017; Zayat & Senvar, 2020). It is not only the individual impact of a pandemic that differs but also the perception of situations (George, Lakhani & Puranam, 2020). Moreover, working methods also differ from lean or agile methods or hybrid approaches (Neumann et al., 2021). Even if we would like to have this in order to make reality more manageable, there is no right or wrong way to use certain working methods in general, but only the suitability of particular working methods to the problem that needs to be solved.

Working in software development has been characterised by dynamics due to the specificities of the area itself. Robillard et al. (2014) developed a framework for measuring teamwork in software engineering using the IPO approach validated by software developers. They pointed to the possibility of errors occurring at every stage with the following examples:

1. Input: Insufficiently defined completeness criteria can lead the team to believe that its documentation is superior to what it is.

2. Process: Too little time spent on review can mistakenly lead to a software release and mislead the team into a false belief in its coding quality.

3. Outcome: The error message system can be set (insensitive) to no longer display warnings.

They already added the category of emergent states with the example of a poorly motivated team that can lead to the task being neglected or even messed up (see section 2.2).

On the other side of the coin, Noll, Razzak and Beecham (2017) evaluated three aspects affecting motivation when working in software development:

- Autonomy

- Competence

- Relatedness

Nevertheless, based on their qualitative approach, they concluded that '(1) autonomy is a necessary but not sufficient condition for motivation among experienced team members, and (2) autonomy is not a motivator unless accompanied by sufficient competence' (Noll, Razzak & Beecham, 2017, para. 1). In addition, Beecham et al. (2008) gave empirical evidence indicating that demotivated software engineers are more likely to quit their job or take sick leave. In contrast, motivated software engineers are more productive and stay with the company longer. Encouraging motivation for software engineers can be achieved by providing problem solving situations, working for the purpose of serving others, or by technical challenges. However, the cultural environment and the respective environment are relevant. These aspects have not been taken into account much in previous research with

regards to leadership in this area, however, insights have been provided with regards to the team-level effects (Poth, Kottke & Riel, 2021).

Successful software projects have always been highly dependent on high-performing teams and and their members with specific skills needed to solve specific customer problems. In addition, those skilled people need to be able and willing to work using specific working methods like Scrum, which has always been limited and is getting worse, for example with an increasing demand for software products that are needed to handle the COVID-19 pandemic in the healthcare system (George, Lakhani & Puranam, 2020; Omar et al., 2018) (see section 2.3). In addition, more general skills such as an overall technical understanding or understanding the domain differ depending on the solution being developed, such as for contact tracing or for virtual collaboration (George, Lakhani & Puranam, 2020). Following the suggestion that there is a need to respect the context and challenges of having enough suitable software solutions to overcome societal and economic problems, the next section summarises and defines the problem scope and research question for the current dissertation project.

## 1.3. PROBLEM SCOPE AND RESEARCH QUESTIONS

Despite more than 50 years of psychological research, including literally thousands of studies in the context of team effectiveness, a lot remains unknown, especially with regards to levers and tools for practical usage (Kozlowski & Ilgen, 2006). In addition, after more than two decades of practice, companies still find themselves (more or less) successfully choosing, using, and improving collaboration methods suitable for their teams, customers, and specific project conditions. Within this, researchers still study these matters and provide help to practitioners to understand and cope with challenges, especially in the area of software development. Moreover, managing change within a work environment that actively promotes embracing change starting with leadership attention requires further research (Hoda, Salleh & Grundy, 2018). For this, the situation of the pandemic provides an appropriate, however, outstanding situation of adapting work environments and leadership habits in dynamic situations to a greater extent than general market changes. Dynamic team collaboration resulting from changing customer needs leads to a need to adopt team constellations to respond appropriately (e. g. Marzi et al., 2021; Mathieu et al., 2019; Poth, Kottke & Riel, 2021; Venkatesh et al., 2020). Due to the ongoing shifts in the structure of (team) work and the often short duration of collaborations due to various dynamics, this dissertation project focuses on the perception of individuals working in the area of software development in general instead of collecting data at the team level (Kozlowski & Ilgen, 2006). Therefore, this dissertation aims to explore how people in the field of software development in Germany perceived their work environment during the volatile situation of the COVID-19 pandemic.

Besides the technical complexity, Fagerholm et al. (2015) recommended further examination of software development from a human perspective. With this, the scope

does not include technical or engineering aspects, but focuses on the social and behavioural part of software development. In more detail, the main goal of this research project is to examine how people currently perceive working in software development teams in Germany. Additionally, the focus is on what effect transformational leadership behaviour has at the team-level through organisational psychological safety, TWQ, and HPT on the individual perception of organisational initiatives (e. g. Hassi, Rohlfer & Jebsen, 2021; Kelloway et al., 2013; Klaic, Burtscher & Jonas, 2020; Mathieu et al., 2019).

Hereby, this dissertation project aims to contribute to scientific knowledge providing insights for the relevant target group and contribute to practical usage by giving data-based advice for improving leadership behaviours and work environments as a prerequisite for sustainably successful organisations. Having started with the general question as to how people perceive leadership when working in software development, two more specific research questions have been derived for this dissertation project. The question will be inspected from both a theoretical and a practical point of view. Overall, the results of two multi-organisation surveys expand the current state of research for people working in software development and provide insights on the current practical state. Both studies contribute to the need for further research, as claimed by Mathieu et al. (2019, p. 17) to '[e]mbracing complexity' and understanding teams as complex dynamic systems, which take place in a context and evolve by team members interacting over time, developing and adapting in response to changing situational demands (Kozlowski & Ilgen, 2006).

## 1.4. SCOPE AND STRUCTURE OF THE DISSERTATION

This dissertation project addresses the digital imperative in the field of innovation, specifically perceived collaboration in software development. The target group is people working in software development in Germany. There is a need first to understand the current situation to derive action. To gain insights into the current state, the research focuses on people's perception of different aspects of work affected by leadership behaviour and other aspects. The need to embrace the addressed complexity in software development means that teams can also be described as dynamic networks and small complex systems, indicating the need to understand and permanently adapt to change (e. g. Mathieu et al., 2019; Venkatesh et al., 2020).

The fluency and dynamic suggests a certain flexibility of individuals not working permanently in one team but changing teams due to the demands of (customer) problems and needed skills (Poth, Kottke & Riel, 2021). The stated need to adopt research accordingly, as well as the contribution to evaluating the status quo of the perception at work for software development in Germany, leads to focussing on individuals' perception rather than examining team comparisons (Mathieu et al., 2019; Mathieu et al., 2017; Mathieu, Wolfson & Park, 2018). Moreover, this dissertation project builds on the findings by Neumann et al. (2021), who focused on teamwork only in the situation of COVID-19. There is a need in software development to understand

and treat organisational development and product development for customers with an iterative approach: Examining the current problem and status quo, deriving appropriate actions for the challenge, continuously asking for feedback and measuring whether actions brought the organisation closer to solving the problem, or redefining actions if they were not helpful until the problem is solved, is vital (Venkatesh et al., 2020).

This dissertation is structured as follows: First, an overview of the general theoretical background and the current state of research is given, including the general underlying research question of this dissertation project. The overall structure of this dissertation project is formed by the two studies conducted. Next, I present the first study of this project, which explores organisational-level perceptions of leadership and collaboration in software development during the COVID-19 pandemic. This chapter covers the theoretical basis for deriving the hypotheses of the first study. It also presents the constructs investigated, as well as the methods and results. The chapter concludes with a discussion of the results and potential implications, as well as a link to the second study. I then present the second study, which focuses on team and individual level perceptions of leadership and collaboration in software development during the COVID-19 pandemic. This part also contains the theoretical derivation of the hypotheses, the constructs used, methods, results, and discussion of the results, as well as links to the overall discussion of this project. The two studies are followed by a discussion of the interpretation of the results in the context of current research. This chapter also identifies the strengths and limitations of this research project, outlines the need for further research, and discusses the practical implications of the results. This dissertation project concludes with a general summary outlining the answers to the overarching research question.

## 2. THEORETICAL FRAMEWORK AND CURRENT RESEARCH

This chapter first focuses on giving an overview of the current theoretical and empirical state. Due to the challenges stated in the introduction, this dissertation project focusses on providing an evidence-based framework for collaboration in software product development that suits both organisations and individuals. Therefore, first, there is a focus on the role of leadership in technology organisations and teams to address the need for change and action. Second, the current state of science with regards to collaboration on software product development is presented to address the need for new measures and evaluations. Third, the current research on teamwork and the latest research framework by Mathieu et al. (2019) are described to address the need to embrace complexity. The aim of this chapter is to set the theoretical framework for the following two studies. The definition of the constructs relevant for this dissertation project and the derivation of the hypotheses takes place in the respective chapter of the study.

## 2.1. LEADERSHIP IN TECHNOLOGY ORGANISATIONS AND TEAMS

Developing valuable software products requires self-organising teams to build the architecture, meet customer requirements, and create suitable designs (Dingsoyr et al., 2016). The organisational structure of self-organisation for software product development teams often goes along with using agile methods (e. g. Hoda & Murugesan, 2016; Venkatesh et al., 2020). Agile methods, however, lack clear guidelines on how the suggested self-management practices can meet a project's objective. Therefore, it is often unknown as to whether self-management results in objective-orientation (Dingsoyr et al., 2016). This requires self-management skills and a less hierarchical structure to meet the demands of being fast and customer-centric with regards to delivering suitable solutions (Rashid & Khan, 2018).

Moreover, self-organisation reaches certain limits evaluated by (Lee & Edmondson, 2017): self-organisation (still) needs leadership for orientation. There has been much research on leadership over the past decades, and different leadership styles have emerged and been criticised at the same time. These leadership styles were, for example, empowering, ambidextrous, authentic, charismatic, complexity, functional, positive, transactional, or transformational leadership (Alvesson & Einola, 2019; Banks et al., 2016; Carter et al., 2020; Cha et al., 2015; Cheong et al., 2019; Gerlach, Hundeling & Rosing, 2020; Rosenhead et al., 2019; van Knippenberg & Sitkin, 2013; Xie et al., 2018, e. g.).

Transformational leadership has often been summarised in the category of

positive leadership theories (i.e., servant, ethical or spiritual leadership). Recent research has stated that other newly developed leadership styles in this category do not provide explanation beyond transformational leadership, or lack differentiation from it (e. g. Alvesson & Einola, 2019; Anderson & Sun, 2017; Monzani & Dick, 2020). This is why they have not been chosen in this dissertation project. Like with all leadership styles, various criticisms in relation to transformational leadership have been raised, e.g. for the aspect of charisma in this context or missing actionability (e. g. Alvesson & Einola, 2019; Siangchokyoo, Klinger & Campion, 2020; van Knippenberg & Sitkin, 2013). In contrast, several studies still supported the favour of measuring and improving transformational leadership behaviours on several kinds of outcomes. Focussing on practical use, several studies examined the differences and suitability of transformational and transactional leadership, both being helpful and being validated over decades (e. g. Anderson & Sun, 2017; Judge & Piccolo, 2004; Kuhnert & Lewis, 1987; Monzani & Dick, 2020). In organisations or teams, transformational leadership behaviours have often been examined in relation to innovation or knowledge exchange behaviours, indicating positive effects on individuals, teams or organisations (e. g. Burmeister et al., 2019; Klaic, Burtscher & Jonas, 2020) Especially in the context of technology, research over the last few years have showed supporting results for the suitability of transformational leadership (e. g. Cha et al., 2015; Xie et al., 2018).

The increasing need for innovations and thereby for new products to offer suitable solutions has come along with a growing research interest on new product development (NPD) in the past 30 years. In their meta analysis, Marzi et al. (2021, p. 330) examined research in strategy, marketing, supply chain management, and project management of the last decade, clustering them into five fields: 'the NPD process, the integration of diverse knowledge sources for NPD optimization, the relationship between NPD and corporate strategy, the role of users and consumers in the NPD process, and the supplier involvement in the NPD activities'. To follow the recommendations by Brodbeck, Anderson and West (2000), fostering innovations needs provided support and an articulated vision by the leadership. Whereas it seems obvious and empirically supported, research has shown that inadequate collaboration with customers, not understanding their needs and therefore not delivering suitable software, are all related to problems in software development teams (Hoda, Noble & Marshall, 2011). In addition, further studies pointed to the need to put more focus on behavioural and social aspects of software development (Fagerholm et al., 2015). Especially in the current situation of the COVID-19 pandemic, this became more urgent with research starting to emphasise team collaboration in this situation, however missing the influence of leadership (Neumann et al., 2021).

Due to the strong influence of leadership behaviour on organisations, teams, and individuals, both studies have the leadership behaviour as the predictor variable (e. g. Carter et al., 2020; Gerlach, Hundeling & Rosing, 2020; Hassi, Rohlfer & Jebsen, 2021; Iqbal, Ahmad & Latif, 2021; Jahanshahi, Maghsoudi & Babaei, 2020; Klaic, Burtscher & Jonas, 2020; van der Voet & Steijn, 2020; Xie et al., 2018). The next section includes prior and current trends, models and insights given for team research.

Figure 2.1.: Input-Process-Outcome (IPO) Framework of Team Research

| | |
|---|---|
| Input | Previous factors enabling and constraining interaction of team members including: |

- Individual-level factors, which are characteristics of team members like skills, personality characteristics, or personalities

- Team-level factors like external leader influences, team size, or task structure

- Organisational-level factor like organisational design, level of environmental stress, or complexity of the environment

| | |
|---|---|
| Process | All kinds of behavioural processes with regards to team members' interactions that describe the transformation of inputs into outcomes with the aim to finish tasks |

| | |
|---|---|
| Outcome | |

- Performance outcomes like performance quality, speed to solution, or amount of errors

- Other outcomes like member satisfaction, group cohesion, or attitude change

*Note.* Own figure according to Mathieu et al. (2019), Hackman and Morris (1975), and McGrath (1964)

## 2.2. EMBRACING COMPLEXITY IN TEAM RESEARCH

Salas et al. (2014) described the importance of teams as ubiquitous in today's world, and rightly so, because we need them. McGrath (1964) and Hackman and Morris (1975) started to structure team research designs using the IPO framework for team effectiveness research, which was present for many years. Figure 2.1 contains the descriptions of the three categories of variables.

Robillard et al. (2014) stated that the software engineering literature had not started publishing conceptual and empirical writings on team research. They used the IPO framework for measuring collaboration of software engineering teams and came to the conclusion that teamwork and environment in this area needs further research e. g. focusing on the perception of collaboration. With regards to the IPO approach, Marks, Mathieu and Zaccaro (2001) and Ilgen et al. (2005) criticised the

Figure 2.2.: Input-Mediating Mechanisms-Outcome (IMO) Framework of Team Research

| Input | Previous factors enabling and constraining interaction of team members including: |
| --- | --- |
| | • Individual: Characteristics of team members like competencies or personalities |
| | • Team: factors like external leader influences or task structure |
| | • Organisational: contextual factors like organisational design or complexity of the environment |
| Mediating Mechanism | |
| | • Behavioural processes |
| | • Collective affect |
| | • Collective cognitions |
| Outcome | Direct results or by-products of team activity which are valuable for one or more other persons including qualitative or quantitative aspects of performance and the affective reactions of team members such as showing commitment or satisfaction |

*Note.* Figure following Mathieu et al. (2019)

fact that the differences between team process and the so-called emergent states, which were the results of the processes, were often not precisely identified. Moreover, they pointed out that many of the mediating factors establishing the influence of the inputs on the outcomes are not (only) processes. Therefore, they updated the IPO by McGrath (1964) and Hackman and Morris (1975) to include overall mediating mechanisms and the Input-Mediating Mechanisms-Output (IMO) to include not only behavioural processes but also collective affects and cognitions to the model. Figure 2.2 contains the descriptions of the adopted categories.

The IMO framework served for many years of team research but lacked the ability to consider dynamics or the complexity of systems (Mathieu, Wolfson & Park, 2018). Since team research emerged over a century ago, in their review on team research LePine et al. (2008) criticised the fact that current research was still

building up on existing research approaches, often simplifying reality, and called for researchers to be open and make sure to capture and embrace the complexity of current team settings, as well as trying to understand and measure contexts and start researching in a new decade of approaches (Mathieu, Wolfson & Park, 2018). Mathieu et al. (2017) published their review of a century of research on work teams and Mathieu et al. (2019) continued by actively encouraging researchers to start a new era of team research. They reviewed the past ten years of team (effectiveness) research and introduced a new perspective by categorising the variables of the studies more precisely in 'compositional and structural features, mediating mechanisms, external influences, and outcomes' (Mathieu et al., 2019, p. 19). These categories were described as overlapping and jointly developed referring to the context. As a result of their review, they assigned some constructs in their framework to two categories, such as psychological safety being used as compositional feature or mediator or (shared) leadership as a structural feature or mediator. Figure 2.3 visualises the framework.

This dissertation project uses the model introduced by Mathieu et al. (2019) to structure the studies and contribute to scientific and practical knowledge by extending the framework. The explanations of and examples for the categories are summarised in Table 2.1.

Due to the results of the analysis in section 2.1 and the importance of transformational leadership for technology organisations and teams, the focus of this dissertation project is on leadership as an influencing factor within the organisation. Since shared leadership has already been categorised as a structural and mediating feature, the two studies aim to enlarge the framework by Mathieu et al. (2019) with regards to (team-level) transformational leadership.

The central aspect remains the mediating mechanisms, with an opportunity for variables to be categorised more precisely, whether the construct is used as a mediator only, as a structural or mediating feature (two variables) or as a mediating and compositional feature (nine variables). Hereby, the mediators are divided into team processes, emergent states and hybrid mediators. This extends the work by Marks, Mathieu and Zaccaro (2001) and Ilgen et al. (2005) as described (see Table 2.1). To validate whether the framework is suitable for the target group of people working in software product development, this dissertation will first make use of an already established variable of the framework in the first study for mediation (see chapter 3) and add a new mediator in the second study (see chapter 4).

Mathieu et al. (2019) divided outcomes into team performance or attitudinal outcomes. With regards to outcomes, prior team research mainly focused on team performance or functioning from the outside perspective of customers, stakeholders, or other teams. From an inside perspective, the individual reaction was more important, resulting in attitudinal outcomes. This was also the case for Xu, Jiang and Wang (2019), who also used a mediation model for the target group of teams working in an information technology company. Their research setup included the predictor of team personality, team climate for innovations as the mediating variable and the performance outcome of individual creative performance and job crafting

Figure 2.3.: Team Collaboration Framework Adapted from Mathieu et al. (2017) and
Mathieu et al. (2019)
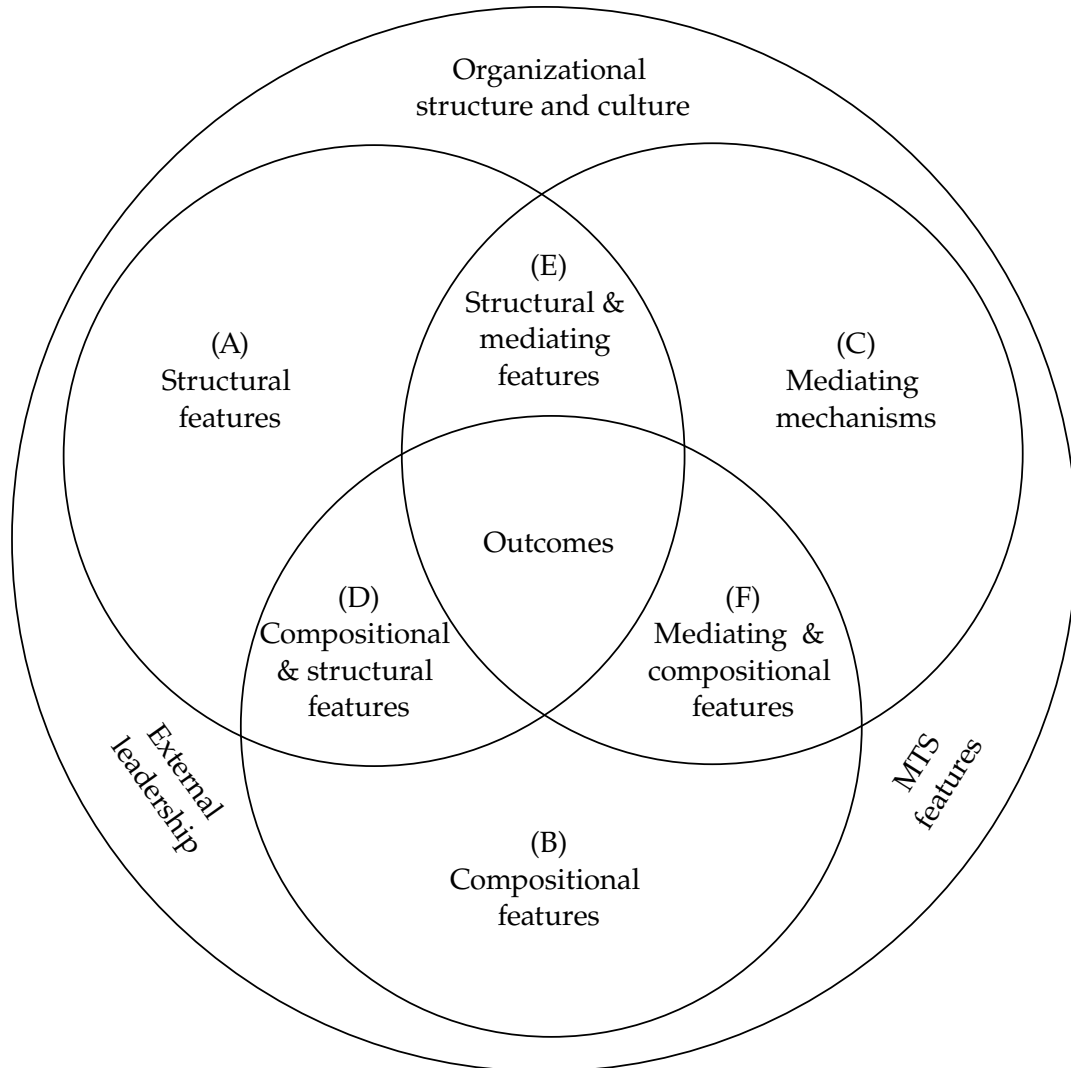


Organizational
structure and culture

(E)
Structural &
mediating
features

(A)
Structural
features

(C)
Mediating
mechanisms

Outcomes

(D)
Compositional
& structural
features

(F)
Mediating &
compositional
features

External
leadership

MTS
features

(B)
Compositional
features

*Note.* Adapted from Mathieu et al. (2017) and Mathieu et al. (2019). Copyright 2017
by the American Psychological Association. Abbreviations: MTS, multiteam systems
.

Table 2.1.: Framework to Embrace Complexity in Team Research

| Category | Explanation |
|---|---|
| Structural Features (Region A) | Variables like task scope and complexity, interdependence, team virtuality or team technology (from 99 studies) |
| Compositional Features (Region B) | '[C]ombination of members' characteristics' (Mathieu et al., 2017, p. 457) like average member attributes, diversity, surface-level or deep-level diversity (from 150 studies) |
| Mediating Mechanisms (Region C) | Members' 'ABC's', i.e., affect, behaviors, and cognitions (Salas, Kozlowski & Chen, 2017). Effects of teams or their direct environment (292 studies)<br><br>• Team process<br>• Emergent state<br>• Hybrid |
| Compositional and Structural (Region D) | Variables simultaneously representing compositional and structural features like skill differentiation, member centrality, or roles in line with Mathieu et al. (2017) (140 studies) |
| Structural and Mediating Features (Region E) | Variables which are overlapping as structural team features and mediators in line with Mathieu et al. (2017). Variables were for example team adaptability, empowerment, or (shared) leadership (66 studies). |
| Compositional and Mediating Features (Region F) | Relationship between team membership variables and the states that emerge, e. g. 'shared mental models played a mediating role in many relationships but were represented by the alignment of different members' individual mental models' (Mathieu et al., 2019, p. 33). Variables included psychological safety or task orientation (80 studies) |
| Outcomes (Center) | Team functioning for team members themselves and others outside the team like customers, stakeholders, or other teams:<br><br>• Team performance: Tangible outcomes or products of team interaction with regards to: (a) productivity (quantitative counts of some unit that a team produces), (b) efficiency, and (c) quality<br><br>• Attitudinal outcomes: Influences on team members |

*Note.* Framework and definitions summarised from Mathieu et al. (2019, p. 21 − 36), Salas, Kozlowski and Chen (2017) and Maynard, Gilson and Mathieu (2012)

(rated by the leader). However, the research by Mathieu et al. (2019) showed that not only from a practical but also a scientific perspective, little research has been done with regards to attitudinal outcomes (38 mediating variables and the effect on team performance outcome versus 23 mediating variables with the examined effect on attitudinal outcome). They also pointed to the importance of team members being willing to collaborate or being committed to the team and the organisation as well, which was seen to be dependant on their individual reactions as an outcome of inputs and mediating mechanisms. Therefore, this dissertation project focuses on attitudinal outcomes as criterion variables in both studies.

Figure 2.4 visualises the framework.

Figure 2.4.: Team Collaboration Framework Including Constructs of the Current Dissertation Project
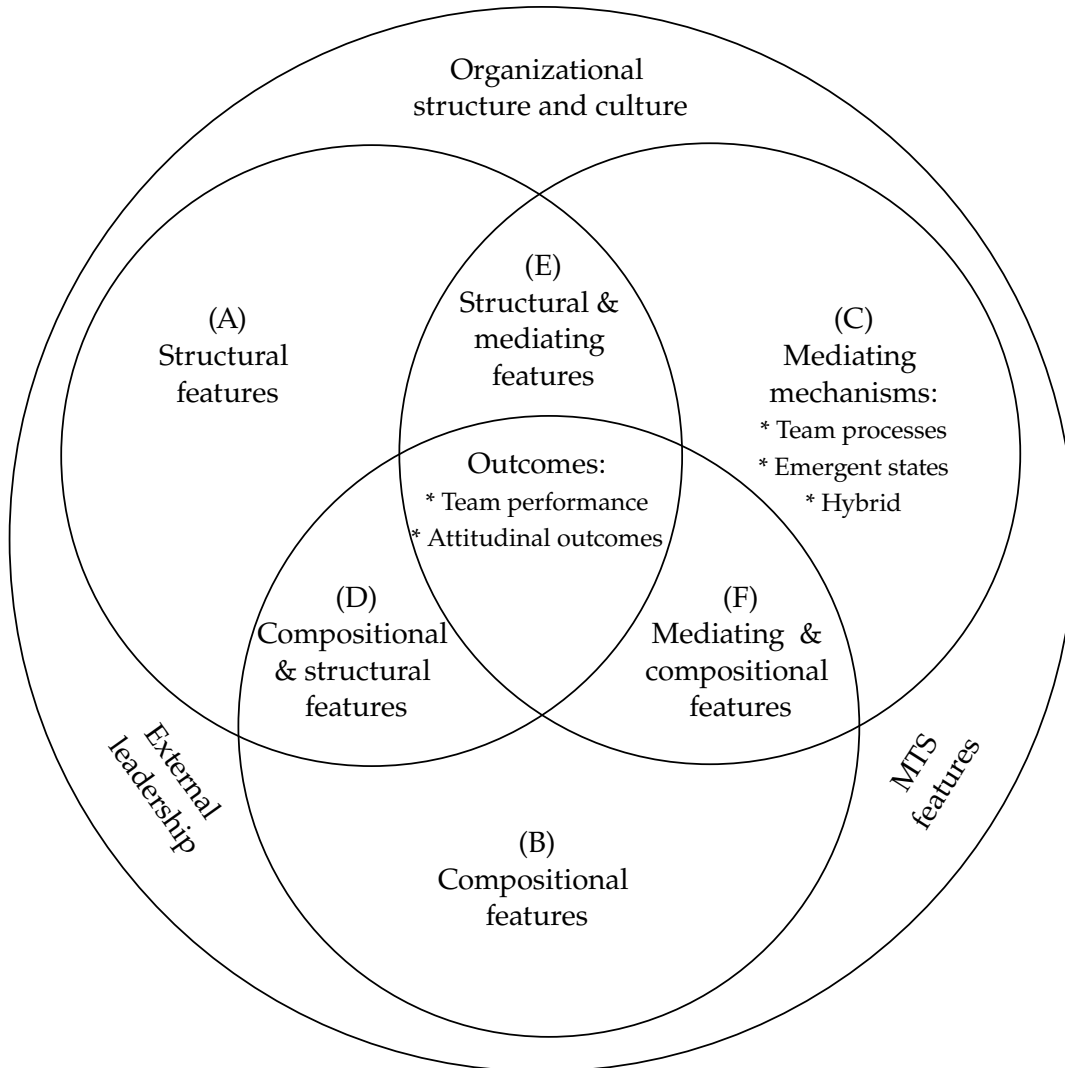


*Note.* Adapted from Mathieu et al. (2017) and Mathieu et al. (2019). Copyright 2017 by the American Psychological Association. Abbreviations: MTS, multiteam systems .

## 2.3.  COLLABORATION IN SOFTWARE PRODUCT DEVELOPMENT

Since collaboration methods and habits are different from classical approaches, and still little is known in detail outside the area, this chapter introduces collaboration in software development in more detail. Since the data collection stage takes place in the area of software development, understanding collaboration is essential to understanding the results and the discussion within this thesis, as well as being able to transform empirical insights into practical use.

Among the first approach to developing software was the so-called waterfall approach by (Royce, 1970). He described the procedure for developing 'a large computer program for delivery to a customer' with the following tasks (Royce, 1970, p. 329): system requirements, software requirements, analysis, program design, coding, testing, and operations. These methods require stability and clarity with regards to requirements and expectations of all parties involved – customers, leaders, stakeholders, teams, and individuals (Cuellar, 2012). Royce (1970) described that the interactions between the different tasks were limited to the successive tasks. Each task ended with a documentary of the results. He noted that, for example, a preliminary draft programme must be completed before analysis begins. Because of this sequential approach, which can be imagined as moving from left still to right down (see Figure B.1 in the section Appendix B), this approach was given the name waterfall (see Figure 2.5).

In general, the traditional waterfall approach was based on the belief that by trying hard to anticipate the entire set of requirements early on, it was possible to lower costs by eliminating the need to make changes (Highsmith & Cockburn, 2001). Moreover, the steps were conducted by required experts only. For the example of the design step, the waterfall approach required the design process to be conducted by program designers only, namely without analysts or software developers, and this step should be repeated as the first result only provides a first sample of the final product. Royce (1970, 331 ff.) defined five stages required to deliver software projects successfully, where all were needed to end the high-risk development process with the requested product:

1. 'Program design comes first [...]

2. Document the design [...]

3. Do [the design] twice [...]

4. Plan, control, and monitor testing [...]

5. Involve the customer [...]'

The waterfall model functions properly when the requirements (and risks) are pre-defined and only a very limited number of changes are expected throughout product

Figure 2.5.: Waterfall Approach for Software Development by Royce (1970, p. 330)
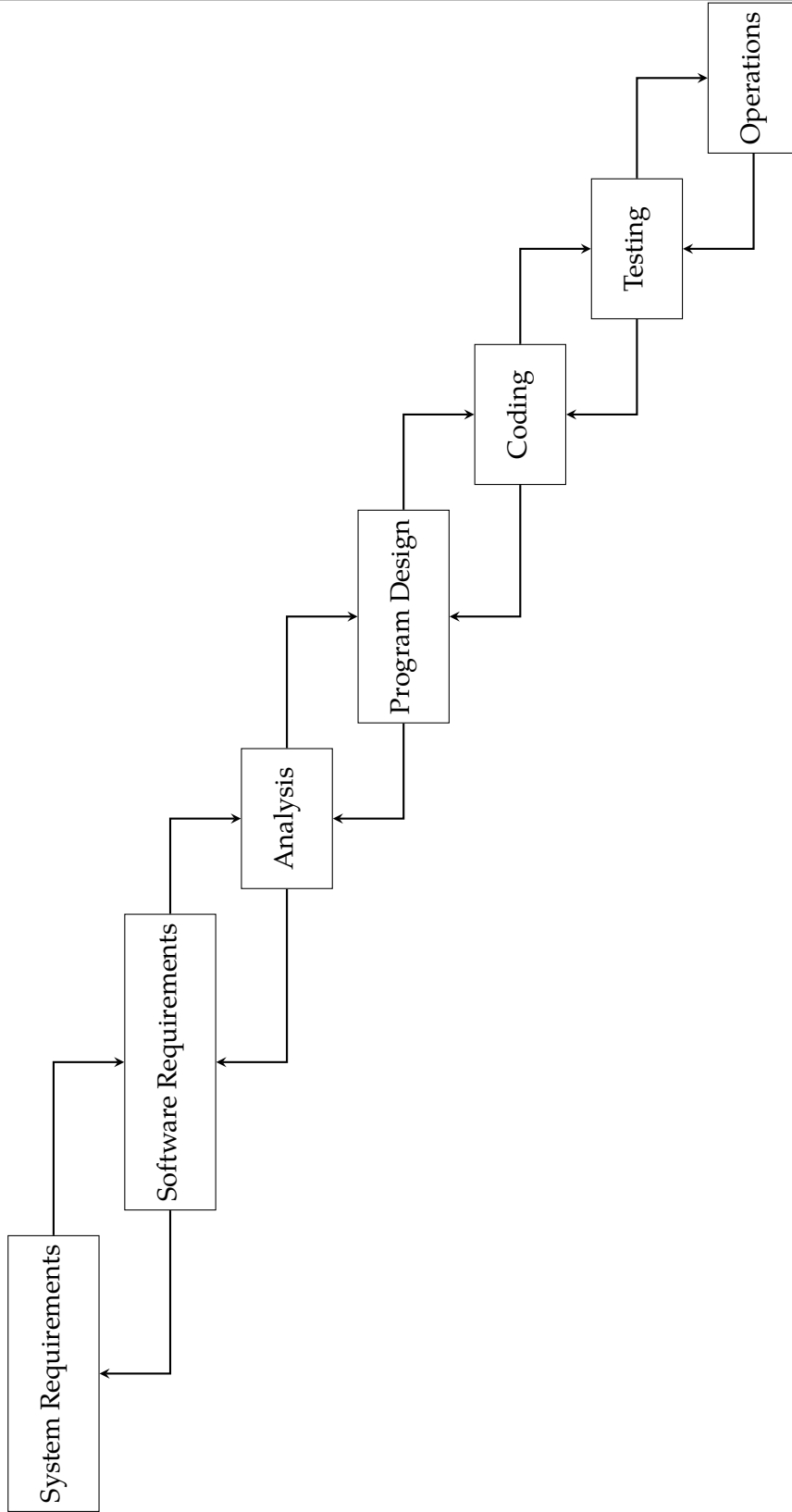
Figure 2.6.: Software Development Life Cycle adapted from Stoica et al. (2016, p. 7)
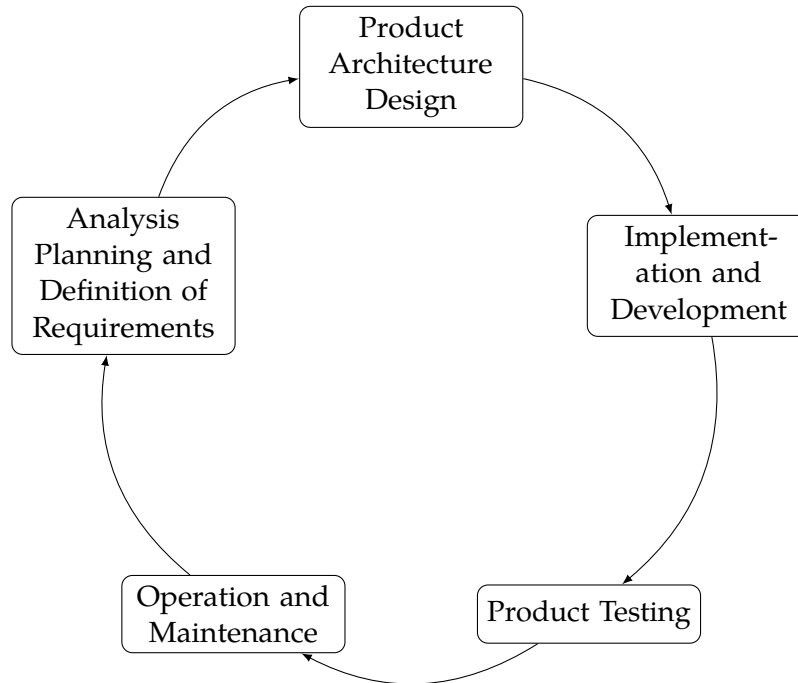


development. On the contrary, when managers, users and developers are left experimenting with the desired features during the development phases, the waterfall model can cause many problems (Cuellar, 2012). This is the case because adherence to the plan was no longer the main goal. Instead, the focus becomes customer satisfaction at the time of delivery, not at the time the project started. In multiple projects Highsmith and Cockburn (2001, p. 120) reviewed, major changes in 'requirements, scope, and technology' often occurred during the duration of the project, which were beyond the control of the software development team. Moreover software projects became more expensive than planned (Highsmith & Cockburn, 2001; Royce, 1970). Therefore, in almost half of the original plans for software projects, researchers were unable to find a basis for comparison at the end. In contrast to Figure 2.5, the Software Development Life Cycle (SDLC) streamlined and visualised this procedure into a circle Figure 2.6, which nevertheless which took an unpredictably long time until each step was completed and documented (Stoica et al., 2016).

However, the question that arose was therefore not how to stop changes in the early stages of a project, but how to more effectively handle unavoidable modifications throughout the life cycle (Highsmith & Cockburn, 2001). These obstacles were overcome in the late 1990s, with the so-called lean or agile approaches for software development. The latter especially has dominated the second half of the last fifty years of software engineering. The ongoing trend started with the establishment of

fundamentals, such as the introduction of so called agile methods and practices and accompanying changes in collaboration in terms of human and social aspects (Hoda, Salleh & Grundy, 2018). Eliminating change early implies being unresponsive to business realities – that is, business disaster (Highsmith & Cockburn, 2001).

In addition to the pandemic, there has been a spectacular development in information and communication technology over the last two decades, with the increasing pursuit of Utopian profit maximisation by economic organisations, which has had an impact on multiple areas – amongst them the methodological toolkit for the software development life cycle (Stoica et al., 2016). Being inherent in the area itself, the digital and the sustainability challenges affect software development (George, Lakhani & Puranam, 2020). Putting the COVID-19 pandemic and awareness around the topic into a broader context, there has been an increasing urgency to not only finding solutions to all kinds of problems but respecting sustainability. With this, software developers have been forced to pay more attention to the green and sustainable facets of software. This development is called Green Software Engineering. Green software engineering has the goal to 'design, develop and use software' with limited resources regarding energy and any kind of hardware used (Rashid & Khan, 2018, p. 1). This continued with the integration of technical software engineering topics and sub-disciplines such as usability, requirements engineering, software architecture or design. Recently, there has been renewed interest in agile development in relation to safety and safety-critical systems. In addition, it seems likely that synergies with Artificial Intelligence (AI) and end-user development will be explored (Hoda, Salleh & Grundy, 2018).

In order to be successful in a dynamic and disruptive environment, there is an organisational requirement for continuous innovation that is appropriate for business needs and we need to shape a working culture of the future. Agile software development practices such as Extreme Programming, Lean Development, Scrum, Adaptive Software Development  (ASD) and others look at change from a perspective that reflects the dynamic business and technological context (Highsmith & Cockburn, 2001). The collaboration in software development has increasingly made use of agile methods over the last decade (Rashid & Khan, 2018). Venkatesh et al. (2020) highlight using agile methods as a common approach in the software industry to develop and deliver new software more quickly to customers. They described agile working as an iterative work process with self-organisation and the ability to welcome change. Going back to the beginning of agile, it was officially introduced through a set of four core values and 12 principles laid down in the Agile Manifesto (van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas, 2001a, 2001b) (see section B and section B in Appendix B). Agile methods emphasise two underlying concepts: the unforgiving rigour of well-functioning code and the effectiveness of people collaborating with genuine intention (Highsmith & Cockburn, 2001). The toolkit is widely accepted as the preferred method of software development around

Figure 2.7.: Adaptive Development Cycle adapted from Stoica et al. (2016, p. 6)
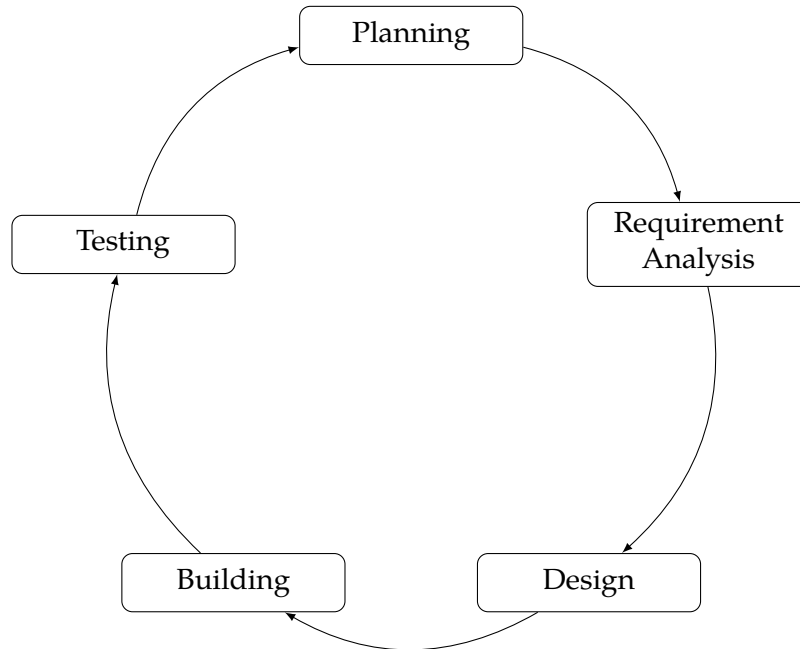


the world today, and it is now common to use a defined agile approach, however many teams develop their own mix of agile practices (Gren, Goldman & Jacobsson, 2020).

Agile software development puts a focus on the customer, the person who is supposed to be the beneficiary of the solution or product. In addition, unlike the traditional approach, the agile approach does not focus on creating documentation for the product, although this is a necessary by-product of being responsible not only for development but also for maintenance. If this is misunderstood and the assumption prevails that documentation is important above all else, this can be a major disadvantage of the agile paradigm (Stoica et al., 2016). If the context is not suitable, using agile methods can also limit or harm collaboration, which is why choosing appropriate working approaches to the problem that need to be solved is important (Cuellar, 2012). However, this is sufficiently described in the agile manifesto (van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas, 2001b).

The further increase of speed and complexity required a faster and more customer-centric approach of developing software. Therefore continuing but adapting the logic of Figure 2.6, the Agile Development Cycle (ADC) is based on a circular approach of agile software development (see Figure 2.7) with the significant improvement that one whole cycle should not take longer than two to four months.

In general, Stoica et al. (2016) stated three aspects that are important to note with regards to theoretically understanding how software development works:

1. Software is developed in successive cycles;

2. Each version as a result of a single cycle is tested to guarantee product quality;

3. This approach is used for solutions requiring completion within a limited amount of time.

### 2.3.1. Philosophies of Collaboration – Lean and Agile

Building on the former waterfall approach, agile and lean were following the philosophies of collaboration in software development. To be precise with vocabulary, agile is a sub-dimension of lean, which itself is a sub-dimension of systems thinking (Stoica et al., 2016). The latter two especially want to avoid waste and increase smooth (working and collaboration) processes with all parties, however lean is often used in production and fabrication contexts (Jadhav, Prakash K., Nagare, M. R., Konda, Srikant, 2018). Lean and agile are both used to foster 'improvements in cost, time, labo[u]r force, quality, internal and external customer satisfaction, speed, reliability, and productivity' (Birgün & Çerkezoğlu, 2019, p. 1940006). Lean and agile are based upon waterfall approaches (Stoica et al., 2016). To differentiate lean and agile more precisely, Table 2.2 includes seven aspects.

Including the rigour values and principles of the Agile Manifesto, the Agile Model Diagram is even more focused on speed and continuously putting a focus on the customer to deliver fast and suitable solutions in increments. Additionally the Figure 2.8 visualises the iterative approach of successive cycles (Stoica et al., 2016; van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas, 2001a).

The collaboration methodologies that bring lean and agile to life are Kanban and Scrum, which will be outlined in the following section (Stoica et al., 2016).

Table 2.2.: Lean and Agile Characterisation adapted from Birgün and Çerkezoğlu (2019), Highsmith and Cockburn (2001), Jadhav, Prakash K., Nagare, M. R., Konda, Srikant (2018) and Stoica et al. (2016)

| Aspect | Lean | Agile |
|---|---|---|
| Aim | Avoiding all aspects not relevant for the customer | Speed to delivering to the customer |
| Definiteness of development process | Sustainable | Flexible |
| Beginning | Manufacturing | Software development |
| Working cycle | Build – measure – learn | Plan – do – check – act |
| Demonstration of progress | Validation of learning and decreasing waiting times, and cycle times | Fulfilling the so called definition of done (acceptance criteria, that the problem is solved) and becoming more precise in prediction, and complexity handled in one iteration |
| Examples for methodologies | Kanban or Kaizen | Scrum or Extreme Programming |
| Examples for characteristics | Hypotheses, flow, work in progress limits, measuring throughput, lead, and cycle time | Sprints, roles, user and acceptance tests, user stories, product increments |

Figure 2.8.: Agile Model Diagram Adapted from Stoica et al. (2016)
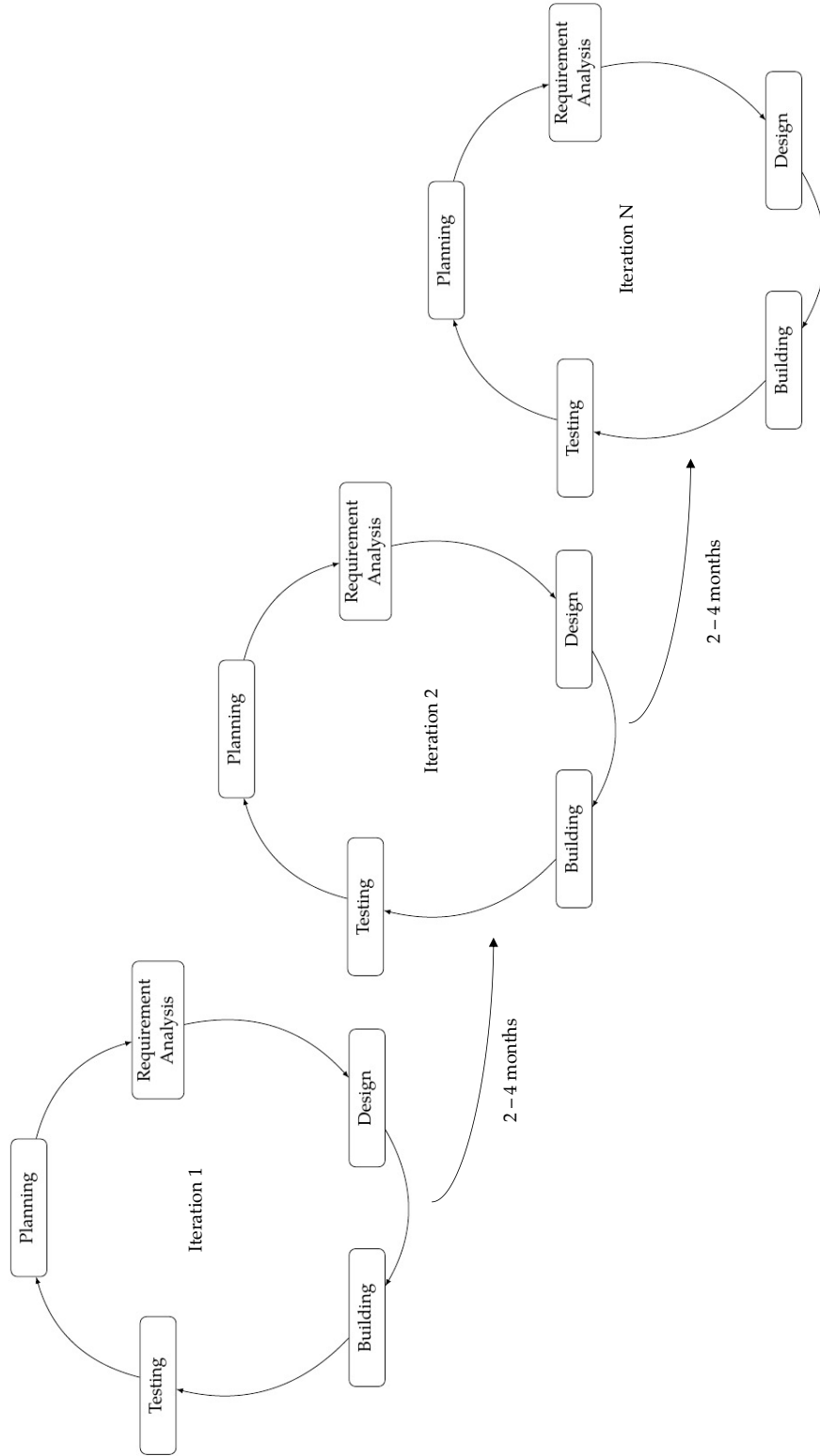
### 2.3.2. Collaboration method – Kanban and Scrum

The use of agile practices continues to grow – even beyond the realm of software development. This is also reflected in the growing research interest in agile. In the field of software development research, a sub-discipline of its own has even developed and continues to grow (Hoda, Salleh & Grundy, 2018). Most known frameworks representing lean and agile are Kanban and Scrum, respectively (Stoica et al., 2016). Kanban is a planning system for managing the flow of work using visual signals to visualise the work to be done and the work process. Therefore, Kanban is suitable for steady, complicated environments with a need for continuously improving the system (Zayat & Senvar, 2020). Scrum is a framework for carrying out projects by dividing tasks into small stages called sprints. The framework was rated to be beneficial in terms of providing collaboration with the customer and development teams. This is especially true regarding planning, organising, presenting, and reviewing product development, which makes it suitable for new and especially complex projects, which needs to regularly involve customers to make sure their expectations are met.

Combining aspects of Scrum and Kanban brought up another working method called Scrumban (Hoda, Salleh & Grundy, 2018). Despite the ongoing hype surrounding agile, Stoica et al. (2016) stated that it is not suitable for all types of projects. Moreover, there is no such thing as one optimal way to find the ideal solution. There are still software projects with a high level of difficulty, with significant usage goals (at least at the regional or national levels) where agile approaches are not helpful, since the problem requires traditional approaches with sequential structures (e. g. the national health cards project in Romania).

With Scrum being more present for handling complexity, software development using Scrum not only requires specific hard skills but also equally important specific soft skills, which Omar et al. (2018) collected in their literature review (see Table B.1 in the Appendix B).

A search in Google Scholar (https://scholar.google.com) for the key words 'agile software development'in the time frame back to 2001, Hoda, Salleh and Grundy (2018) found in April 2018 over 13 000 results, and 260 000 entries by the end of the same year. In November 2021, for the same keywords, search engine and period of 2001 und 2021, there were 240 000 results (see in the Appendix B in Figure B.2).

Table 2.3.: Kanban versus Scrum adapted from Schwaber and Sutherland (2020) and Stoica et al. (2016)

| Aspect | Kanban | Scrum |
|---|---|---|
| Team Involvement | in every iteration | Optional |
| Measurement of improvement | velocity to measure and improve complexity or tasks handled per sprint to plan more precisely | Lead or cycle time to increase throughput and flow, and reduce waiting times |
| Visualisation of work | Team measures complexity or time | Optional |
| Overview of work | Product and sprint backlog and additional Kanban Board for visualising currently planned work and the status | Kanban Board with all tasks overall to do, doing and done |
| Roles | Three needed roles at the minimum: Product Owner (business and customer perspective), Development Team (technical realisation), and Scrum Master (process responsibility) | |
| Priorities | Priorities based on customer values are determined per sprint by the product owner in relation to the current sprint backlog | Optionally also set according to customer value but in relation to all tasks |

### 2.3.3. Connections and Effects in Software Development Organisations

The main difference between traditional organisations and teams and organisations and teams involved in software product development is based on the form of collaboration. Traditional organisations process information and decisions from the top down, while decision-making templates and results are reported from the bottom up. The role of leadership is designed to command and control. These organisational structures are not suitable for software product development departments or organisations. This is because they are not able to respond to changes quickly enough, and a number of teams end up building software products that do not solve the problems of the customers or do not meet their needs (e. g. Bhavsar, Gopalan & Shah, 2020; Cuellar, 2012; Royce, 1970; Stoica et al., 2016). Therefore, they adopted the organisational structure and decisions are made in the teams based on the delegation level. Leadership is informed about decisions and results. Therefore, the leadership role is shaped by serving the teams and individuals, removing their obstacles, assisting in the development of people, and ensuring that the environment changes so that everyone can work without disturbances (e. g. Dingsoyr et al., 2016; Highsmith & Cockburn, 2001; Noll, Razzak & Beecham, 2017; Omar et al., 2018; Zayat & Senvar, 2020). This way of collaboration is known as a self-(managing)-organisation (Lee & Edmondson, 2017). One of the first companies to introduce this type of collaboration was the American company Morningstar. Managers no longer directed employees; instead, tasks were coordinated directly through voluntary bilateral agreements between employees with mutual dependencies. These agreements were usually decided annually and included, for example, responsibilities, activities, goals or performance evaluation measures. Morningstar's goal was thus to have a working environment in which employees 'will be self-managing professionals, initiating communications and the coordination of their activities with fellow colleagues, customers, suppliers, and fellow industry participants, absent directives from others' (Gino et al., 2013, p. 4).

Dingsoyr et al. (2016) pointed to the opportunity for software development to draw on established methods and concepts of team research for evaluating practical results. Figure 2.9 visualises the differences of the organisational structure between traditional, hierarchical organisations and value-based organisational designs derived from the literature of this section. From this, value-based organisational designs became suitable for software product development organisations with the nature of setting priorities based on customer value. Customers interact directly with the individuals in the teams. The leadership role was to make sure to keep balances and that teams had all the resources necessary to fulfil customer needs (e. g. Lee & Edmondson, 2017).

Traditional organisations were based on a high level of hierarchy going along with thinking and working inside-out – starting from internal departments' perspective. In contrast, collaboration in software product development (organisations) is based on low hierarchy and self-organisation, going along with thinking and working outside-in, starting from the customer's perspective. Mason and Chakrabarti (2017) examined the role of proximity in terms of the customer and the tasks involved as a

Figure 2.9.: Difference in Setting Priorities and Determining Hierarchy in Organisations
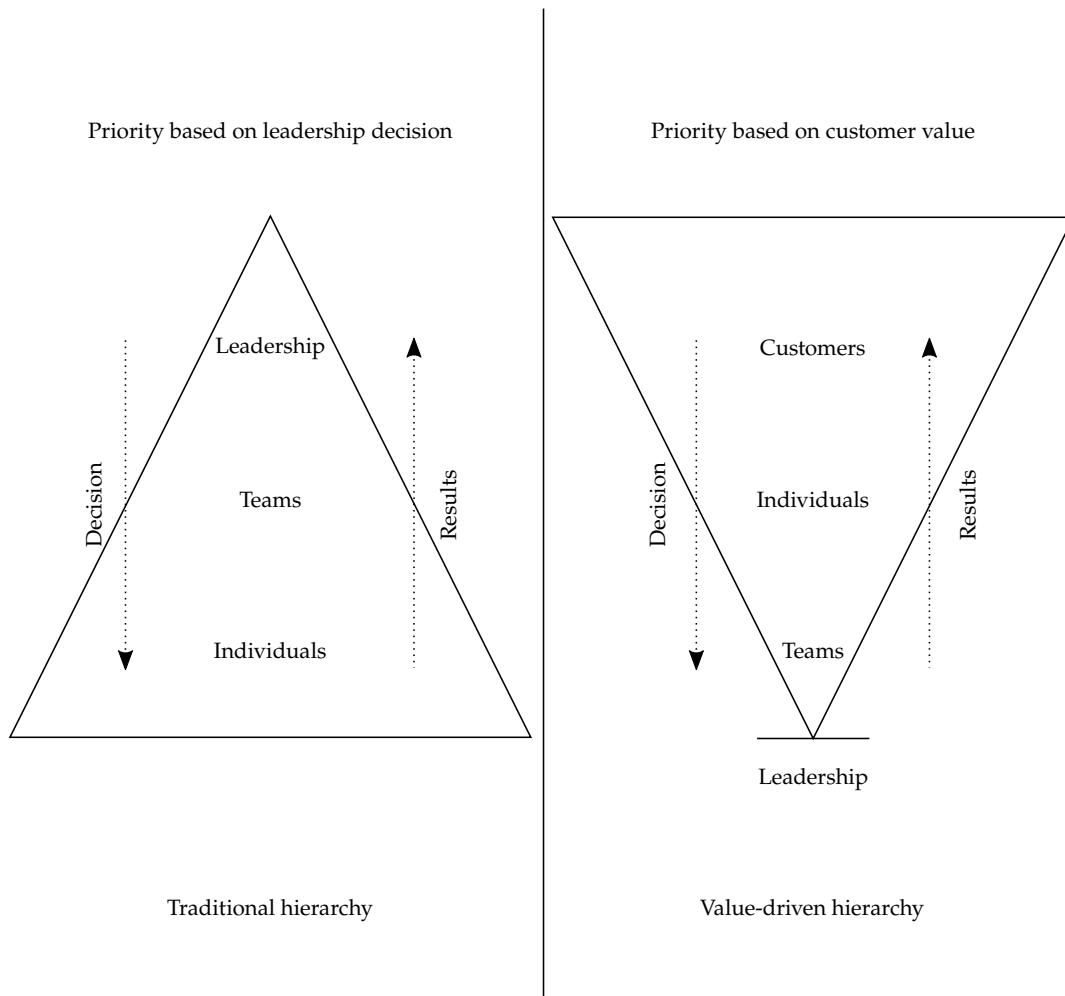


*Note.* Own figure according to Bhavsar, Gopalan and Shah (2020), Cuellar (2012), Dingsoyr et al. (2016), Gino et al. (2013), Highsmith and Cockburn (2001), Lee and Edmondson (2017), Machado and Tavares (2007), Mason and Chakrabarti (2017), Noll, Razzak and Beecham (2017), Omar et al. (2018), Royce (1970), Stoica et al. (2016) and Zayat and Senvar (2020)

fundament of building suitable business and organisational models. They started with the question 'how do managers and entrepreneurs organise their business activities to connect to business networks and markets?' (Mason & Chakrabarti, 2017, p. 78)

The understanding behind the organisational structure was to give autonomy to the teams that interact with customers and who know their needs better than leaders. Therefore, the aim is to let teams decide how to build software products to fulfil customers' needs. With the autonomy given based on self-organising structures and increasing team responsibilities, such as estimating, planning, or testing, this raised the amount and levels of challenges within the context of working in software development. To handle these challenges successfully, there was a need identified to work in appropriate organisational structures (Hoda & Murugesan, 2016).

From over five decades of development, the so called Conway's law is a phenomena derived from software companies (Bailey et al., 2013). It includes organisational structures in line with communication structures (Conway, 1968). Overall, this is meant to create an alignment in technological architecture with communication and collaboration. In the literature, those organisational designs were called value-stream organisations and were handled with appropriate management based on each value stream, built along the value for the customer and prioritising and deciding on factors from the customer's perspective (Machado & Tavares, 2007). The underlying logic is to bring the product to the customer by passing three critical steps on the way (Powell & Bartolome, 2020, p. 551):

1. problem solving

2. task management

3. physical transformation

These three steps in total were defined as the value stream (Powell & Bartolome, 2020). With this, the organisational structure was designed differently, which is visualised in Figure 2.10 based on the prior literature review.

Since organisations tend to think and act in terms of performance and productivity, Kersten (2018) reminded that they should start with the definition of productivity and thinking from the customer's perspective when designing values streams and being precise in what flows should be examined. From this, flow means 'the end-to-end feedback loop of flowing software to customers in a way that maximizes the business value delivered' (Kersten, 2017, p. 11).

Having put a focus on organisations in software development, an essential aspect is people working in software development, which is the topic of the next section.

Figure 2.10.: Outside-in Organisational Structure in Software Product Development Derived from Bailey et al. (2013), Conway (1968), Hoda and Murugesan (2016), Kersten (2017, 2018), Mason and Chakrabarti (2017) and Powell and Bartolome (2020)
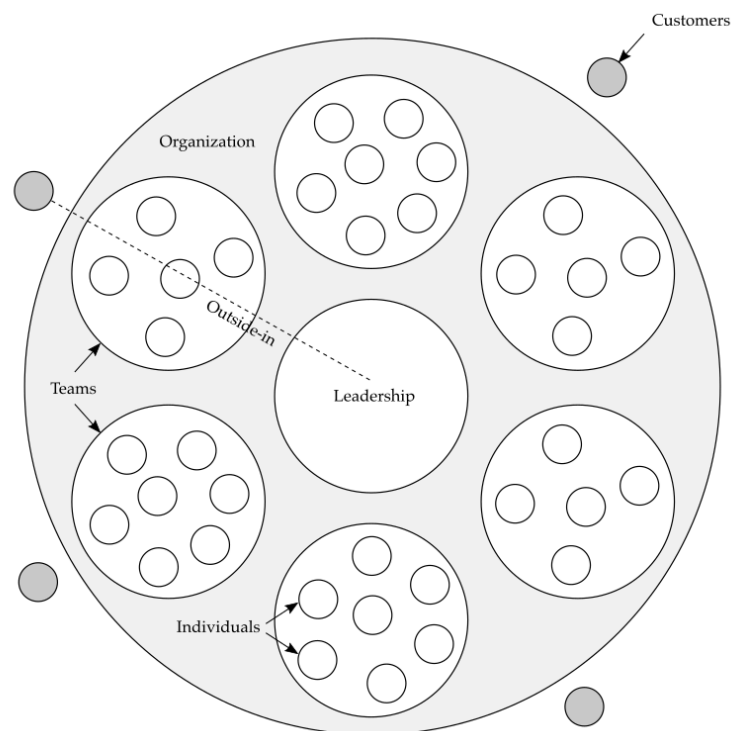
### 2.3.4. The Human Factor in Software Development Collaboration

Agile methods in general offer a framework as to how software developers collaborate within the team and with external stakeholders. Additionally, these methods ensure that there are improvements in the delivery of valuable software, decreased costs and increased user satisfaction, which are all mainly organisational benefits (Rashid & Khan, 2018). Venkatesh et al. (2020) examined the perception of work for software developers using agile methods. Their results showed that it not only provided role clarity, but also had the effect of a decrease in work exhaustion. This was especially the case when developers made use of organisational resources to foster effective interactions with other people within the organisation. With regards to the findings by (Debus et al., 2014), the decrease in work exhaustion could be seen as being beneficial for the organisation as well. The results of their research with software developers indicated an importance of recovery during non-work time in order to experience flow within the entire working day. Hoegl and Gemuenden (2001) addressed the amount of studies and literature on teamwork as offering an indication of the importance for successful innovation projects. To provide practical use to achieve successful teamwork, Hoegl and Gemuenden (2001) developed the construct TWQ to achieve measurement and tested the scale with leaders and members of German software teams.

The perceived TWQ was significantly connected to team achievement and team members' personal success, such as work satisfaction or learning. However, there has been no standard tool to measure the level of agility nor to indicate the suitable agile method for a certain project (Rashid & Khan, 2018). The organisational need and ongoing striving for an innovation climate has been observed in research for several years. Newman et al. (2020) published a systematic literature review into innovation climate research and provided a future need for investigating in the individual (adverse) effects of an innovation climate. There has been an ongoing economic and societal need for innovations, alongside a growing interest in research on innovation climates at team and organisations and its antecedents and outcomes, not only in software development but also in general (Newman et al., 2020). To innovate, organisations need to handle many kinds of challenges. Therefore, it was said to be especially relevant for them to have a culture endorsing innovations and decision-making (Heinze & Heinze, 2020). With the COVID-19 pandemic, the importance of an innovation climate and valuable collaboration became even more important, for example to develop software products like apps for tracing and testing to follow infections (George, Lakhani & Puranam, 2020). Prior research was evaluated to predominantly focus on positive aspects around innovation climate, going along with a need to also investigate adverse effects. The construct of *flow* has been important, not only in the context of values streams but also at an individual level, . Flow can be defined as a mental status that occurs when a person receives ideal challenge and at the same time is fully absorbed in the current activity. This state has been described as fascinating and enjoyable, and it is not necessarily what people do, but how they do it that matters in the experience of flow and joy (Csikszentmihalyi, 1999).

*Worry* is described as the other side of the coin when dealing with challenges. This includes the perceived importance or the meaning of the outcome of the currently fulfilled task. Therefore, it can be seen as a relevant aspect for software development since there is a need to be aware and accept the products' shared responsibility and open communication (Schiepe-Tiska & Engeser, 2012; Thorgren & Caiman, 2019). To address the reasons and overcome adverse individual effects, Edmondson (1999, p. 350) introduced the construct of psychological safety, which was defined as 'a shared belief held by members of a team that the team is safe for interpersonal risk taking'. Therefore, the importance of an integrative approach was pointed at respecting both context and leader to shape team outcomes. The importance of context and collaboration has also been a key aspect ever since flow research started. The question in the beginning was whether doing something together was more enjoyable than doing it alone (Schiepe-Tiska & Engeser, 2012). Bakker (2005) gave insights that in social situations, there were so called spill-over effects, where the experience of flow went from one person to another person. Those insights were in line with Mathieu et al. (2019) and the relevance of both context and complexity on one side and individual perception on the other. Yuan and van Knippenberg (2021) understood collaboration as a network, where handling communication and coordination were essential to successfully handling challenge. This was evaluated to be especially relevant in less hierarchical environments, which was seen to be the case for software product development (Lee & Edmondson, 2017; Zayat & Senvar, 2020).

With this, Powell and Bartolome (2020) pointed to further examining value streams and collaboration in software development, aiming to leave the state of dysfunction growing into cross-functionality as well as collaborative learning and continuous improvement. Therefore, this dissertation project focuses on individuals contributing to Newman et al. (2020) and Mathieu et al. (2019) focusing on individual outcome effects.

This chapter aimed to set the theoretical context of the current dissertation project regarding overall leadership in technology organisations, team research, and the specifications of collaboration in software development. To focus on the current challenges, more specifically to break down the main question of how people perceive leadership and working in software development in Germany during the COVID-19 pandemic, the following chapter includes the perception of leadership and collaboration at an organisational level. The next chapter outlines the specific literature base and derivation of the hypothesis for the first study, as well as the methods, results, and discussion.

# 3. FIRST MAIN STUDY

In this chapter, the relevant constructs, definitions, current research, and methods are introduced, followed by the presentation of the results. Following this, the discussion and brief conclusion link to the second study that is outlined in the next chapter.

## 3.1. LEADERSHIP AND ORGANISATIONAL CLIMATE

Carter et al. (2020) reviewed and summarised the results from empirical studies covering the past 30 years, giving a recommendation for further investigation to contribute to a deeper insight into leadership in the context of organisational systems. Overall, leadership style was defined as a constant behaviour shown by the leader (Xie et al., 2018).

Prior research on leadership mainly focused on single teams. Moreover, teams started becoming more open systems interacting with other teams to achieve goals that were broader than the team's own goals, raising the need for appropriate leadership.

Alvesson and Einola (2019) warned against the trend of excessive positivity in leadership research regarding different leadership styles, i. e., positive, transformational, servant, ethical, or spiritual leadership. They criticised 'shaky philosophical and theoretical foundations, tautological reasoning, weak empirical studies, nonsensical measurement tools, unsupported knowledge claims, and a generally simplistic and out of date view of corporate life' (Alvesson & Einola, 2019, p. 383).

In addition, Carter et al. (2020) pointed to the need for research on leadership in inter-team contexts, since until now it has been relatively rare. Due to more interactions needed between individuals and teams, more than 10 years ago research started examining the phenomenon of so-called multiteam systems (MTS) as a way to overcome traditional boundaries of teams and organisations. The approach was developed to tackle both theoretical and practical problems. MTS were defined as closely connected systems of teams that, in addition to the goals of their individual teams, pursue at least one common overarching objective (Luciano, DeChurch & Mathieu, 2018). This implies teams turning into knot points or units that have to act in a complex system of relationships pursuing one or multiple overarching goals (Mathieu et al., 2019). In software development, Dingsoyr et al. (2016) referred to the role that leadership style plays in software development that implies goal-orientation. Open aspects include questions such as 'what, where, why, when, and who related to inter-team leadership' (Carter et al., 2020, p. 452).

In general, leaders who demonstrate transformational behaviour show their employees a sense of purpose that goes beyond near-term objectives and concentrates on overriding intrinsic needs. As a result, transformational leadership fosters

employees identifying with the leader's needs (Kuhnert & Lewis, 1987). Related to this, the next chapter focuses on transformational leadership.

### 3.1.1. Transformational Leadership

Prior to the COVID-19 pandemic, Geier (2016) gave empirical insights for leaders showing different behaviour in normal or extreme situations. For example, for the target group of firefighters in professional fire stations, the results indicated that leaders exhibited less transformational behaviour during extreme incidents and that transactional leadership displayed the most significant predictor of the firefighters' team performance. However, in the context of fire fighters, extreme events were more predictable and practicable than the COVID-19 pandemic. The pandemic situation, as well as the overall trend of increasing complexity and accompanied need for technological solutions, especially software products, has sharpened the focus at looking for solutions instead of things that don't work to deal with the need for transformation (George, Lakhani & Puranam, 2020).

In the context of software development, the empirical study by Xie et al. (2018) showed that a transformational leadership style was more helpful for building an organisational climate supporting innovations than transactional leadership. Furthermore, their results showed that it was easier for leaders showing transformational leadership behaviour to build trust, which also positively affected the climate and supported innovations. Their study did not address a specific target group.

The current state of research for the query 'transformational leadership AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) over the last ten years (from 2011 to 2021 indicates the scientific gap for research on these constructs, with few entries for all three key words in Google Scholar and no entries in Web of Science (see Table 3.1).

The results presented in Table 3.1 highlight the need for further research in the extreme situation of the COVID-19 pandemic. Table 3.2 provides samples of the team-level transformational leadership literature and research over the past ten years to highlight the major contributions respected in this field of study.

This study aims out to specify the knowledge on the level of perceived transformational leadership for the target group of members of software development teams. Carter et al. (2020) reviewed studies with the insight that leadership processes were essential within and across team boundaries to achieve both team- and organisational-level shared goals. There have been many critics on transformational leadership, such as van Knippenberg and Sitkin (2013) who stated that the measurement tools were invalid and also did not replicate the dimensional structure or empirically differ from other leadership styles.

The book on transformational leadership, named Leadership and Performance Beyond Expectations, by Bass (1985) has attracted a lot of attention over the last forty years and has triggered a wave of research into the subject.

Transformational leadership was defined by Carless, Wearing and Mann (2000) to consist of seven behaviours:

Table 3.1.: Search Results for Transformational Leadership, Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'transformational leadership' | 84,000 | Google Scholar | Figure B.3 |
|  | 5,713 | Web of Science | Figure B.4 |
| 'transformational leadership' AND 'agile software development' | 527 | Google Scholar | Figure B.5 |
|  | 1 | Web of Science | Figure B.6 |
| 'transformational leadership' AND 'agile software development' AND 'Germany' | 107 | Google Scholar | Figure B.7 |
|  | 0 | Web of Science | Figure B.8 |

*Note.* Status in November 2021

1. Communicating a vision

2. Developing employees

3. Providing support

4. Empowering employees

5. Thinking innovatively

6. Leading by example

7. Being charismatic

Results by Jahanshahi, Maghsoudi and Babaei (2020) for high technology ventures suggested that transformational leadership had no direct relation to team innovations but facilitated the improvement of both trust and communication within teams. Both outcomes are important in the complex environment of high technology. Combining the need to better understand inter-team contexts and the overall organisational environment, this study was set up to add knowledge by not focusing on the innovation climate itself but organisational psychological safety and organisational initiative, as described in the following section. Clarke (2012) gave empirical evidence for transformational leadership having a positive relationship to the perceived safety climate, as well as positively affecting the encouragement for employees participating in safety. In this study, participation safety means acting at an organisational level to support other employees, suggesting safety actions and engaging in actions and training activities (Neal, Griffin & Hart, 2000).

Table 3.2.: Sample of Transformational Leadership Meta Analysis and Literature Reviews

| Source | Approach | Major Contribution(s) |
|---|---|---|
| Anderson and Sun (2017) | Literature Synthesis | The overlaps of newer leadership styles such as servant or ethical leadership with transformational leadership were judged to be of such concern that they pointed to the need for concerted empirical efforts to identify the key differences. Based on the outlined current state of research (see Table 3.1), transformational leadership is therefore examined in this study, despite all the criticism and new leadership styles emerging. |
| Banks et al. (2016) | Meta-Analysis | Comparison of authentic leadership* to transformational leadership indicating a strong relationship between both constructs. However, there is a high demand for future research to differentiate authentic from transformational leadership and to better understand the former and more recent construct of authentic leadership. |
| Clarke (2012) | Meta-Analysis | Transformational leadership in combination with transactional leadership behaviour is summarised in safety leadership. Hereby, transformational leadership supports the perceived climate for psychological safety. |
| Wang et al. (2011) | Meta-Analysis | Transformational leadership is associated favourably with individual performance as well as team and organisational performance. Relative to transactional leadership, transformational leadership was better at predicting performance at the individual level and at the team level because this leadership behaviour had a reinforcement effect. |
| Judge and Piccolo (2004) | Meta-Analysis | Investigating transformational, transactional** and laissez-faire** leadership. Overall validity for transformational leadership of .44 and generalised across longitudinal and multi-source designs. However, transformational leadership behaviour did not predict leaders' work performance. |

*Note.* * Banks et al. (2016) outlined the concept of authentic leadership, which comprises four elements, namely 'self-awareness, rational transparency, balanced processing, and an internalized moral perspective'. Walumbwa et al. (2007) described authentic leaders' behaviour as being confident, open and clear about who they are and acting consistently in accordance with their personal values, beliefs, reasons and feelings. **Unlike transformational leadership behaviour, transactional leadership behaviour emphasises the sharing of resources by giving employees something they want to do or have in return for something the leader asks them to do. ***Laissez-faire leadership is described as a form of leadership that is not actually leadership. It means the avoidance or absence of leadership. Leaders who show this behaviour avoid making decisions, are reluctant to act and are not present when they are needed (Judge & Piccolo, 2004).

The next section focuses on the theoretical deduction for organisational effects in software development affected by leadership behaviour.

### 3.1.2. Organisational Psychological Safety and Organisational Initiative

Xu, Jiang and Wang (2019) showed that, for teams working in an information technology company, the perceived work atmosphere mediates several aspects of outcomes. Within the ongoing hype on an innovation climate, Baer and Frese (2003, p. 45) stated that '[i]nnovation is not enough' and showed the importance of organisational psychological safety and innovation with a positive relationship to firm performance. They operationalised business performance as the long-term shift in return on investment and the achievement of business objectives. Moreover, their results showed the moderating influence of these two aspects on the connection between process innovation and firm performance. Their sample was taken in mid-sized companies in Germany, including a variety of industries.

The concept of psychological safety is based on Schein and Bennis (1965)'s seminal and groundbreaking piece on organisational change. Since then, the empirical literature on predictors, outcomes and moderators has diversified at different analytical levels (Newman, Donohue & Eva, 2017). Schein and Bennis (1965) described psychological safety as the degree to which individuals both feel secure and have confidence in their ability to cope with change. Since then, numerous other researchers like Edmondson (1999) have explored the importance of psychological safety in work environments, not only dealing with the ability to cope with change. The construct describes the shared perception among members of a team or a whole organisation that a person does not have to fear being sanctioned or excluded for critical contributions. In the positive case, this means that there is a high level of trust in a team or organisation with high psychological safety. As a result, members are more likely to talk about mistakes and the associated learning experiences. They are also more willing to explore new ideas and are more willing to take risks (Frazier et al., 2016). In contrast to the moderation approach by Baer and Frese (2003), Mathieu et al. (2019) categorised psychological safety as an emergent state used as a mediating variable. They reviewed the rapidly growing number of emergent states studies over the past decade. The common factor was that each of these mediators was different from the team processes and had connections to the team delivery. They stated that future research should continue to examine emergent states. Therefore, this study examines the emergent state of psychological safety for the target group of people working in software development in Germany and extends the findings of Baer and Frese (2003) by using it as a mediating variable.

Using the query 'organisational psychological safety AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) for the last ten years (from 2011 to 2021) indicates the scientific gap for research on these constructs with no entries for all three key words in both search engines (see Table 3.3). Since no entries were found for the key words 'organisational psychological safety' in Web of Science and 'organisational psychological

Table 3.3.: Search Results for Organisational Psychological Safety, Agile Software
Development, and Germany in Google Scholar and Web of Science in the
Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'organisational psychological safety' | 7 | Google Scholar | Figure B.9 |
|  | 0 | Web of Science | Figure B.10 |
| 'organisational psychological safety' AND 'agile software development' | 0 | Google Scholar | Figure B.11 |

*Note.* Status in November 2021. When having no entries for prior research queries,
testing of combinations was ended.

safety AND agile software development' in Google Scholar, the testing of further
combinations was ended.

Table 3.4 provides samples of the (organisational) psychological safety literat-
ure and research over the past ten years to highlight the major contributions respected
in this study.

Based on their research, Venkatesh et al. (2020) encouraged companies to adopt
agile software development methods. However, they pointed out that developers
need to have organisational skills to take advantage of these methods. To contribute
to the model to embrace complexity by Mathieu et al. (2019) for the area of software
product development, this study extends it by adding organisational initiative as
an outcome. The working method agile software development might be supportive,
since it mixes both creative teamwork and a strong emphasis on being effective and
responsive (Highsmith & Cockburn, 2001).

Outcomes are defined as deliverables and side-products of collective activit-
ies that are cherished by one or more people. Due to the growing importance of
inter-team collaboration, this study does not categorise organisational initiative as a
mediating, behavioural process but as an outcome (Cha et al., 2015; Mathieu et al.,
2019). Collaborating across team boundaries is seen to be relevant e. g. to achieve
both team- and organisation-level collective goals (Carter et al., 2020). Both concepts,
psychological safety and initiative, are theoretically and empirically of interest on
different levels.

The organisational initiative describes an organisational-level construct derived
from individual initiative. Organisational initiative is based on the concept of personal
initiative (Frese et al., 1997). Within this, organisational initiative is described to be
a psychological process that facilitates the development of individual roles, teams,
and organisations from the status quo into any kind of requested future states (Rank,
Pace & Frese, 2004). Organisational initiative is specified as a contextual predecessor

Table 3.4.: Sample of (Organisational) Psychological Safety Literature Reviews and Meta-Analysis

| Source | Approach | Major Contribution(s) |
|---|---|---|
| O'Donovan and McAuliffe (2020) | Systematic Literature Review | In the context of health care, although being low for this target group, a climate of psychological safety affects learning, creativity and performance within an organisation. Future research needs to measure leader's support and interdisciplinary teams. |
| Nellen, Gijselaers and Grohnert (2019) | Systematic Literature Review | The results for the connection between psychological safety and the outcome of team learning, for example, are consistently on the positive side. |
| Newman, Donohue and Eva (2017) | Qualitative Review | Upcoming research needs to examine the impact of psychological safety on work outcomes at different levels of analysis, including the organisational level. |
| Frazier et al. (2016) | Meta-analysis | The results show that psychological safety remains an important construct. Further studies are needed at the organisational level, as these have so far been in the minority, as well as an indication of causal effects. |
| Edmondson and Lei (2014) | Systematic Literature Review | Over the past six decades, numerous studies across levels of analysis, industries and nations reveal the importance of psychological safety in organisations. These studies provide empirical evidence of the human need to feel safe at work in order to succeed, be able to learn, make a contribution and work together in an accelerating world. |

Table 3.5.: Search Results for Organisational Initiative, Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'organisational initiative' | 375 | Google Scholar | Figure B.12 |
| | 1 | Web of Science | Figure B.13 |
| 'organisational initiative' AND 'agile software development' | 3 | Google Scholar | Figure B.14 |
| | 0 | Web of Science | Figure B.15 |
| 'organisational initiative' AND 'agile software development' AND ('Germany' | 0 | Google Scholar | Figure B.16 |

*Note.* Status in November 2021. When no entries were found for prior research queries, the testing of combinations was ended.

of innovation which lacks further examination besides, for example, the Moroccan context (Hassi, Rohlfer & Jebsen, 2021). Hereby, the organisational initiative is defined as a decisive factor determining overall behaviour at work. The aspect of organisation refers to the level to which the work environment supports employees' own initiative to a greater or lesser extent. (Baer & Frese, 2003) defined organisational initiative as a proactive, independent and persistent way of working beyond the borders of one's own tasks.

The current state of research for the query 'organisational initiative AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) from 2011 to 2021 indicates the need for research on these constructs, with no entries for all three key words in both search engines and even no entry in Web of Science for 'organisational initiative AND agile software development' (see Table 3.5).

Table 3.6 provides a sample of the (organisational) initiative literature and research. The small number of meta analyses emphasises the need for further research and major contributions are respected in this study.

A mediator points out how external processes have an inherent psychological importance (Baron & Kenny, 1986). These presumed effects lead to the following first hypothesis, which states:

H1: The perceived organisational psychological safety mediates the path between transformational leadership and organisational initiative.

Figure 3.1 visualises the presumed paths between the constructs of the first hypothesis.

Table 3.6.: Sample of (Organisational) Initiative Meta-Analysis

| Source | Approach | Major Contribution(s) |
|---|---|---|
| de Freitas et al. (2016) | Meta-analysis | In the case of individual initiative in relation to one's own personal growth*, all studies showed that this was positively related to positive factors such as the level of well-being and self-esteem, among others. It was also negatively related to negative dimensions such as anxiety or depression. However, this study has only little substantive proximity to this study. |

*Note.* *Personal growth initiative is defined by four behaviours including 'readiness for change, planfulness, intentional behaviour, and using resources' (de Freitas et al., 2016, p. 776)

Figure 3.1.: Conceptual Visualisation of the Presumed Paths between Transformational Leadership, Organisational Psychological Safety and Organisational Initiative
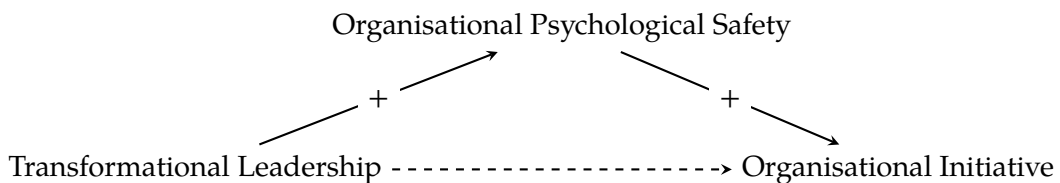
### 3.1.3. Moderating Effect of Positive Leadership

Kelloway et al. (2013) developed a measure to assess the perceived positive leadership behaviour with a target group of nursing home employees. Furthermore, they found empirical evidence that positive and transformational leadership were distinct from each other. Kelloway et al. (2013) examined the potential of the interaction of positive and transformational leadership to predict positive employee affects. Furthermore, their results showed that there was only a moderate correlation of positive and transformational leadership, which supported their hypothesis that positive leadership is empirically distinct from transformational leadership. Their results showed that positive leadership partially substituted transformational leadership when transformational leadership was low. They also found support that the interaction of positive and transformational leadership predicted positive employee effects for the target group of nursing home employees. Positive leadership was defined as 'those behaviours that are enacted by leaders and result in increasing followers' experience of positive emotions' (Kelloway et al., 2013, p. 108). Monzani and Dick (2020) described the characteristic 'positive' as a behavioural pattern of the leader that establishes the conditions in the work environment so that employees can realise themselves and grow at work.

Adams, Meyers and Sekaja (2019) validated positive leadership as a common latent factor. They suggested the desire to cultivate positive leadership behaviours in order to support employee well-being and collaboration. Since they evaluated the mediating role of inclusion and discrimination they pointed to a special need for positive leadership for diverse teams. The main criticisms of positive leadership are that it is conceptually redundant to other leadership styles, that there are few studies on two-way and multi-level influences in organisations, and that this leadership style appears to be both naïve and unhelpful in practice (Monzani & Dick, 2020).

Experimental results by Avey, Avolio and Luthans (2011) indicated overall leader positivity was positively related to both followers' results and positivity. With this, leader and follower positivity can be summarised by the construct psychological capital. This includes four criteria: Confidence or efficacy, hope, positivity and resilience (Luthans et al., 2007). Especially during the COVID-19 pandemic, positive psychology in general was examined to play an important role in reducing mental illness and increasing mental health (Waters et al., 2021).

Due to an increasing need for people working in software product development in different roles and in international teams (e. g. George, Lakhani & Puranam, 2020), insights given by Monzani and Dick (2020) indicated that positive leadership behaviour may be helpful for the target area. This assumption was made because Monzani and Dick (2020) outlined the positive effects on role identities or improving the culture by acting as a role model for improving the work environment continuously and engaging in ongoing learning activities.

From 2011 to 2021, the present state of research for the query 'positive leadership AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) emphasises the gap for research on

Table 3.7.: Search Results for Positive Leadership, Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'positive leadership' | 14,800 | Google Scholar | Figure B.17 |
| | 40 | Web of Science | Figure B.18 |
| 'positive leadership' AND 'agile software development' | 24 | Google Scholar | Figure B.19 |
| | 0 | Web of Science | Figure B.20 |
| 'positive leadership' AND 'agile software development' AND ('Germany' | 5 | Google Scholar | Figure B.21 |

*Note.* Status in November 2021. When no entries were found for prior research queries, the testing of combinations was ended.

these constructs with no entries for all three key words in Web of Science for 'organisational initiative AND agile software development' and few entries for all three key words in Google Scholar (see Table 3.7).

Table 3.8 provides samples of the positive leadership literature and research over the past ten years to emphasise the need for major contributions respected in this study.

In their systematic review, Monzani and Dick (2020) concluded that positive leadership not only allows leaders to help themselves, but also fosters positive effects on teams at an organisational level, such as cohesion, identification or learning. To extend the knowledge and replicate the findings for the target software product development employees, the second hypothesis states:

H2: The effect of transformational leadership on the perceived organisational psychological is moderated by positive leadership such that the effects are enhanced when leaders engage in positive leadership behaviours

.

Figure 3.2 visualises the presumed paths between the constructs of the second hypothesis.

Based on the prior literature review, the research question for the first main study is: Does the perceived organisational psychological safety mediate the path between transformational leadership and organisational initiative for members of software development teams? And is this enhanced when leaders engage in positive leadership behaviours? The next section summarises the research design and hypotheses for the first study.

Table 3.8.: Sample of Positive Leadership Literature Reviews and Meta-Analysis

| Source | Approach | Major Contribution(s) |
|---|---|---|
| Monzani and Dick (2020)* | Systematic Review | Summary of main critiques and effects on the individual level for the leader, on the team and organisational level. |
| Malinga, Stander and Nell (2019) | Meta-analysis | Due to confusion with regards to the construct positive leadership, leadership traits as well as motivations, and behaviours were derived. Based on the analysis they summarised that development is possible and they gave recommendations for suitable interventions. |

*Note.* *Lacking meta-analysis or literature synthesis for the construct of positive psychology, the in-book contribution is taken into consideration

Figure 3.2.: Conceptual Visualisation of the Presumed Moderating Effect of Positive Leadership on the Path between Transformational Leadership and Organisational Psychological Safety
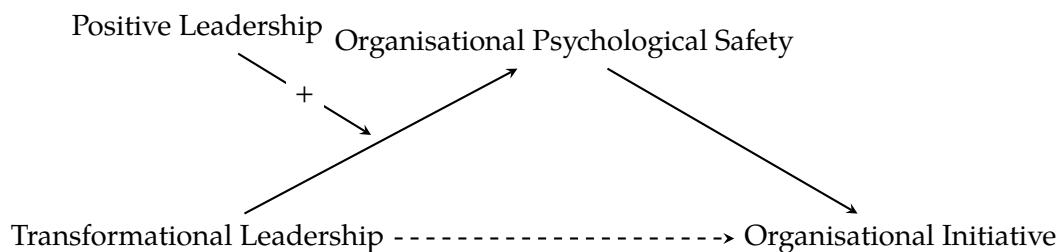
### 3.1.4. Research Design for the First Main Study

To give an overview based on the literature review, Table 3.9 summarises the research question and constructs for the first study. Figure 3.3 visualises the constructs of the first main study in the context of the framework by Mathieu et al. (2017) and Mathieu et al. (2019).

Additionally, the conceptual model in Figure 3.4 visualises and summarises the constructs, paths, and derived hypotheses of the research design for the first main study.

To keep the research design clean, it was decided to test the paths of the mediation hypothesis (H1) as one hypothesis rather than testing the four step approach dividing the respective paths into different hypotheses, as is often seen when testing mediation with the PROCESS macro (Hayes, 2015, 2021). This is in line with Sarstedt et al. (2020) who argued that composite methods such as partial least squares (PLS-SEM) represent the favoured and inferior approach for the estimation of mediation as well as conditional process models and that the PROCESS approach is unnecessary when mediation is studied with PLS-SEM.

Figure 3.3.: Location of the Constructs of the First Main Study in the Framework for Team Research
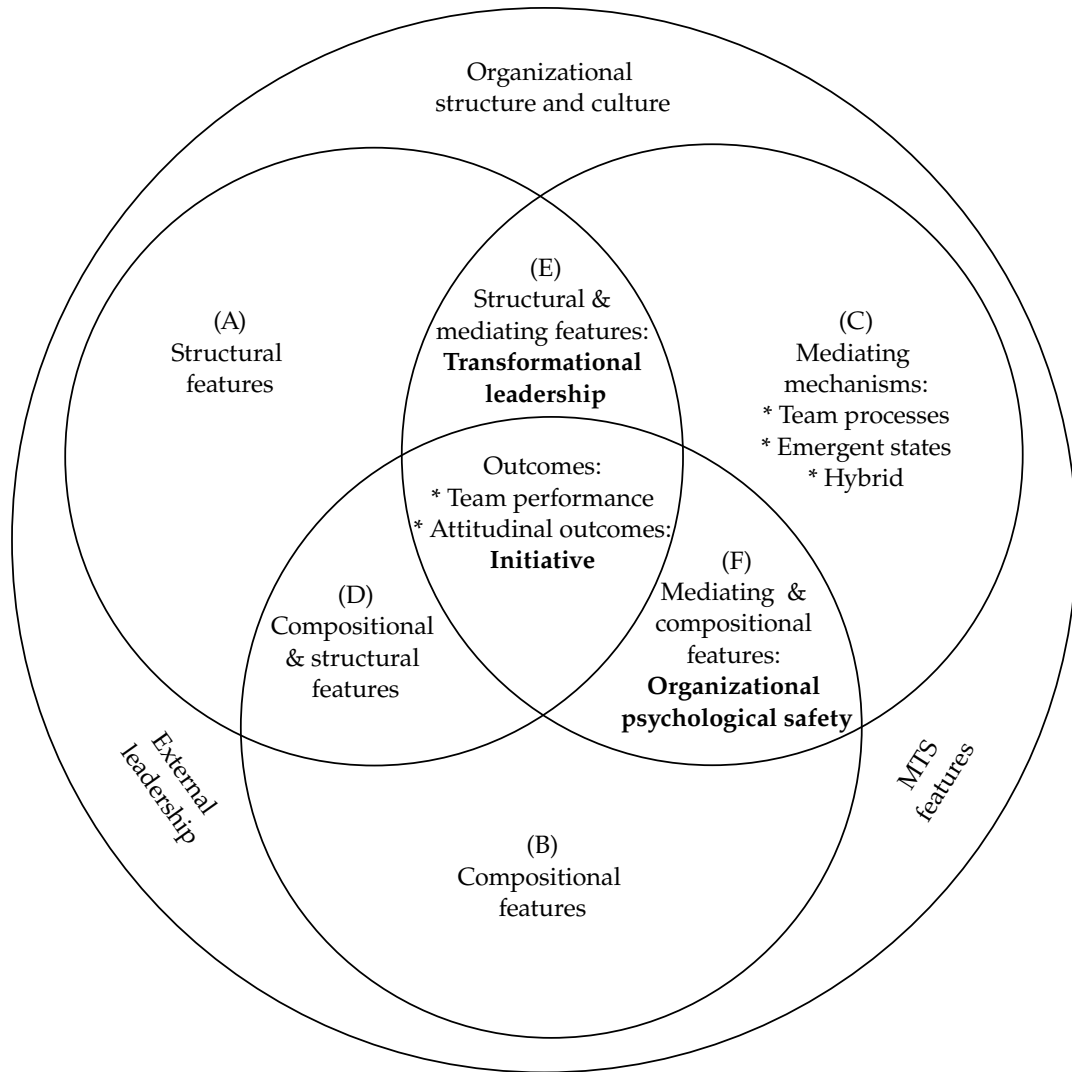


*Note.* Adapted from Mathieu et al. (2017) and Mathieu et al. (2019). Copyright 2017 by the American Psychological Association. Abbreviations: MTS, multiteam systems .

Figure 3.4.: Research Framework and Derived Hypotheses for the First Main Study
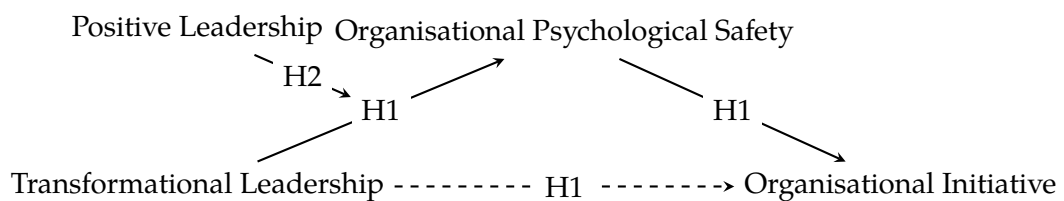
Table 3.9.: Overview of Research Question and Constructs for The First Study

| Study and Research Question |
| --- |
| Study 1 |
| Does the perceived organisational psychological safety mediate the path between transformational leadership and organisational initiative for members of software development teams? And is this enhanced when leaders engage in positive leadership behaviours? |
| Constructs |
| • Transformational leadership<br><br>• Organisational psychological safety<br><br>• Organisational initiative<br><br>• Positive Leadership |

## 3.2. METHODS

This section describes the methods used in this study: inclusions and exclusions, participants characteristics, sampling procedure, sample size, power and precision, measures and covariates, data collection, quality of measurement, conditions and research design, data diagnostics and analysis strategy.

### 3.2.1. Inclusion, Exclusion and Participants Characteristics

Only participants working in software product development teams were accepted. Datasets of participants not working in teams but by themselves were excluded. Furthermore, the surveys contained the information for the regional focus on Germany. Therefore, only participants working in Germany took part. To evaluate and exclude outliers, boxplots were planned to be analysed to examine univariate outliers (JASP Team, 2020). Datasets with more than two standard deviations faster than the mean of duration with regards to participation were set to be excluded. Additionally, datasets with more than one and a half standard deviations from the mean of one of the variables were planned to be excluded with regards to one and a half interquartile range method. Multivariate, model fit, and prediction outlier analysis were evaluated in RStudio and SmartPLS to remove the outliers and improve the accuracy of the model for SEM (Ringle, Wende & Becker, 2015; RStudio Team, 2020). Moreover, Cook's distance was specified to be evaluated for further outliers in R (Aguinis, Gottfredson & Joo, 2013; R Core Team, 2020).

Hereby, the threshold for outliers was based on F distribution, with the obser-

vations apart from a scatter plots.

Overall, participants were asked for their socio-demographic data: gender, age, role, education, duration of professional activity, company size, division, length of current employment, whether they work in a team or alone, team size, working method and leader's gender.

The study was conducted with developers, agile coaches, Scrum masters, user experience (UX) designers as well as project leads/project managers, (team) assistants, and leadership roles, all working in the area of software product development. Among the 111 participants included in the final analysis, 31.53 % were female and 68.47 % were male. Participants' ages ranged from 21 years to 54 years ($M = 34.51$, $SD = 7.77$). Most represented roles were developers (35.54 %), product owners (15.70 %), and leaders (12.40 %) (see Figure 4.7).

Figure 3.5.: Descriptives for the Second Study – Roles of Participants
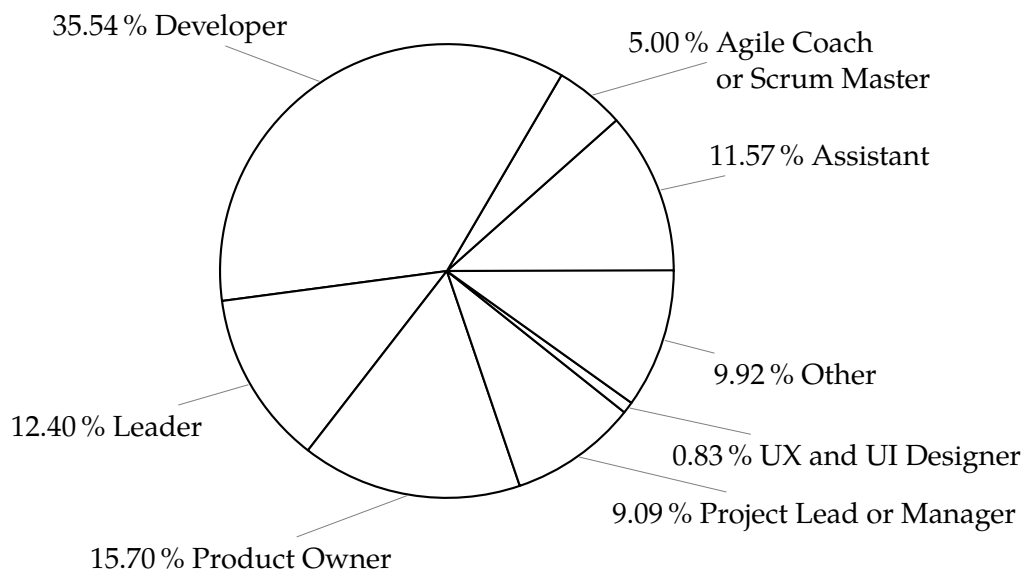


The majority of participants hold a university degree (69.37 %). The duration of the professional activity was up to 37 years ($M = 11.71$, $SD = 7.58$). Most participants worked in large companies with 201 or more employees (51.35 %). The product areas most represented were software (41.44 %) and service providers (20.72 %). Participants' length of current employment ranged up to 24 years ($M = 4.86$, $SD = 4.56$). The team size ranged from two to 30 team members ($M = 8.09$, $SD = 5.18$). The most used working methods were Scrum in an adapted form (41.44 %), classical project management (14.41 %), and Kanban in an adapted form (11.71 %) (see Figure 3.6).

10.81 % stated, that they do not know or it is unclear to them, which method they are working with. 88.29 % had a male leader and 11.71 % a female leader. The socio-demographic data is displayed in Table B.4 and frequency tables for nominal

Figure 3.6.: Descriptives for the First Study – Penetration of working methods in
Software Development in Germany



10.74 % Kanban
in adapted form

5.79 % Scrum
by the book

0.83 % Kanban

15.70 % Classical
project management

8.26 % Checklist
or To-Do-List

9.92 % I don't know

6.61 % Other
working method

42.15 % Scrum
in an adapted form
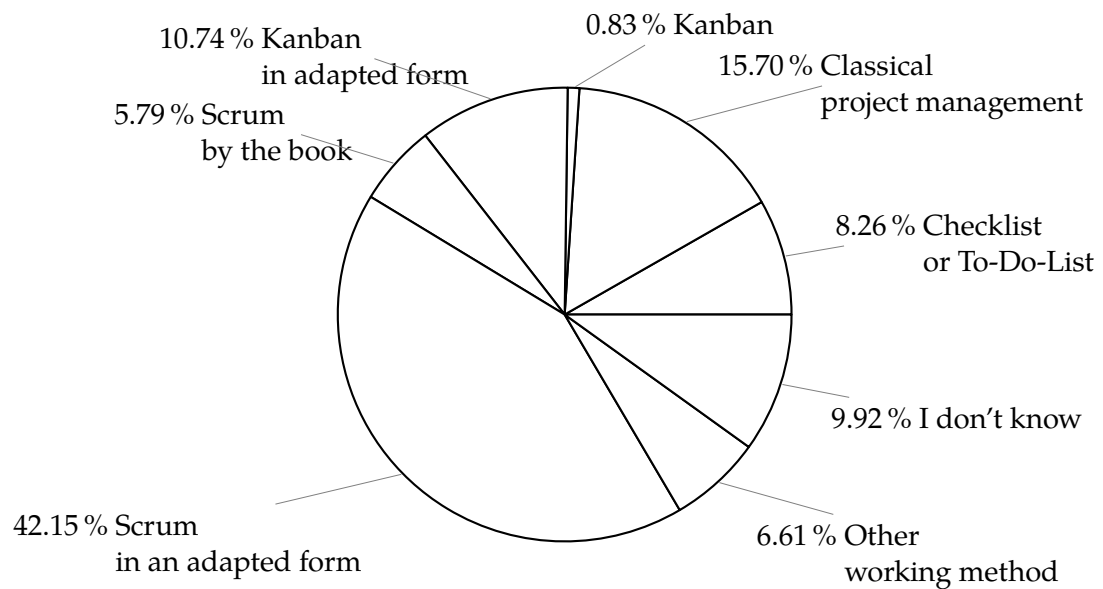
and ordinal variables are attached in the Appendix B.

### 3.2.2. Sampling Procedures, Sample Size and Power

All participants answered the questionnaire online. This allowed for easy and fast participation and evaluation of the data. The online link was spread via business networks as well as members of IT teams, who were approached via e-mail or business networks. A pre-test was conducted (N = 8). Participation was voluntary, anonymous, and without any incentives. All participants were above 18 years old and gave consent to respect and fulfil the guidelines for good ethical research (see Appendix B in Table B.12). There is no conflict of interest nor financial support to disclose for the study.

With regards to the specific target group of members of software product development teams in Germany, there were no reliable estimates for the expected effect size. Therefore other indications had to be used: large effects seemed to be not expectable and small effects seem to be lacking in practical usage. With this, medium effects were aimed at. The goal was a power of .8 for two-sided testing for the directional hypotheses.

For the simple mediation analysis the tables provided by Fritz and MacKinnon (2007), Hair et al. (2019), and Marcoulides and Chin (2013) were considered. For the regressions as part of the moderation analysis, G*Power in the version 3.1.9.6 was used (Faul et al., 2009). Fritz and MacKinnon (2007) recommended for the simple mediation analysis a planned sample size of 71 for detecting medium effects when using bias-corrected bootstrapping as described in subsection 3.2.5. Hair et al. (2019) and Marcoulides and Chin (2013) suggested to plan the sample size using power analysis with respect to the model structure, the expected level of significance, and the awaited effect size: For a minimum $R^2$ of .10, a maximum number of two arrows pointing at a construct and a significance level of 5 %, they suggest a planned sample size of 110. This is close to Cohen (1988) who suggests an $R^2$ value of .13 a medium effect size. For the moderation analysis, a sample size of 55 was suggested (see Table B.3).

With this, the planned net sample size number was the maximum value of all sources of N = 110. To achieve that, based on the expected outliers, the gross planned sample size needed to be enlarged. Oriented to the report on behalf of the Federal Ministry for Work and Social Affairs in Germany, a mark-up of 6 % for the potential participants being (solo-) self-employed and therefore not working in a team in the area of software development (Bonin et al., 2020). To account for further exclusion criteria for which no detailed forecast was possible in advance, a further 10 % was added as a lump sum. Thus, the target was 16 % more participants than the above net sample, resulting in a target gross sample of N = 127. It was planned to stop data collection once this number of participants was reached.

After finishing the data collection stage, there were 121 questionnaires completed. Thus, the planned size of the gross sample was slightly undercut. The sample was cleaned according to the criteria defined before the data collection stage, as follows: First, ten cases were excluded, covering those who did not work in a team but alone. Therefore, they did not fit to the target group of this study.

One case had to be excluded after boxplot analysis due to a too short duration of participation of one and a half standard deviations from the mean. Additionally, five cases were excluded with one and a half standard deviations from the mean of at least one of the four variables out of transformational and positive leadership, organisational initiative, or organisational psychological safety as a cut off criteria. Standardized residual plots and Cook's distance did not indicate any further outliers. This resulted in a net sample of N = 104 for the statistical tests, which was slightly more than planned. Since all unfinished datasets were excluded from the analysis, there are no missing data.

### 3.2.3. Measures and Covariates

Four existing scales were used to operationalise the constructs. Since the manners in the area of software product development are based on the German informal personal address, the questionnaires were adapted in the salutation. All items are attached in English Table B.13 in the Appendix B. The measures include the predictor variable transformational leadership, the moderator positive leadership, the mediator organisational psychological safety, and the criterion organisational initiative.

*Transformational Leadership*

Transformational leadership ($\alpha = .90$) was measured with the seven-item measure of the Global Transformational Leadership (GTL) scale by Carless, Wearing and Mann (2000) also used by Kelloway et al. (2013) when dealing with the interaction of transformational and positive leadership. Participants rated the items on a five-point response scale with higher scores indicating more perceived transformational leadership behaviour. Responses ranged from *Rarely or never* to *Very frequently, if not always*. A sample item is 'My leader communicates a clear and positive vision of the future'.

*Positive Leadership*

Kelloway et al. (2013) developed and validated the scale for measuring positive leadership ($\alpha = .85$) using five items. Participants answered on a five-point scale. Higher scores indicated higher levels of perceived positive leadership behaviour. Sample items are 'my manager thanked me' or 'my manager helped me'.

*Climate for Psychological Safety*

The measure of organisational psychological safety ($\alpha = .80$) contained the adapted original seven items by Edmondson (1999) for measuring the climate for psychological safety, which were transformed to the organisational level by Baer and Frese (2003), who also translated them into German. Responses ranged on seven points from *Fully agree* to *Do not agree at all*. A sample item is 'In our company one is free to take risks'.

*Climate for Initiative*

The measure of the perceived organisational initiative was made using the climate for initiative scale from Baer and Frese (2003), who adopted the scale from Frese et al. (1997) and transformed it on the organisational level for initiative. Responses ranged on a five-point scale from *Fully applicable Does not apply at all*. Sample items are 'Whenever there is a chance to get actively involved, people in our company take it'. The reliability was α = .86.

*Covariates*

In addition to the mentioned constructs, control variables are also relevant to ensure the quality of the study. Participant's gender and age were control variables due to research similarities for example with Bernerth and Aguinis (2015) or Klaic, Burtscher and Jonas (2020).

### 3.2.4. Data Collection and Diagnostics

The survey included existing, validated scales to ensure the quality of measurement. They were used with the permission of the authors to operationalise the constructs or used with regards to Creative Commons (Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) https://creativecommons.org/licenses/by-nc-nd/4.0/).

All data were treated confidentially. All questions were fixed response questions and all items were mandatory. To gain insights, a multidimensional, multi-organisational study was conducted. The study had a non-experimental, cross-sectional design with self-assessment surveys asking for participants' individual perceptions of aspects of working in software product development.

For the analysis of the data, JASP version 0.14.1 (JASP Team, 2020), R version 4.1.0 (R Core Team, 2020), RStudio version 1.4.1717 (RStudio Team, 2020), and SmartPLS version 3 (Ringle, Wende & Becker, 2015) were used. SmartPLS centered standardised all variables in the model to make the effects of the five-point scale comparable with the seven-point scales. This was achieved by the calculation of the mean and standard deviation for each indicator, followed by subtracting and dividing the mean of each indicator score by the respective standard deviation (Chin, Marcolin & Newsted, 2003; Hair et al., 2019). Gender was recoded (male: 0, female: 1). Due to coding all fields as mandatory items, there were no missing data.

To gain a snapshot on people's perception during the pandemic, a one wave study was designed. To avoid common method bias, Kock (2015) analysed common method bias on assessing Variance Inflation Factor (VIF) for testing collinearity. In addition, their results indicated that the standard criteria for assessing convergent and discriminant validity based on a confirmatory factor analysis were also met. Hence, those assessments were also respected in evaluating the measurement model within the current study.

### 3.2.5. Analytic Strategy

Although working with robust non-parametric tests and tools, the normality was checked. The kurtosis and skewness was within the range of $> -2$ and $< 2$, which indicates normality of the data.

In general, SEM is becoming increasingly popular in research regarding the examination of the effect of perceived leadership behaviour and the impact on employees (e. g. Hassi, Rohlfer & Jebsen, 2021; Iqbal, Ahmad & Latif, 2021) In this study, the specific form of PLS-SEM technique was used to analyse the data. Using PLS-SEM is beneficial compared to factor-based SEM with regards to greater statistical power, which makes it more likely to examine the significance of an effect when present in the population (Sarstedt, Ringle & Hair, 2021). Adapted from Sarstedt, Ringle and Hair (2021) the use cases for PLS-SEM can be summarised as:

- Forecast and explanation of a central target construct and/or detection of the relevant antecedent constructs

- Complex pathway model, i.e. many constructs per model (six or more) and many indicators per construct (more than four indicators)

- Pathway model contains formatively measured constructs (instead of reflectively measured constructs)

- Restricted sample size (the same if it is large)

- Study based on secondary or even archival data (no strong foundation based on measurement theory)

- Use values of latent variables in further research

There is a lot of controversy on PLS and the value for quantitative research. Rigdon (2016) states that SEM per se is still young as a statistical method spreading more rapidly than PLS which is younger and evolving slower. In addition, he points to the effect of analogies and heuristics as a powerful instrument on one hand but, a misleading trap on the other hand. Therefore, it depends on the study and the circumstances as to whether PLS-SEM is suitable (Rigdon, 2016; Sarstedt, Ringle & Hair, 2021). Despite criticisms on using PLS-SEM e. g. to cope with unnecessary sample sizes or in psychology in general, Sarstedt, Ringle and Hair (2021) pointed to the need to run power analysis in advance. Although PLS-SEM is applicable for smaller samples, they insist that no statistical 'can offset a badly designed sample' (Sarstedt, Ringle & Hair, 2021, p. 13).

Even for the estimation of very complex mediation models, PLS-SEM as a composite-based approach is not restricted by the constraints of regression- and factor-based SEM analysis. In addition to measurement error, composite-based approaches take the entire model structure into account in parameter estimation. Compared to factor-based SEM methods, they also offer more flexibility in designing and specifying the model. Researchers can easily incorporate interaction terms with

simultaneous consideration of measurement errors (Sarstedt et al., 2020). Being part of the algorithm, PLS-SEM computes case values or construct scores for every latent variable used in the model (Sarstedt, Ringle & Hair, 2021).

Hair et al. (2019) suggest the method to be useful, e. g. when taking a prediction perspective for testing a theoretical framework, when the population is small which limits the sample size, or when the structural model is complex. Since several of the advantages apply to this study, PLS-SEM was chosen to address those challenges using the appropriate method, although being aware of the criticisms. One reason is that the target group of members of Software Product Development teams in Germany being a small part of people working in IT. Another aspect is to ensure distribution requirements not lacking of normality and to be able to handle complex structural models (Hair et al., 2019). To contribute to the call by Mathieu et al. (2019) for embracing complexity with regards to work team research, PLS-SEM seems to be suitable as well, since the model proposed is based on focusing on mediation effects.

This study was set up to contribute to the model for embracing complexity by Mathieu et al. (2019, p. 19) dividing constructs into '[c]o-evolving team compositional and structural features, mediating mechanisms, external influences, and outcomes': Leadership was set as a structural feature and external influence, psychological safety was in this case chosen as a mediator, and the organisational initiative as an outcome with regards to individual reactions. The study hereby aims to add knowledge to the proposed need to measure constructs triggered by the environment. This content and contribution was evaluated to suggest a methodological approach that handles complex structural models (Hair et al., 2019). Furthermore, Sarstedt et al. (2020) recommended the use of PLS-SEM for estimating mediation and moderation to help understand and explain complex causal processes, regardless of the research discipline. This argument was evaluated to be in line with Hayes and Rockwood (2019, pp. 48-49) who addressed the research focus on understanding 'the mechanisms by which efforts operate and the factors that influence the size or strength of those mechanisms'. They criticised that until now effects are often treated as independent. Nevertheless, there is a necessity to respect and accept the dependency gut to get insights on the operation itself and in addition into the boundary conditions. This means e.g.. that it is necessary to understand the mechanisms at work and when they take place.

With regards to the structural model, bias-corrected bootstrapping was used (5000 samples) as a non-parametric procedure, that in addition to percentile boot-strapping 'corrects for skew in the population' (Fritz & MacKinnon, 2007, p. 5).

For the mediation analysis (H1), the decision criterion was whether the indirect effect became significant (Baron & Kenny, 1986). For testing mediated effects, Cohen (1988) described the need for the total effect of the latent predictor (X) on the latent criterion variable (Y) to be significant referring to Baron and Kenny (1986). With regards to Hayes (2017), it is now generally accepted that a significant indirect effect via a mediator can also occur in the absence of a significant total effect. For PLS-SEM, Sarstedt, Ringle and Hair (2021) recommended an assessment of the total effect. Due

Figure 3.7.: PLS-SEM Analysis Elements

| | |
|---|---|
| Preliminary Considerations | Sample Size |
| | Statistical Power |
| | Distributional Assumptions |
| | Goodness of Fit |
| Measurement Model Assessment | Reflective: Loadings, α, Composite Reliability, *p*, Average Variance Extracted (AVE), Heterotrait-Monotrait Ratio (HTMT) |
| Structural Model Assessment | VIF |
| | Explanatory Power and out-of-sample power ($R^2, Q^2$) |
| | Significance and relevance of the path coefficients |
| | Model Comparisons |

*Note.* Figure following Hair et al. (2019)

to the specific recommendations for the statistical method chosen, the decision was made to consider the total effect as well. Fritz and MacKinnon (2007) emphasised the necessity for mediation to examine whether the confidence interval contains zero (insignificant) or not (significant).

For the moderation analysis (H2), the decision criterion was whether the interaction term of X, which was transformational leadership and the latent moderator variable (W), which was positive leadership became significant (Baron & Kenny, 1986). Therefore, the product indicator calculation method was used, pairing the indicators of X and W. Standardised values were chosen for the product term generation.

## 3.3. RESULTS

This section presents the results of the analyses using the statistical techniques discussed in 3.2.5. The reporting style follows the reporting style of PLS analysis as suggested by Chin (2010). First, participant flow and recruitment will be reported. Second, the reliability and validity of the measurement model are assessed. Since this dissertation includes assessing the mediating role of the perceived organisational psychological safety on transformational leadership and organisational initiative, and the moderating role of the perceived positive leadership, which includes the interaction of positive and transformational leadership, a post-hoc analysis was conducted

to investigate these effects. Therefore, the third step is to present the structural model results.

The study started with a short introduction to the scope, boundary conditions and use of the data of the study, with an explanation that there was no commercial usage or interest. Then, the participants gave consent, agreeing that they were above 18 years old and respected the rules of participation. The content scales where ordered from the individual to the leadership perception. Therefore, the first content scale was the *climate for psychological safety* by Baer and Frese (2003) and Edmondson (1999), followed by the *climate for initiative* scale by Baer and Frese (2003) and Frese et al. (1997), both on the perception of the organisational level. The perception of leadership started with the *positive leadership* scale by Kelloway et al. (2013), followed by the *transformational leadership* by Carless, Wearing and Mann (2000). The final part was the socio-demographic data. The last page included contact details and further information. Details of the scales are attached in the Appendix B Table B.13.

The data collection took place from September to November 2020 with respect to the sampling procedure described in subsection 3.2.2. The next section presents the results of the measurement model.

### 3.3.1. Evaluation of the Measurement Model

This section consists of the reporting of the measurement model, including the common method variance and the validation of instruments and psychometrics. PLS-SEM analysis includes the assessment of the measurement and structural model. The measurement model tests the reliability and validity of the constructs. The structural model includes the significance of the hypothesised relationships. The data analysis and report of results follows the reporting style for PLS-SEM analysis suggested by previous studies (e. g. Chin, 2010; Sarstedt, Ringle & Hair, 2021).

For factor loadings, Hulland (1999) suggested a threshold of 0.50. More strictly, items with factor loadings smaller than 0.60 were reviewed and sorted out referring to Gefen and Straub (2005). Consistent with Hair, Ringle and Sarstedt (2011), the threshold of 0.70 was chosen. An inappropriate loading was the case for one item of organisational initiative (OI06) and two items for climate for psychological safety (PS04 and PS07), which were removed. Table 3.10 reports on the results for reliability and validity for the overall sample as well as the factor loadings for the remaining items.

In order to test the reliability of the scales, Cronbach's Alpha was used. To overcome criticisms of Cronbach's Alpha being a lower boundary, as well as having the characteristic to underestimate reliability, Composite Reliability (CR) was also used. In the current research, the measurement model was evaluated by using Confirmatory Factor Analysis (CFA) and, while investigating the proposed framework, focusing on convergent reliability. The measurement model had four latent constructs. With regards to factor analysis, first, the overall sample was assessed. Additionally, CR and Cronbach's Alpha were used to analyse internal consistency. The Cronbach's Alpha of the constructs ranged from $\alpha = .80$ to $\alpha = .90$. Referring to Field (2017) or Taber

Table 3.10.: Loadings, Reliability, and Convergent Validity for the First Main Study

| Construct | Coding | Loading | *alpha* | CR | AVE |
|---|---|---|---|---|---|
| Transformational Leadership | TL1 | 0.74 | 0.90 | 0.92 | 0.64 |
| | TL2 | 0.81 | | | |
| | TL3 | 0.84 | | | |
| | TL4 | 0.86 | | | |
| | TL5 | 0.72 | | | |
| | TL6 | 0.84 | | | |
| | TL7 | 0.75 | | | |
| Positive Leadership | PL1 | 0.82 | 0.85 | 0.89 | 0.63 |
| | PL2 | 0.83 | | | |
| | PL3 | 0.82 | | | |
| | PL4 | 0.72 | | | |
| | PL5 | 0.77 | | | |
| Organisational Psychological Safety | PS1 | 0.75 | 0.80 | 0.86 | 0.56 |
| | PS2 | 0.73 | | | |
| | PS3 | 0.74 | | | |
| | PS5 | 0.77 | | | |
| | PS6 | 0.76 | | | |
| Organisational Initiative | OI1 | 0.79 | 0.87 | 0.90 | 0.60 |
| | OI2 | 0.73 | | | |
| | OI3 | 0.74 | | | |
| | OI4 | 0.80 | | | |
| | OI5 | 0.78 | | | |
| | OI7 | 0.78 | | | |

*Note.* N = 111, missing = 0. Average Variance Extracted (AVE) = Average Variance Extracted, *alpha* = Cronbach's Alpha, TL = Transformational Leadership, PL = Positive Leadership, PS = Organisational Psychological Safety, OI = Organisational Initiative.

(2018), the results for all constructs exceed the threshold of 0.70. If an item of a scale was deleted, it was also analysed whether the reliability was significantly increased by the deletion of an item. It showed that eliminating an item did not enhance construct reliability. Additionally, all CR were higher than the recommended value of 0.70 (Netemeyer, Bearden & Sharma, 2003).

After ensuring reliability, convergent validity of all constructs was analysed. To ensure convergent validity through factor analysis, all items measuring the same construct must strongly agree (converge) in terms of their representation of the construct for which they were developed. Convergent validity is achieved when the constructs that are supposed to be linked are related to each other, which prior research such as Carless, Wearing and Mann (2000) already indicated for transformational leadership. Usually, convergent validity is examined by values of Average Variance Extracted (AVE) and CR with a threshold of 0.50 or above (Fornell & Larcker, 1981). Furthermore, the AVE and CRs for all constructs are all above 0.50, which also indicates convergent validity. Therefore, transformational leadership, positive leadership, organisational psychological safety and organisational initiative are all uni-dimensional constructs, and convergent validity is ensured.

The descriptives for the metric variables included in testing the hypotheses were evaluated. The perceived transformational leadership is above average ($M = 3.48$, $SD = 0.67$) and higher than positive leadership ($M = 2.79$, $SD = 0.77$). To derive practical implications, the results of each item were analysed and reported. Referring to (Carless, Wearing & Mann, 2000) transformational leadership behaviour includes the following aspects:

- Vision ($M = 3.27$, $SD = 1.17$)

- Staff Development ($M = 3.87$, $SD = 1.19$)

- Supportive Leadership ($M = 3.55$, $SD = 1.23$)

- Empowerment ($M = 3.73$, $SD = 1.23$)

- Innovative Thinking ($M = 3.43$, $SD = 1.23$)

- Leading by Example ($M = 3.41$, $SD = 1.25$)

- Charisma ($M = 3.09$, $SD = 1.23$)

Table 3.11.: Fornell-Larcker Criterion for the First Main Study

| Variable | Age | Age*TL | OI | PS | G*TL | G | LG*TL | LG | PL | TL*PL | TL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | **1.000** | | | | | | | | | | |
| Age*TL | −0.165 | **0.293** | | | | | | | | | |
| OI | −0.001 | −0.241 | **0.771** | | | | | | | | |
| PS | −0.014 | −0.239 | 0.737 | **0.748** | | | | | | | |
| G*TL | −0.389 | 0.033 | 0.127 | 0.081 | **0.970** | | | | | | |
| G | −0.406 | 0.115 | 0.056 | 0.011 | 0.953 | 1.000 | | | | | |
| LG*TL | 0.107 | 0.028 | −0.001 | −0.059 | 0.195 | 0.125 | 0.978 | | | | |
| LG | 0.052 | 0.059 | −0.089 | −0.125 | 0.098 | 0.054 | 0.926 | **1.000** | | | |
| PL | 0.048 | −0.106 | 0.394 | 0.528 | 0.179 | 0.058 | −0.073 | −0.183 | **0.794** | | |
| TL*PL | −0.060 | 0.061 | −0.292 | −0.330 | −0.054 | −0.017 | −0.012 | 0.108 | −0.242 | **0.667** | |
| TL | 0.069 | −0.142 | 0.566 | 0.625 | 0.205 | 0.045 | 0.068 | −0.103 | 0.722 | −0.376 | **0.797** |

*Note.* = 111, missing = 0. ***$p < .001$. Diagonal elements are the square root of the average variance extracted of each construct. G = gender, LG = leaders' gender, TL = transformational leadership, OI = organisational initiative, PL = positive leadership, PS = (organisational) psychological safety

The referring items are attached in Appendix B in Table B.14. The perceived organisational psychological safety is above average as well ($M = 5.37$, $SD = 1.08$). This is also the case for organisational initiative ($M = 3.50$, $SD = 0.69$).

Overall, construct validity is established when convergent and discriminant validity are determined. Discriminant validity was inspected with the value of each indicator's inner VIF value for collinearity statistics being less than the threshold of 3.3. This indicates not only that the moderated mediation model does not indicate pathological collinearity but it can also be considered free of common method bias. Additionally, Fornell-Larcker criterion was used. Table 3.11 shows that square-root of AVE for the construct is greater than the inter-construct correlation (Kock, 2015). Discriminant validity was also assessed using Heterotrait-Monotrait Ratio (HTMT) ratio of correlations (Henseler, Ringle & Sarstedt, 2015). All values are below the threshold of 0.90. Therefore, discriminant validity is ensured. The results of the Fornell-Larcker criterion is displayed in Table 3.11 and for the HTMT testing in Table 3.12 (Fornell & Larcker, 1981).

Overall, the data model is suitable for structural model assessment due to the above analysis of the indicating established reliability and validity of all constructs used in the current study. Being part of the two models approach of PLS-SEM, the next section gives insights into the second part: the structural model.

Table 3.12.: Heterotrait-Monotrait Ratio

| | Age | Age*TL | OI | PS | Gender | Gender*TL | LG | LG*TL | PL | TL*PL | TL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | | | | | | | | | | | |
| Age*TL | 0.352 | | | | | | | | | | |
| OI | 0.069 | 0.107 | | | | | | | | | |
| PS | 0.052 | 0.130 | 0.876 | | | | | | | | |
| Gender | 0.406 | 0.121 | 0.079 | 0.024 | | | | | | | |
| Gender*TL | 0.120 | 0.406 | 0.141 | 0.213 | 0.071 | | | | | | |
| LG | 0.052 | 0.179 | 0.129 | 0.198 | 0.054 | 0.264 | | | | | |
| LG*TL | 0.133 | 0.100 | 0.128 | 0.110 | 0.197 | 0.102 | 0.207 | | | | |
| PL | 0.052 | 0.114 | 0.445 | 0.624 | 0.072 | 0.112 | 0.199 | 0.138 | | | |
| TL*PL | 0.090 | 0.137 | 0.309 | 0.359 | 0.090 | 0.209 | 0.147 | 0.276 | 0.265 | | |
| TL | 0.074 | 0.087 | 0.620 | 0.726 | 0.086 | 0.098 | 0.113 | 0.218 | 0.809 | 0.373 | |

*Note.* = 220, missing = 0. TL = transformational leadership, PL = positive leadership, PS = (organisational) psychological safety, OI = organisational initiative, LG = Leader's Gender, Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples)

### 3.3.2. Evaluation of the Structural Model

Different hypotheses were proposed to evaluate the relationship of predictor and outcome.

H1: The perceived organisational psychological safety mediates the relationship between transformational leadership and organisational initiative.

H2: The effect of transformational leadership on the perceived organisational psychological is moderated by positive leadership such that the effects are enhanced when leaders engage in positive leadership behaviours.

This section includes the presentation of the inferential statistics and data analysis. In fact, assessment of the structural model includes $R^2$, $Q^2$ for the endogenous variables organisational psychological safety and organisational initiative, and the significance of paths. The strength of the structural model determines the goodness of the model by evaluating $R^2$ for the mediating and dependant variable. The threshold value for an acceptable $R^2$ value depends on the research context (Hair et al., 2012). The results of $R^2$ for organisational psychological safety ($R^2 = 0.48$) and organisational initiative ($R^2 = .56$) are above .10 indicating the predictive capability. Furthermore, $Q^2$ indicates the predictive relevance of the endogenous constructs. A $Q^2$ value greater than 0 displays the predictive relevance of the model (Chin, 2010). The results for this study point to significant prediction of organisational psychological safety ($Q^2 = 0.208$) and organisational initiative ($Q^2 = 0.318$). Additionally, standardized root mean residual (SRMR) was used to assess the model fit of the data with a threshold below .10 for an acceptable model fit. The SRMR value of .080 indicates an acceptable model fit (Hair et al., 2016). To further assess the goodness of fit, hypotheses were tested to ensure the significance of the relationships for mediation and moderation analyses.

*Mediation Analysis*

To test the statistical significance of path coefficients of the hypothesised effects, t-values and p-values were calculated using bootstrapping (5000 samples). To evaluate mediating effects, recommendations by Nitzl, Roldan and Cepeda (2016) and guidelines by Sarstedt, Ringle and Hair (2021) were respected. Figure 3.8 visualises the structural path coefficients and the results of the structural model evaluation for hypothesis testing (see Table 3.13).

H1 stated that the perceived organisational psychological safety mediates the relationship between transformational leadership and organisational initiative. To assess the mediating role of the perceived climate for psychological safety, mediation analysis was performed. The study's 5000 resamples generate 95 % bias-corrected bootstrapping confidence intervals. A confidence interval not including zero indicates a significant relationship (see Table 3.13). Figure 3.9 visualises the results for testing the first hypothesis.

As presented in Table 3.13 and visualised in Figure 3.9, the total effect, the

Figure 3.8.: Structural Model with Path Coefficients
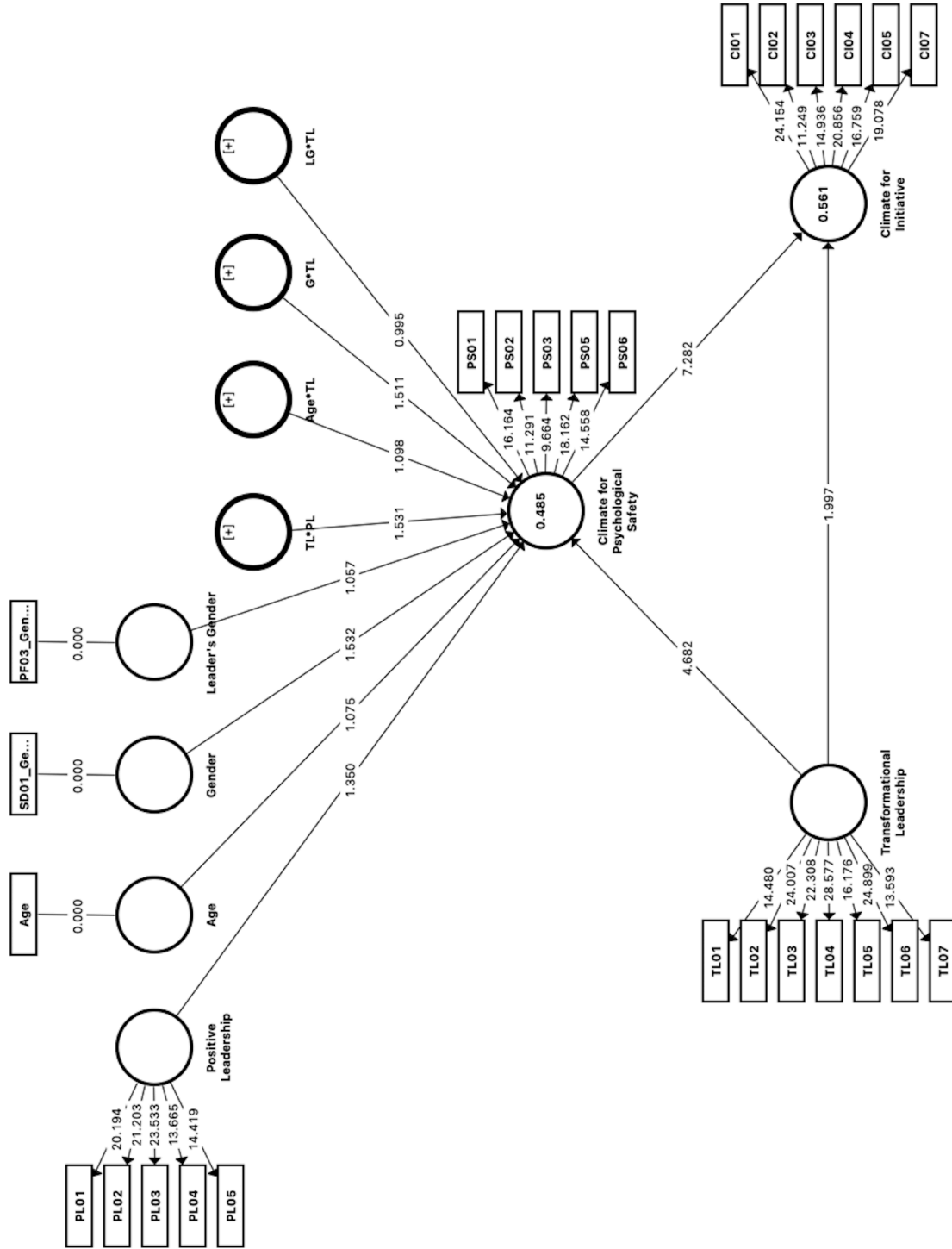
Table 3.13.: Results of Structural Model Assessment for Mediation Analysis

| Paths | Paths coefficients | T values | p values | LL | UL |
|---|---|---|---|---|---|
| *Total effects* | | | | | |
| TL -> PS | 0.599 | 4.682 | <0.001 | 0.408 | 0.907 |
| TL -> OI | 0.549 | 5.694 | <0.001 | 0.383 | 0.750 |
| PL -> PS | 0.166 | 1.350 | 0.177 | −0.097 | 0.386 |
| PL -> OI | 0.104 | 1.371 | 0.170 | −0.062 | 0.242 |
| LG -> PS | 0.337 | 1.057 | 0.290 | −0.201 | 1.055 |
| LG -> OI | 0.212 | 1.038 | 0.299 | −0.118 | 0.726 |
| G -> PS | 0.585 | 1.532 | 0.126 | 0.034 | 1.501 |
| G -> OI | 0.368 | 1.510 | 0.131 | 0.035 | 1.009 |
| PS -> OI | 0.629 | 7.282 | <0.001 | 0.448 | 0.785 |
| Age -> PS | −0.094 | 1.075 | 0.283 | −0.296 | 0.053 |
| Age -> OI | −0.059 | 1.064 | 0.287 | −0.194 | 0.033 |
| *Direct effect* | | | | | |
| TL -> PS | 0.599 | 4.682 | <0.001 | −0.296 | 0.053 |
| TL -> OI | 0.173 | 1.997 | <0.05 | −0.483 | −0.115 |
| PL -> PS | 0.166 | 1.350 | 0.177 | −0.986 | −0.015 |
| LG -> PS | 0.337 | 1.057 | 0.290 | 0.034 | 1.501 |
| G -> PS | 0.585 | 1.532 | 0.126 | −0.201 | 1.055 |
| PS -> OI | 0.629 | 7.282 | <0.001 | −0.242 | 0.074 |
| Age -> PS | −0.094 | 1.075 | 0.283 | 0.408 | 0.907 |
| *Indirect effect* | | | | | |
| TL -> PS -> OI | 0.376 | 3.730 | <0.001 | 0.224 | 0.648 |
| PL -> PS -> OI | 0.104 | 1.371 | 0.170 | −0.062 | 0.242 |
| LG -> PS -> OI | 0.212 | 1.038 | 0.299 | −0.118 | 0.726 |
| G -> PS -> OI | 0.368 | 1.510 | 0.131 | 0.035 | 1.009 |
| Age -> PS -> OI | −0.059 | 1.064 | 0.287 | −0.194 | 0.033 |

*Note.* = 220, missing = 0. TL = transformational leadership, PL = positive leadership, PS = (organisational) psychological safety, OI = organisational initiative, G = Gender, LG = Leader's Gender, Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 3.9.: Visualisation of the Results for the Mediation Analysis for the First Main
　　　　　Study

Organisational Psychological Safety

0.60　　　　　　　　　　　　0.63

Transformational Leadership - - - - - - - - - 0.17 - - - - - - -→ Organisational Initiative
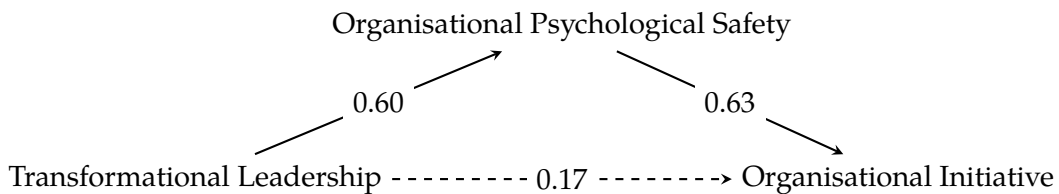
*Note.* Paths coefficients. $R^2 = 0.49$ for Organisational Psychological Safety and
$R^2 = 0.56$ for Organisational Initiative

path between transformational leadership and the organisational initiative, ignoring the mediator, was significant ($\beta = 0.55$, $t = 5.69$, $p < .001$). The a-path showed a positive significant effect of the predictor variable transformational leadership on the mediator organisational psychological safety ($\beta = 0.60$, $t = 4.68$, $p < .001$). The b-path from the mediator organisational psychological safety to the criterion variable organisational initiative was positive and significant as well ($\beta = 0.63$, $t = 7.28$, $p < .001$). With the inclusion of the mediating variable (organisational psychological safety), the impact of transformational leadership on organisational initiative did not become insignificant, but was reduced ($\beta = 0.17$, $t = 2.00$, $p < .05$. The indirect effect of transformational leadership on organisational initiative through organisational psychological safety was found to be significant ($\beta = 0.38$, $t = 3.70$, $p < .001$).

　　　Therefore, this showed partial mediation from the perceived transformational leadership through organisational psychological safety on organisational initiative. Hence, H1 can be accepted.

*Moderation Analysis*

　　　Moderation analysis was performed to evaluate the moderating role of positive leadership and the control variables of leader's gender, participant's and age afterwards. H2 proposed that positive leadership behaviour moderated the effect of the perceived transformational leadership on organisational psychological safety, such that the effects of transformational leadership behaviour on organisational psychological safety were enhanced when leaders engaged in positive leadership behaviours. To assess the moderating role of the perceived positive leadership, moderation analysis was performed (Hayes, 2015). Figure 3.10 visualises the results for testing the second hypothesis, additionally to the presentation of the findings in Table 3.14.

　　　The results revealed an insignificant role of the perceived positive leadership for the relationship between transformational leadership and organisational psychological safety due to an insignificant interaction term ($\beta = -0.12$, $t = 1.53$, $p = .122$). Hence, H2 was not supported.

　　　To control whether there are differences with regards to leaders' gender, parti-

Table 3.14.: Results of Structural Model Assessment for Moderation Analysis

| Paths | Paths coefficients | T values | $p$ values | LL | UL |
|---|---|---|---|---|---|
| *Total effects* | | | | | |
| TL*PL -> PS | −0.118 | 1.531 | 0.126 | −0.242 | −0.074 |
| LG*TL -> PS | −0.302 | 0.995 | 0.320 | −0.895 | −0.257 |
| Gender*TL -> PS | −0.353 | 1.511 | 0.131 | −0.986 | −0.015 |
| Age*TL -> PS | −0.216 | 1.098 | 0.272 | −0.483 | −0.115 |

*Note.* = 220, missing = 0. TL = transformational leadership, PL = positive leadership, PS = (organisational) psychological safety, OI = organisational initiative, G = Gender, LG = Leader's Gender, Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 3.10.: Visualisation of the Results for the Moderation Analysis for the First Main Study
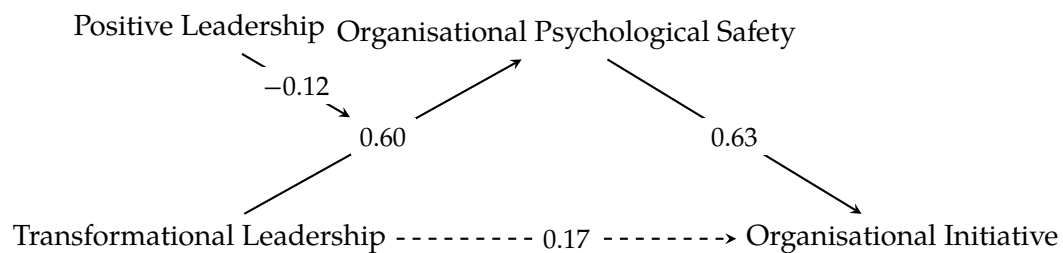


*Note.* Path coefficients. $R^2 = .49$ for Organisational Psychological Safety and $R^2 = .56$ for Organisational Initiative

cipant's gender, or age a moderation analysis was performed to assess the moderating roles for the effect of transformational leadership on organisational psychological safety as well. The results revealed an insignificant role of leader's gender for the relationship between transformational leadership and organisational psychological safety due to an insignificant interaction term. Gender and age were also not found to have a significant moderating role on the relationship between transformational leadership and organisational psychological safety due to an insignificant interaction term (see Table 3.14). After having described the results of the first main study, the next section discusses the results.

## 3.4. DISCUSSION

In the following section, the results of the study are first interpreted in the light of the current state of research. Then, the strengths and possible limitations of the conducted research are discussed. The section concludes with an outlook on the need for further research and an examination of the practical implications of the results.

The purpose of this research was to examine the effect between a change-oriented form of leadership, i.e. transformational leadership, and organisational initiative and determining the mediating role of the organisational psychological safety in the underlying effect. Therefore, hypotheses were proposed drawing on team research theories, namely the co-evolving model of team research by Mathieu et al. (2019), Mathieu et al. (2017), Mathieu et al. (2015). To empirically test the proposed hypotheses, data were collected in one wave from employees working in software product development teams in Germany to provide a snapshot in the light of the COVID-19 pandemic.

### 3.4.1. Interpretation and Context within the Current State of Research

In the following section, the results for the criterion variable considered in the tests is interpreted, which was consistent with the expectations. Following this, the moderating variable is commented upon, which showed results contrary to expectations. The results for these variables are also examined in relation to the current state of research.

H1 hypothesised the mediating effect of the perceived organisational psychological safety between transformational leadership and organisational initiative. The findings of this study enlarge the organisational aspect of psychological safety as a mediator to the co-evolving model by Mathieu et al. (2019) and additionally extend findings by Baer and Frese (2003) to an organisational level mediator and not only functioning as a moderating variable. However, the results supported the findings of Judge and Piccolo (2004) for validity of transformational leadership. Regarding the research design examining individuals' perspectives in a multi-organisational evaluation in the area of software product development, the insights support organisational psychological safety to be a process facilitating individuals into the

desired future state of showing organisation-wide initiative (Rank, Pace & Frese, 2004). Nevertheless, the COVID-19 pandemic is no normal context, but a crisis, and transformational leadership behaviour was significantly perceived in the area of software development in Germany. With this, the findings of this study enlarge insights gained by Geier (2016) beyond insights in extreme situations in a crisis. Additionally, leadership behaviour is dependant on the employees they interact with, which supports the approach by Clarke (2012) to examine the individual perspective. A deeper look and contextualisation is outlined in subsubsection 3.4.1.

H2 suggested that positive leadership moderates the path between transformational leadership and organisational psychological safety such that the effect is enhanced when employees perceive leaders to be engaging in positive leadership behaviours. Additionally, the results do not support the moderating effect of participant's age, participant's gender and leader's gender influencing the path between the perceived transformational leadership behaviour and organisational psychological safety. All moderating effects not supported give a positive sign for practical recommendations that leaders can focus on, by engaging in transformational leadership behaviour and not by adding positive leadership behaviour or adapting with regards to employees age or gender. Hereby, the results of the current study support the findings of Ng and Feldman (2013), who did not find evidence for the context of innovation-related behaviour that older employees or those who worked at the organisation for a longer time period engaged in less. Additionally, the results can help leadership coaches or trainers to treat and teach leaders equally, without making a difference with regards to their gender. A discussion in more depth and with reference to the theoretical framework is given in subsubsection 3.4.1.

With regards to the theoretical perspective, this research suggests the following overarching theoretical implications: By examining the effect between transformational leadership via organisational psychological safety for organisational initiative, it contributes to the leadership literature. Therefore, it is necessary to note that recent prior research often focused on sticking to the team level for evaluating mediating effects or examining other leadership styles, not focusing on the perception of organisational mediators (e. g. Hassi, Rohlfer & Jebsen, 2021; Klaic, Burtscher & Jonas, 2020; van der Voet & Steijn, 2020).

From a practical perspective, Figure 2.10 visualises the organisational structure derived from the literature for the outside-in approach in software product development organisations (see section 2.3). From a theoretical perspective, Figure 3.3 showed the constructs of the first main study in the context of the framework by Mathieu et al. (2017) and Mathieu et al. (2019) (see subsection 3.1.4). To bring both perspectives together deriving a research-based framework for software product development, Figure 3.11 displays the measured constructs combined with the practical outside-in organisational structure.

Figure 3.11.: Collaboration Framework for Outside-in Organisational Structures in Software Product Development based on the Results of the First Main Study
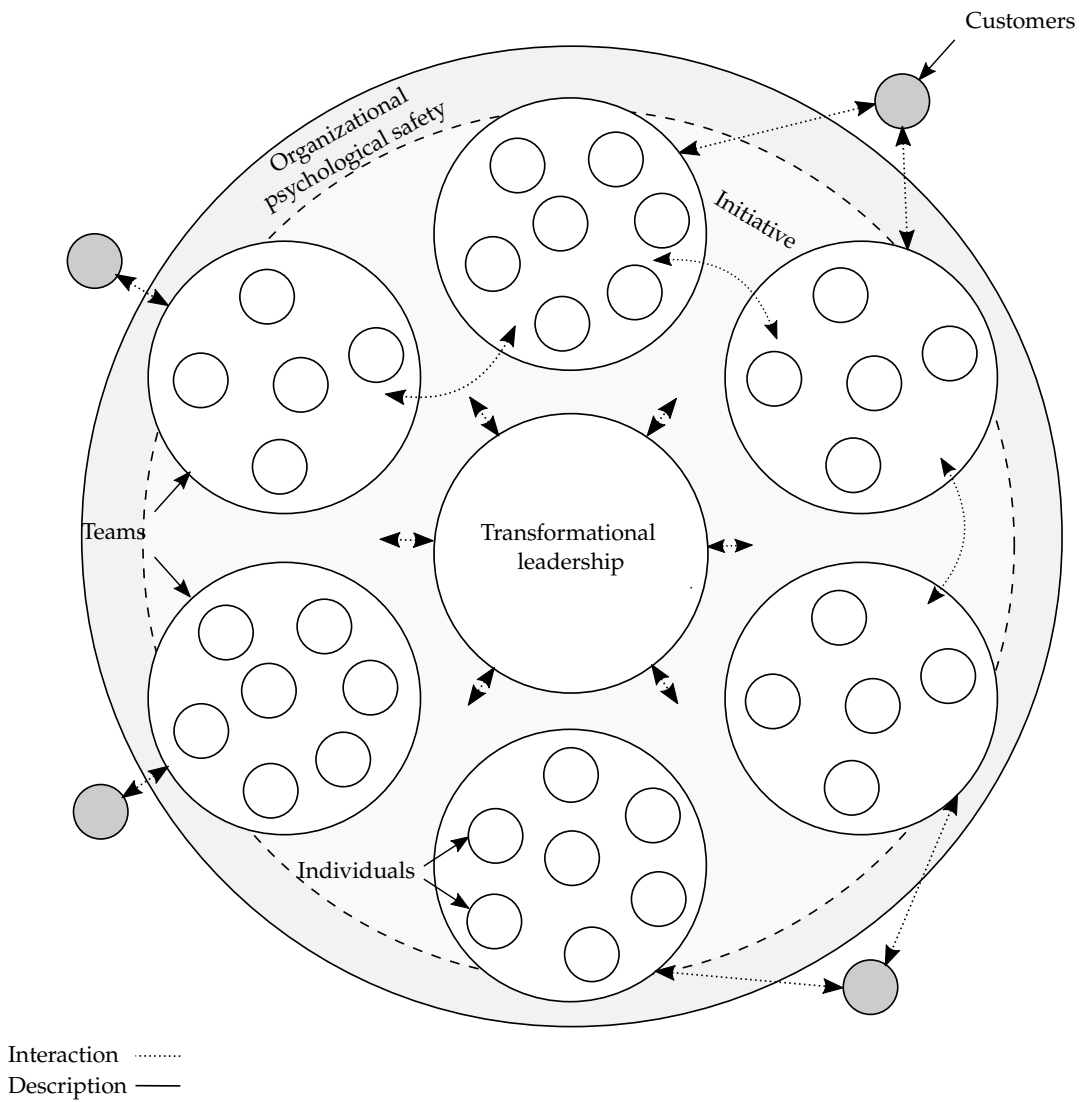
*Interpretation of the Results with regards to Organisational Initiative*

The results of this study contribute to the model for embracing complexity by Mathieu et al. (2019) and can enlarge it. The insights given in the current study support the role of leadership as a structural feature and external influence, psychological safety as an organisational-level mediating variable, and organisational initiative as an attitudinal outcome with regards to individual reactions. The research therefore adds knowledge to the proposed need to measure constructs triggered by the environment for the context of software product development in Germany.

The results of this study support the findings by Carless, Wearing and Mann (2000), who did an exploratory and confirmatory factor analysis for the Global Transformational Leadership Scale, which was also used in this study, indicating the measurement of a single construct of leadership with satisfactory reliability. Carless, Wearing and Mann (2000) provided evidence for the convergent and discriminant validity of the scale measuring transformational leadership, which the results of this study support.

Going back to Baron and Kenny (1986), they already addressed the strongest representation of mediating effects with an insignificant direct effect and a significant indirect effect. Nevertheless, they pointed to the realistic perspective, that social phenomena may have multiple causes. This indicated a need to seek mediators that significantly reduce the direct effect in presence of a significant indirect effect instead of removing the direct effect. Methodologically, this study strengthens the addressed need by Preacher (2015) for contributions to causal inferences for indirect effects due to the mediation hypothesis. Although there is no full mediation, the partial mediation supports prior research. Figure 3.12 visualises the insights given in the first main study with regards to the mediating mechanisms. The first main study focused on the organisational environment, indicating the importance of overall transformational leadership via organisational psychological safety affecting (organisation-wide) initiative in software product development as a knowledge intensive area.

Not only do the results support the first hypothesis, but also strengthen the recommendations by Newman et al. (2020), who pointed to the need for further research insights on antecedents and outcomes of innovative environments. Hereby, the results support Rank, Pace and Frese (2004) in understanding psychological safety as a psychological process facilitating the development of individual roles, teams, and organisations into the desired future states, i.e. showing organisational initiative to foster inter-team collaboration and strengthen the whole organisation. The results also enlarge knowledge for the mediating mechanism at the organisational level and organisational outcomes. Additionally, prior research on leadership has often focused on single teams, whereas this study examined overall perceived transformational leadership focusing on inter-team leadership behaviours (Carter et al., 2020). This study builds upon insights given by Hassi, Rohlfer and Jebsen (2021), who evaluated initiative as a contextual antecedent of innovation. Therefore, the findings extend the effect from empowering leadership to transformational leadership behaviour via

Figure 3.12.: Mediating Mechanisms within the Collaboration Framework for Outside-in Organisational Structures in Software Product Development based on the Results of the First Main Study
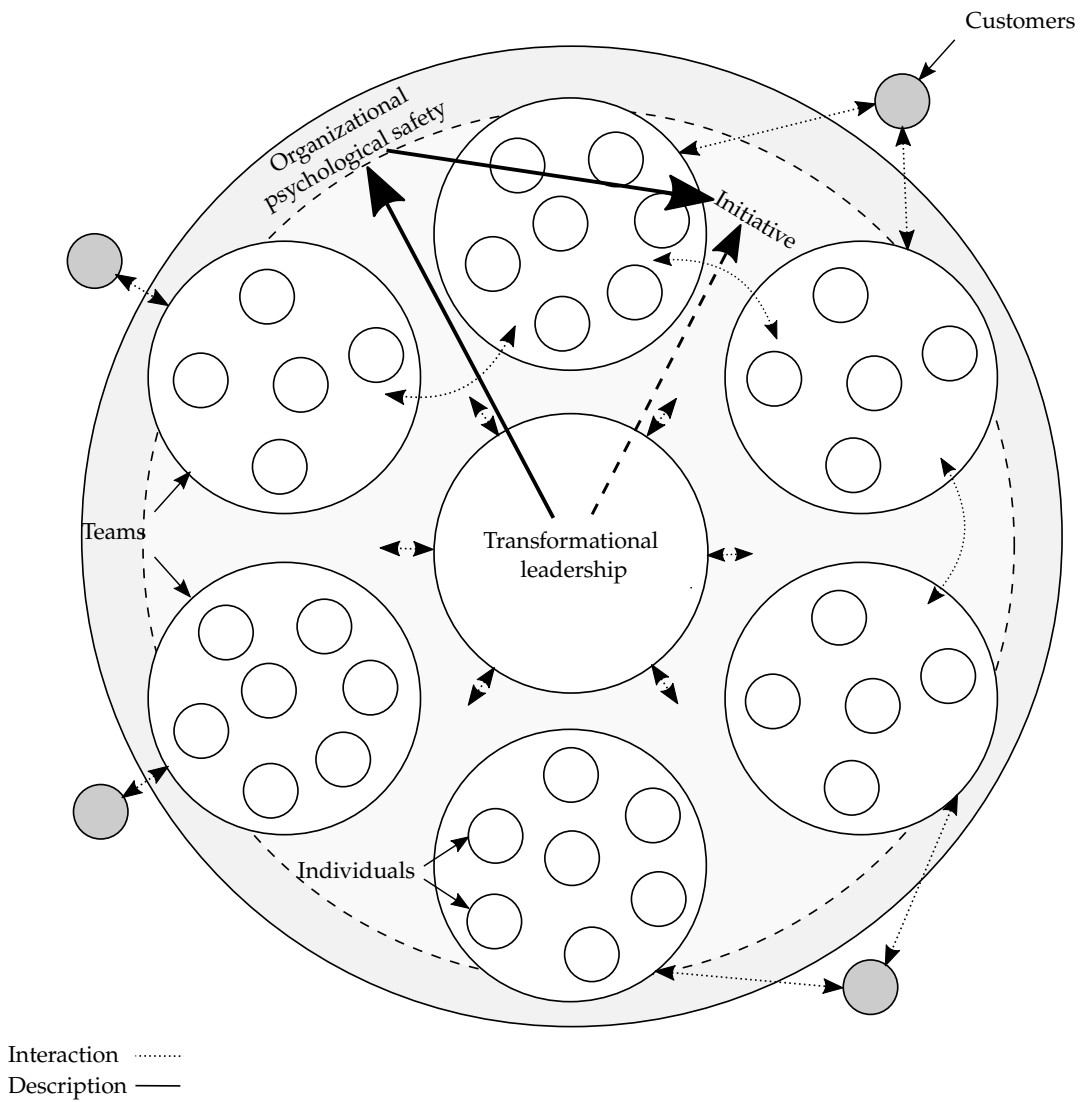
mediating effects on initiative. The insights of the current study also support the results by Xie et al. (2018), who showed that transformational leadership style was more helpful for building an organisational climate supporting innovations than transactional leadership.

Moreover, the findings given in this research support George, Lakhani and Puranam (2020), who raised the awareness on the recent importance of an environment supporting valuable collaboration, especially in the recent global crisis. They outlined that valuable collaboration is needed e. g. for developing apps for tracing and testing to follow infections, which is done in software product development as a societally and economically crucial area. Therefore, the insights given for the specific target group tend to offer a historic insight on peoples' perceptions of their organisational work environment with the relevant skills for society in such a unique event, such as how Bapuji et al. (2020) described the current pandemic. Heinze and Heinze (2020) emphasised the importance of a environment endorsing innovative and decision-making security, which the results of this study support in indicating a significant path between transformational leadership, organisational psychological safety and organisational initiative.

To answer the first part of the research question for the first main study, the above results and discussions indicate that the perceived organisational climate for psychological safety partially mediates the path between the transformational leadership and the organisational initiative for members of software development teams. The next part focuses on the findings of the current study with regards to positive leadership in the light of the current research.

*Interpretation of the Results with regards to Positive Leadership*

Although the results support the validation of the positive leadership scale by Adams, Meyers and Sekaja (2019), the findings do not enlarge the insights given by Kelloway et al. (2013) reporting a moderating effect of positive leadership. Their findings indicated that there was a significant positive interaction between positive leadership and transformational leadership predicting employees positive effects, being enhanced when leaders showed positive leadership behaviour. The insights given in this study do not indicate that effect for the interaction of positive leadership and transformational leadership predicting organisational psychological safety. Moreover, the results do not enlarge the findings by Adams, Meyers and Sekaja (2019), who examined positive leadership behaviours to support collaboration for software product development.

The current research does not include further boundary conditions of the organisational context besides the area of software product development, the German hub, and the essence of results being helpful for companies with more than 200 employees (see subsection 3.2.1). Iqbal, Ahmad and Latif (2021) argued that a facilitating environment helps positive organisational behaviours bloom and, additionally, allows positive leadership behaviours to dispose of adverse behaviours more quickly. Although the results do not support the moderating effect of positive leadership

behaviour in interaction with transformational leadership to enhance organisational initiative, the results raise the question as to whether the area of software product development with according self-organisational structures and working methods might already foster positive organisational behaviours. Having found no support for the moderating effects in this study, the results support the critics of the current trend of excessive positivism in leadership research (Alvesson & Einola, 2019).

Despite the overall increasing interest in positive psychology in general, started by Seligman and Csikszentmihalyi (2000), the results support criticism on having no further theoretical and practical use of leadership styles beyond transformational leadership (e. g. Alvesson & Einola, 2019; Monzani & Dick, 2020).

To sum up the second part of the research question for the first main study, the above results and discussions propose that the mediating effect between the perceived transformational leadership behaviour via organisational climate for psychological safety on the organisational initiative is not enhanced when leaders engage in positive leadership behaviours.

### 3.4.2. Strengths and Limitations

While this study, like others, is not free of limitations, it does have distinct strengths, so both aspects are outlined in this section.

To respect the complexity of reality, Mathieu et al. (2019) called for the need to embrace complexity within research activities, which was respected in this study. Focusing on the strengths of the current study, there are aspects to outline regarding the measurement model as well as the statistical model. As part of the measurement model evaluation, the AVE was satisfying (above the threshold of 0.50). It was shown in the course of their investigation that the standard criteria for assessing convergent and discriminant validity based on a confirmatory factor analysis were also met here. Consequently, those measures were also respected in assessing the measurement model within this study and indicated satisfying results. Carless, Wearing and Mann (2000), in criticising the development of the scale for measuring transformational leadership behaviour, argued that some of the items take one singular statement to reflect complex behaviours and therefore (over-)simplify reality. Nevertheless, they continued with the approach to use broad statements to aim at developing a brief measure in consistency with theoretical concepts of transformational leadership. Their results already indicated the GTL measuring a single construct of leadership with satisfactory reliability. Evidence for the convergent and discriminant validity were also given. The quality aspects of reliability and validity are supported by the results of this study. Aside from the lack of support for a moderating effect of positive leadership within the statistical model, there are also no moderating effects of age, gender or leader's gender, which strengthens the results of the mediation analysis. To be able to better understanding the work context of software development in the German economy, there is a need to examine how individuals perceive the current situation. With this, the current study is among the earliest to put focus on an examination of the effects of leadership. Despite insights given by Poth, Kottke and Riel

(2021) on people's perception of working in software development during COVID-19, this study contributes to empirical insights for this specific target group in those unique times of dynamic and disruption. Moreover, data indicating mediating effects suggests an extention to the knowledge given by Mathieu et al. (2019) supporting the mediating effects being relevant for the work environment of self-organisation in software development. Additionally, the results support the call by Lee and Edmondson (2017) for the need and importance of leadership in those forms of organisational designs, despite all responsibility being taken by employees.

In terms of limitations, there are five points to mention. First, the sample for this study was limited to software product development in Germany, which does not provide specific insights for wider areas, and instead they are limited to the specific geographic and industry context. Second, the insights given in this research should be specified in a longitudinal study to provide insights above the considered snapshot during COVID-19, therefore the results need to be considered as an indicator but with caution to generalisation. However, this research provides historically unique insights for this specific target group needed for societal and economically important tasks to handle the pandemic through the use of much needed digital tools and solutions for collaboration, as well as in daily life activities. Third, the underlying research draws on the current individual perspective using a cross-sectional data collection approach to provide practical implications quickly with the risk of trapping into the common method bias. To address the common method bias, Kock (2015) identified common method bias on evaluating VIF for testing collinearity. Moreover, PLS-SEM is seen critically by methodology experts due to the small samples sizes that are used. This study had more participants than planned, what counters this criticism in terms of the current study. Fourth, the study is based on individual self-report questionnaires. As a result, the measurement findings have some subjectivity due to certain psychological factors. To deal with these effects, the study was conducted with a multi-organisation design and featured anonymous, voluntary data collection without any rewards. Fifth, the cross-sectional nature of the research design used makes it impossible to draw definitive causal conclusions about the reported effects. For example, it is possible – though not probable – that perceived organisational initiative has an impact on transformational leadership and organisational psychological safety. Again, it will be important that future studies use longitudinal or lagged designs to examine these effects more comprehensively.

### 3.4.3. Further Research and Practical Implications

The current research study not only contributes to the existing leadership and organisational behaviour literature, but also shows some avenues for further empirical evidence needed, as well as the derivation of practical and managerial implications. First, this section points to the need for future research based on the findings of this study to embrace complexity in team research. Second, by focusing on leadership in technology organisations and collaboration in software product development, the insights given can support practical outcomes.

Future research may include samples of other information technology departments or differentiate by sizes of organisations for a more precise understanding of the proposed effects and generalisation for the whole department and industry. For instance, the empirical evidence provided in this research indicates the need for software product development organisations to support people in managerial positions. Moreover, insights are given to address the necessity to continuously show and enhance transformational leadership behaviours and skills, and therefore support those leaders in their daily interactions with their teams, as well as offereing feedback on those behaviours. Since the results of this study are in contrast to effects of positive leadership by Adams, Meyers and Sekaja (2019) or Kelloway et al. (2013), further research with regards to the moderating effect of positive leadership, not only on the perception of organisational level phenomena but team or individual aspects, are needed. To enlarge knowledge, further research needs to conduct a multi-group or multi-level analysis and replication, to assess whether the overall individual perception differs from team- or organisational-nested data approaches. Moreover, it is recommended for future researchers to investigate the construct of perceived personal initiative as an individual-level attitudinal outcome and compare the results to the ones found at the organisational level. The results of the current study draw from a one wave evaluation in order to provide a snapshot of people's perception at work in the special situation of the COVID-19 pandemic (George, Lakhani & Puranam, 2020). Consequently, the current research setup requires future replication using a multi-wave approach evaluating differences and controlling for biases.

Since this study did not control for counterproductive behaviours under an environment fostering organisational initiative, future research needs to address it. Suitable climate forms besides psychological safety (e.g.. Baer & Frese, 2003; Edmondson & Lei, 2014) may be facilitating climate (Iqbal, Ahmad & Latif, 2021)), or climate for innovation (Newman et al., 2020) to evaluate whether they also show mediating effects or even keep employees from engaging in counterproductive behaviours, as has been examined for other leadership styles (Eva et al., 2019). Finally, future research may examine the mediating role for the used predictor on team-level transformational leadership and team-level mediating mechanisms contributing to situational strength theory (Meyer, Dalal & Hermida, 2009)). With this, situational strength theory is understood as the implicit or explicit guidance given by external persons regarding the suitability of specific behaviours. Hence, future research should take more objective ways to increase the strength and relevance of the results of this study. Additionally, further studies are required to evaluate whether organisational initiative also works and to examine a mediating mechanism to contribute to the co-evolving model by Mathieu et al. (2019) and the multi-categorial function of constructs. To cope with common method bias and self-reported data, approaches to replicate the findings of this study in an experimental design are needed to evaluate causal effects.

On the practical side, since the results do not support the moderating effect of positive leadership, it is recommended to focus on developing transformational leadership behaviours within all kinds of managerial training. The empirical evidence

provided in this research indicates the importance of suitable and active leadership behaviour, not only trusting in self-organisational structures but also being aware of the need of leadership. Although the results do not support the moderating effects of positive leadership on the path between transformational leadership and organisational psychological safety, the insights foster the need to concentrate on transformational leadership behaviour, raising awareness to its importance. Therefore, the insights support the necessity to continuously improve team-level transformational leadership skills and support those leaders along the way in practising and receiving feedback on those behaviours. Leaders showing transformational behaviour influence and in best cases improve organisation-wide psychological safety. A work climate providing organisational psychological safety supports employees engaging in inter-team initiatives, which needs attention and support to not only exist but also improve over time and foster all kinds of beneficial organisational, team, and individual outcomes. In times of growing importance of software products designed to solve problems such as contact tracing to deal with the COVID-19 pandemic, there is a need for people engaging outside of the borders of their own tasks or teams (e.g.. Carter et al., 2020; George, Lakhani & Puranam, 2020; Mathieu et al., 2019; Venkatesh et al., 2020; Xie et al., 2018). Referring to Carless, Wearing and Mann (2000) transformational leadership behaviour includes:

1. Staff Development

2. Empowerment

3. Innovative Thinking

4. Leading by Example

5. Supportive Leadership

6. Vision

7. Charisma

Results for all items were reported in subsection 3.3.1. Participants rated the items measuring the perceived transformational leadership behaviour on a five-point Likert scale with higher scores indicating more perceived transformational leadership from 1 = *Rarely or never* to 5 = *Very frequently, if not always* ($M = 3.48$, $SD = 0.67$). On the one hand, these items tend to suggest the development of an understanding among all leaders of an organisation on what each aspect means and what suitable behaviour can look like. On the other hand, those evaluations indicate room for improvement, especially with regards to charisma and vision, which needs suitable training for leaders to enhance knowledge leading to be clear and to show those behavioural aspects.

Overall, due to 10.81 % of participants not knowing or being unclear about the working method of the team they work in, the results indicate a need to improve collaboration in software product development at a basic level. Teams can be supported

by managerial attention and can help to start those processes, or seek further help from roles like Agile Coaches or Scrum Masters.

## 3.5. CONCLUSION AND LINK TO THE SECOND MAIN STUDY

Despite the criticisms, in response to the ongoing and even increasing interest in transformational leadership in general, the aims of this study were three-fold: First, the insights given in the first main study point to the need for change and action by addressing transformational leadership in a more specific manner, such as has been demanded by Carless, Wearing and Mann (2000). Transformational leadership is suggested to be suitable for significantly and positively affecting organisational psychological safety via organisational initiative, with recommendations to train and help leaders in showing those behaviours. Hereby, the results also indicate a starting point for precise and measurable actions for people, especially leaders, working in software product development organisations. Second, the insights propose that positive leadership behaviour not only moderates the first stage, which provides leaders with empirical support to fully and only focus on transformational leadership behaviour. Third, neither age, gender, nor leaders' gender moderates the effects examined in this study. The results of the study hereby suggest that transformational leadership behaviours by all genders seem to be lived and perceived with no differentiation for younger or older employees of all ages, making training for those behaviours, and evaluating their effectiveness, more easy. Finally, this study pursued and supported the scientific approach to handle complexity by Mathieu et al. (2019) investigating the used constructs in the categories identified by their framework and enlarging it.

Continuing to contribute to the framework of co-evolving features with regards to team collaboration, this study points to a need to go from an organisational level of interest to people's perception regarding their team and individual persons. Due to the criticisms, in response to the ongoing and even increasing interest in transformational leadership in general, as well as a lack of a focus on team-level transformational leadership, the next study will make use of the more specified approach of leadership behaviour, similar to how a few other studies have already done, such as Klaic, Burtscher and Jonas (2020) or Wang and Howell (2010).

# 4. SECOND MAIN STUDY

This chapter outlines the second main study of this thesis. In this section, the relevant constructs, definitions, current research, and methods are introduced, followed by the presentation of the results. Following this, the discussion and brief conclusion direct to the overall discussion in the next chapter.

## 4.1. TEAM FOCUS, ENVIRONMENT, AND INDIVIDUALS

Since time immemorial, a lot of the work in organisations has been done by teamwork. People collaborate to accomplish tasks beyond the abilities of an individual working on their own. Being successful depends not only on the individual talents of team members and the overall resources available, but also on the processes team members use to engage with each other and to get work done. As soon as organisations and leaders begin to understand the processes team members use to collaborate, they get the chance to adjust the environment, enabling leaders to chose, support, develop, or reward employees for successful teamwork (Marks, Mathieu & Zaccaro, 2001).

In addition to the results outlined in subsection 3.3.2, over recent years numerous research has examined leaders' influences on multiple kinds of organisational or team performance, as well as employees' behavior (e. g. Daud et al., 2018; Gerlach, Hundeling & Rosing, 2020; Iqbal, Ahmad & Latif, 2021). In this chapter, the focus is on the team and individual level perception of people working in software development in Germany.

### 4.1.1. Team-level Transformational Leadership

Transformational leadership, especially the more specific form of team-level transformational leadership, has been shown to be essential in fostering innovation and learning. In a team-focused study, a positive effect of transformational leadership at team level was demonstrated on team innovation as well as on individual member learning. Hereby, this leadership style can be defined as behaviours emphasising group identity and active communication of a group vision, or supporting team-building (Klaic, Burtscher & Jonas, 2020). In this study, the authors used team-level transformational leadership to examine a more specific behaviour which aligned with the critique by Carless, Wearing and Mann (2000) for the need to respect the complexity of reality in research approaches. Working in software product development teams mainly goes along with using agile methods for collaboration, which requires a lot of self-organisation due to a low number of hierarchies (e. g. Dingsoyr et al., 2016; Edmondson & Lei, 2014). Therefore, the findings for the technology industry by Jahanshahi, Maghsoudi and Babaei (2020) were in contrast to prior insights

given by Lee and Edmondson (2017). They summarised that self-organisation is the latest trend of organisational design aiming to handle complexity, but still needed leadership for orientation. The findings by Klaic, Burtscher and Jonas (2020) and Lee and Edmondson (2017) were in contrast to Jahanshahi, Maghsoudi and Babaei (2020), who concluded for high technology ventures that transformational leadership had no direct relation to team innovations but facilitated the improvement of both trust and communication within teams. Those opposite insights suggest the need to examine the effect of team-transformational leadership in the area of software product development. In contrast to transformational leadership on a broad level, the specification of team-level was defined as behaviours emphasising not only group identity, but especially the active communication of a group vision to each group, or supporting team-building (Klaic, Burtscher & Jonas, 2020). This goal-orientation, as well as team building and improvements, were evaluated to be important for developing software products (Dingsoyr et al., 2016).

Despite the proliferation of studies on transformational leadership, there is a lack of studies focusing on team-specific transformational leadership, especially in agile software development teams and in the German economy. Table 4.1 displays the findings.

Analysing the current state of research for the query 'team-level transformational leadership AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) for the last ten years (from 2011 to 2021) indicates the scientific gap for research on this topic, with no entries for all three key words in both search engines (see Table 4.1). Since team-level transformational leadership is also called team-centric transformational leadership, this query was examined as well with no entries for all three key words in both search engines (see Appendix B in Table B.2).

Besides meta-analyses or literature reviews on transformational leadership (see Table 3.2) no additional samples of team-level transformational leadership literature were found.

Contributing to empirical evidence and practical recommendations, this study aims to support leaders thriving to handle the challenges of the COVID-19 pandemic. Therefore, the research questions of the second main study are:

Is the relationship between the perceived team-level transformational leadership and individual learning mediated by TWQ respectively working in a HPT for members of software development teams?

Do team interventions moderate the mediating effect of TWQ respectively HPT on individual learning?

Table 4.1.: Search Results for Team-level Transformational Leadership, Agile Software
Development, and Germany in Google Scholar and Web of Science in the
Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'team-level transformational leadership' | 69 | Google Scholar | Figure B.22 |
| | 1 | Web of Science | Figure B.23 |
| 'team-level transformational leadership' AND 'agile software development' | 342 | Google Scholar | Figure B.24 |
| | 1 | Web of Science | Figure B.25 |
| 'team-level transformational leadership' AND 'agile software development' AND 'Germany' | 0 | Google Scholar | Figure B.26 |
| | 0 | Web of Science | Figure B.27 |

*Note.* Status in November 2021

### 4.1.2. Teamwork and Learning

Despite the ongoing interest and progress within research on teams, Mathieu et al. (2019) called for a new era, supported by Mathieu, Wolfson and Park (2018) writing about the 'evolution of work team research' addressing the need to respect the dynamics with regards to environment, team work and outcomes. Whereas the first study (see chapter 3) focused on an organisational level mediator, this study addresses a team-level mediator. Mathieu et al. (2019) described the environment and tasks of a team as dynamic with an impact on collaboration processes within the team, as well as states and results. Therefore, they point to the need to conduct research respecting triggering events within the team setting and the effect on emergent states or outcomes. With this need, the current study focuses on the effect of team dimensions on individual learning.

*Team and (Individual) Learning*

To collaborate successfully, teams need both task-related and social practices and support. Therefore, the quality of teamwork is defined as the correct fulfilment of tasks, as well as the quality of teamwork being essential to success (Hüffmeier & Hertel, 2011). Salas et al. (2014) added the importance of several individuals and interdependencies in task completion, as well as a shared goal. LePine et al. (2008) argued that teamwork processes were positively associated with team performance as the most common outcome variable in team research in recent years – regardless

of the nature of the process.

The aim of this study is to extend the findings of (Venkatesh et al., 2020). Their results showed that agile development methods in software development have a significant impact at the individual level and that the effectiveness of development methods can depend on the specific skills of individual developers. In contrast to prior research, Hüffmeier and Hertel (2011) found social support being a universal resource for process improvements in work teams. Beyond that, Klaic, Burtscher and Jonas (2020) gave insights that team-level transformational leadership positively effected individual members' learning for members of scientific teams in Switzerland and Germany. Moreover, certain dimensions TWQ mediated the path between team-level transformational leadership and individual members' learning. Nevertheless, further research is needed to examine teamwork in a more holistic manner. In line with the categories of the co-evolving framework by Mathieu et al. (2019), teamwork includes several team processes such as communication and emergent states like cohesion (Klaic, Burtscher & Jonas, 2020). Therefore, it is important to evaluate whether developing specific skills is influenced by TWQ (Venkatesh et al., 2020).

Collaboration does not only consist of one but several team processes, as well as emergent states (Mathieu et al., 2019). Looking at the theoretical and practical perspectives, an extensive and growing literature points to the importance of teamwork in achieving innovative projects in any kind of area. This is accompanied by a growing awareness that 'good teamwork' increases the likelihood of successfully completing innovative projects (Hoegl & Gemuenden, 2001, p. 435). Valls, González-Romá and Tomás (2016) evaluated the mediating effect of team communication quality,+ linking educational diversity and team performance with an additional moderating effect of team innovation climate regarding the path between educational diversity and team communication quality. Furthermore, Hoegl and Gemuenden (2001) raised more questions about what teamwork is and how it can be evaluated. They asked why and how teamwork is connected to the outcome of innovative projects, or how powerful the link is between teamwork and different indicators of a successful project (e.g. performance or team member satisfaction). To start answering those questions, they developed a comprehensive concept of teamwork called TWQ as a multifaceted construct. Working with the target area of software development in Germany, they initially derived six facets of the construct TWQ from interviews, which are named and described in Table 4.2.

Hoegl and Gemuenden (2001) described TWQ as behaviours observably shown by very collaborative teams including the above-mentioned six aspects. This scale supports the approach of this study in choosing the construct of TWQ as a mediator.

Analysing the current state of research for the query 'TWQ AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) for the last ten years (from 2011 to 2021) suggests the scientific gap for research on this topics. Table 4.3 shows the findings.

Table 4.4 provides samples of the teamwork literature and research over the past ten years to highlight the major contributions respected in this study.

Table 4.2.: Subscales and Descriptions of the Initial Construct Teamwork Quality

| Subscale | Description |
|---|---|
| Communication | adequately regular, non-formal, direct and frank communication |
| Coordination | well-structured and coordinated individual activities within the team |
| Balance of member contributions | all team members are able to contribute their expertise according to their maximum potential |
| Mutual support | team members offering each other assistance and encouragement, carrying out their tasks |
| Effort | team members commit themselves with all their strength to the duties of the team |
| Cohesion | all team members are motivated to continue working together as a team, and whether 'team spirit' is present (Hoegl & Gemuenden, 2001, p. 437) |

*Note.* Subscales and descriptions from Hoegl and Gemuenden (2001)

Table 4.3.: Search Results for TWQ, Agile Software Development and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'teamwork quality' | 3.980 | Google Scholar | Figure B.34 |
| | 30 | Web of Science | Figure B.35 |
| 'teamwork quality' | 3.980 | Google Scholar | Figure B.34 |
| | 30 | Web of Science | Figure B.35 |
| 'teamwork quality' AND 'agile software development' | 342 | Google Scholar | Figure B.36 |
| | 1 | Web of Science | Figure B.37 |
| 'teamwork quality' AND 'agile software development' AND 'Germany' | 65 | Google Scholar | Figure B.38 |
| | 0 | Web of Science | Figure B.39 |

*Note.* Status in November 2021

Table 4.4.: Sample of Teamwork Quality Reviews in the Past 10 Years

| Source | Approach | Major Contribution(s) |
| --- | --- | --- |
| Koerner2015 | Systematic review | Identification of key aspects of teamwork, which were team member characteristics, common task, communication, cooperation, coordination, responsibility, participation, staff satisfaction, patient satisfaction, and efficiency. |
| LePine et al. (2008) | Meta-analysis | Teamwork focusing on work processes are positively related to team performance and member satisfaction. Furthermore, results supported a moderating effect of task independence and team size. |

Learning is especially important for knowledge-intensive areas (e. g. Hoegl & Gemuenden, 2001; Yoon & Kayes, 2016). As learning is crucial to the success of an organisation, additionally it adds to outcomes on the individual level. Despite the well-investigated aspect of team performance outcomes as an organisational success, learning as a personal success for team members has received less research attention (Denison, 1996; Hoegl & Gemuenden, 2001). Due to an increasing demand lacking enough supply, people with skills in the area of software development are the core resource for software vendors and overall organisations seeking to develop software (Venkatesh et al., 2020).

At the team level, Edmondson (1999, p. 353) describes learning as a 'continuous process of reflection and action'. Edmondson (1999, p. 353) describes this process to consist of

- asking questions,

- seeking feedback,

- conducting experiments,

- reflecting on results, and

- discussing mistakes or unexpected outcomes of actions.

At the team level, this is important so a team can initially identify what expectations or tasks they do not have skills in. Action can then be taken to change this. The basic requirement is that team members discuss disagreements openly among the whole team and not individually or outside the group. Edmondson (1999) also refers to this as (observable) learning behaviour, as it is through this reflection, exchange and action that learning takes place at the team level. Moreover, the meta-analysis by

Table 4.5.: Search Results for Learning, Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'learning' | 954,000 | Google Scholar | Figure B.40 |
| | 930,726 | Web of Science | Figure B.41 |
| 'learning' AND 'agile software development' | 19,100 | Google Scholar | Figure B.42 |
| | 168 | Web of Science | Figure B.43 |
| 'learning' AND 'agile software development' AND ('Germany' | 4,800 | Google Scholar | Figure B.44 |
| | 21 | Web of Science | Figure B.45 |

*Note.* Status in November 2021

Koeslag-Kreunen et al. (2018) indicated that that team-focused leadership behaviour explains 18 % of the variance in team learning behaviour.

However, collaboration with others gives team members the chance to learn a variety of skills such as social or creative skills, but also technical or project management skills. Moreover, learning can contribute to different outcomes in a team but also in comparison between teams, if team learning is understood at its best as the sum of team members' learning (Mathieu et al., 2019). Batt-Rawden, Lien Gudbrand and Slaatten (2019) developed the concept of team learning, which consists of three components: relational learning in teams, trusting team climate and staff engagement. The insights of their study with the target group of counsellors in service companies supported the model. The results indicated a strong positive relationship between team learning as a predictor and innovation readiness as the criterion variable in professional service firms. With regards to the effect of transformational leadership, without a specific team focus on team knowledge exchange, data from Burmeister et al. (2019) suggested the parallel mediating effect of both team knowledge goal generation as well as goal striving on this path.

The current state of research for the query 'learning AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) for the last ten years (from 2011 to 2021) indicates a further need for research on this topic, with no entries for all three key words in both search engines (see Table 4.5).

While recent research has often focused on team learning, individual-level learning has been identified as the extent to which employees perceive that they have gained expertise, capabilities and know-how that are useful for their work practice and professional development and can also be used in future projects (Hoegl & Gemuenden, 2001; Liu & Fu, 2011; Yoon & Kayes, 2016). Individual learning refers

to the level to which employees have acquired new expertise, capabilities and know-how and is therefore an outcome variable (Yoon & Kayes, 2016). Since Mathieu et al. (2019) differentiated between team performance and attitudinal outcomes, the nature of learning as such includes an individual process which requires the willingness to engage and also remember, and make use of the gained learnings in future projects, which indicates the nature of an attitudinal outcome. This distinction is crucial in software product development. Insights given by Klaic, Burtscher and Jonas (2020) addressed the knowledge-intensive area of science.

This study aims to extend that knowledge for the also knowledge-intensive area of software product development. Knowledge-sharing and learning has been analysed be essential for software development, where team members enhance their expertise through reasoning, research and working in pairs to learn from each other. Hereby, learning greatly improves performance at this level (Dingsoyr et al., 2016). Therefore, people working in this area can be characterised by their willingness and need to learn continuously to keep up to date (Robillard et al., 2014). This indicates the importance of individual members' learning and the required attitude to behave appropriately.

Table 4.6 includes samples of research work, which were important for the literature base of this study.

To extend the model of Mathieu et al. (2019), the first hypothesis builds on the findings of Klaic, Burtscher and Jonas (2020). The model is intended to complement empirical findings of organisational initiative as a mediator. Anderson, Potočnik and Zhou (2014) summarised that prior research using frameworks often focused on individual levels or team levels but lack an integrative approach emphasising different levels of organisations. Enhancing the process of collaboration is important. Software product development, however, using agile methods of collaboration also emphasises the importance of learning with regards to the disciplines and technologies, for example by demonstrations by others, or two team members collaborating in pair programming (Dingsoyr et al., 2016). To contribute to this avenue for future research, the perspective given in this study can be understood as a first snapshot of the constructs asking for team-level leadership and organisational mediators and individual attitudinal outcome variables. For this, the first hypothesis is:

H1: The perceived TWQ mediates the path between team-level transformational leadership and individual learning.

Figure 4.1 visualises the presumed paths between the constructs of the first hypothesis.

Table 4.6.: Sample of Learning Reviews in the Past 10 Years

| Source | Approach | Major Contribution(s) |
|---|---|---|
| O'Donovan and McAuliffe (2020) | Systematic Literature Review | Although a climate of psychological security encourages employees to learn, be creative and perform, interventions promoting psychological safety did not show clear results. |
| Nellen, Gijselaers and Grohnert (2019) | Systematic Literature Review | Continuous learning at work (as a team) requires money and time as well as resources such as autonomy and enrichment. This requires not only a supportive culture but the support of the leader. The leader should foster a climate of psychological safety, shared cognition, efficacy and a social and task-related sense of 'we'. |
| Koeslag-Kreunen et al. (2018) | Meta-analysis | Team-oriented leadership behaviour explained 18 % of the variance in team learning behaviour. Furthermore, the results point to the fact that people-oriented leaders enhance team learning for adaptive as well as developmental tasks. Leaders who focus on tasks influence team learning only in relation to adaptive tasks. |

Figure 4.1.: Conceptual Visualization of the Presumed Paths between Team-Level Transformational Leadership, Teamwork quality and Individual Learning

Teamwork Quality

Team-Level Transformational Leadership - - - - - - - - - - - - - → Individual Learning
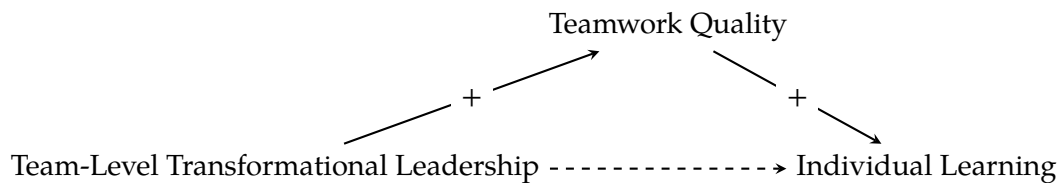
*High-Performing Team and Individual Learning*

Much has been said about team and importance in this dissertation so for. Moreover, a lot of studies have dealt with performance. But what is the ultimate state of a team? Dutra, Prikladnicki and Franca (2015, p. 183) gave the following definition: 'A high performance team is one that exceeds all reasonable expectations and produces extraordinary results.' Fischer and Hüttermann (2020) added the perception of the work team with regards to dimensions making the state measurable (HPT). The High-Performance-Team-Survey (HPTS) was developed to measure the success factors of high performance teams from Google's so-called Project Aristotle (https://rework.withgoogle.com/print/guides/5721312655835136/) and include insights from international team research. It can be used for team diagnostics and development or to assess and compare several teams or divisions. The questionnaire includes five constructs and exists in three versions, a short, medium and long version, with one or more items per construct with five dimensions (Fischer & Hüttermann, 2020, p. 1):

1. psychological safety

2. dependability and high performance standards

3. structure and clarity of roles, plans, and goals

4. meaningfulness of work

5. impact on the organisation

Table 4.7 includes the definitions, scales and authors of the five constructs in line with Fischer and Hüttermann (2020).

The current state of research for the query 'high-performing team AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) for the last ten years (from 2011 to 2021) suggests a scientific gap on this topic with few entries for all three key words in both search engines (see Table 4.8).

Due to the considerable correlations with other constructs, the authors assume the construct and criterion validity of the HPTS since it was developed by experts in

Table 4.7.: Dimensions of the High-Performing Team Survey by Fischer and Hüttermann (2020, p.4 – 5)

| Dimension | Definition | Authors |
|---|---|---|
| Psychological safety | The shared belief, demonstrated in behaviour, that team members feel safe for interpersonal risk-taking (e. g. by proactively sharing mistakes) | Edmondson (1999) |
| Dependability and high performance standards | Shared ownership of challenging performance targets and shared attention to the progress of work, and the (balanced) contribution of all team members | Jong and Elfring (2010) and Anderson and West (1994) |
| Structure and clarity of roles, plans, and goals | Need for a shared understanding of roles, processes and goals in the team, with clarity enabling a common focus and direction for the work in the team | Morgeson and Humphrey (2006) and Rizzo, House and Lirtzman (1970) |
| Meaningfulness of work | Shared perception in the team that the work task is important and relevant, because teams that perceive high importance experience positive emotions like pride related to their work | Kirkman and Rosen (1999) and Hackman (1987) |
| Impact on the organisation | Positive impact due to a significant contribution to the overall success of the organisation through the team's work results. I.e. if a team has a major impact, others in the organisation or customers can directly process the results. | Wageman, Hackman and Lehman (2005), Kirkman and Rosen (1999), and Hackman (1987) |

Table 4.8.: Search Results for HPT, Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'HPT' | 4,460 | Google Scholar | Figure B.46 |
| | 16 | Web of Science | Figure B.47 |
| 'HPT' AND 'agile software development' | 146 | Google Scholar | Figure B.48 |
| | 0 | Web of Science | Figure B.49 |
| 'HPT' AND 'agile software development' AND ('Germany' | 22 | Google Scholar | Figure B.50 |
| | 0 | Web of Science | Figure B.51 |

*Note.* Status in November 2021, HPT = High-Performance-Team

Table 4.9.: Sample of HPT Meta-Analysis

| Source | Approach | Major Contribution(s) |
|---|---|---|
| Dutra, Prikladnicki and Franca (2015) | Meta-analysis | Levers for software teams becoming high-performing like leadership style, learning ability, communication, or shared information. |

*Note.* HPT = High-Performance-Team

Figure 4.2.: Conceptual Visualisation of the Presumed Paths between Team-Level Transformational Leadership, Teamwork quality and Individual Learning
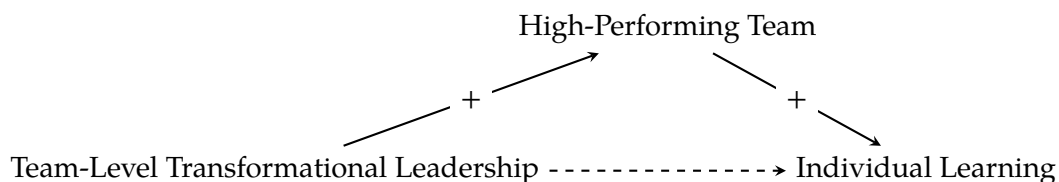


organisational research and applied organisational development in line with recommendations by Zickar (2020) for scale development (Fischer & Hüttermann, 2020). The development of this scale did not include the target area of software product development. With this, the current study extends prior scientific knowledge for this area.

On team-level learning, Edmondson (1999) concluded that psychological safety in the team improves learning behaviour in work teams, as members worry less about the reaction of others and address ignorance or mistakes more freely as an opportunity for further development. Therefore, this study also suggests positive effects from HPT to individual learning, since psychological safety is one important dimension of the construct HPT.

Usually, the HPTS was used to rate the perception of a whole team and therefore, needed the rating of all team members having set at least half of the items with valid values. This study makes use of the HPTS to get an overall perception of working in a software product development team in Germany.

With this, the second hypothesis states:

H2: The perceived degree of being a HPT mediates the path between team-level transformational leadership and individual learning.

Figure 4.1 shows the presumed paths between the constructs of the second hypothesis.

### 4.1.3. Moderating Effect of Team Interventions

As the amount of teamwork and collaboration within the workforce has increased greatly in recent years, it is expected that the use and importance of teams will also continue to increase. Successful teams can be described as those achieving the desired results. Therefore, team members need to show effective practices to obtain the required results. As teamwork increases, so does the need for measures to improve the effectiveness of teamwork (Lacerenza et al., 2018). Several studies, such as Mathieu et al. (2019) and Mathieu et al. (2017), Mathieu et al. (2015), Mathieu, Wolfson and Park (2018), have examined helpful guidelines for teamwork, like providing research evidence of the importance of creating a good and organised start of collaboration, which is essential to overall team performance. This study contributes to this field of

research by investigating the moderating effect of overall engaging in team interventions. For this reason, the current study expands on previous knowledge on team interventions by investigating the effect on individuals in the knowledge-intensive area of software product development (see subsubsection 4.1.2).

The increasing demand for software products is exacerbated by an increasing expectation of development and delivery speed. This goes along with an increasing level of pressure for team members, on whom these expectations are placed. This challenge is widely addressed by changing the framework for collaboration to agile methods (Venkatesh et al., 2020). Due to the increasing globalisation, collaboration across cultural boundaries is an increasingly present phenomena, not only in software development. This adds to the challenge of implementing the working method itself, as there is a need to take cultural differences into account (Thorgren & Caiman, 2019). Moreover, the need for a tool measuring agility and choosing the appropriate working method still exists (Maneva, Koceska & Koceski, 2017). Venkatesh et al. (2020) showed that using agile methods reduced the perception of work exhaustion for the target group of software developers.

People, namely software developers and other needed team members such as product owners or scrum masters, are the most precious resource for organisations (Venkatesh et al., 2020). Therefore, this study was conducted to make a scientific contribution to understanding the impact of team interventions on employees. From a psychological perspective, Gren, Goldman and Jacobsson (2020) stated empirical evidence for the maturity of teams being closely linked to team agility. This study showed for example a perceived positive impact of training agile software teams in group development psychology in Brazil. They concluded that there is great potential for training agile teams on this topic, as the positive effects could extend to the entire organisation.

Using the well spread working method of scrum for collaboration in software product development includes the team intervention of engaging in retrospectives (Zayat & Senvar, 2020). Thereby, this research contributes to the proven effect of team interventions being relevant for team process improvements, team members' reactions as well as learning to transfer this to individual learning in software product development (e. g. Dingsoyr et al., 2016; Lacerenza et al., 2018).

This research investigated the moderating effect of team interventions on the path between TWQ and individual learning and on team members' perception of working in a HPT and the effect on individual learning for software product development teams in Germany. The derivation of the hypothesis followed the assumption by Salas, Reyes and McDaniel (2018) that an expert team can not succeed if it does not know how to work well together, coordinate appropriately or show helpful communication skills. For enhancing and sustaining effective teamwork, there is a need to engage in team development activities and assess relevant team outcomes before and afterwards using robust diagnostic measurements to measure success. In the context of higher education, Gast, Schildkamp and van der Veen (2017) reviewed team-level interventions influencing individual attitudes and learning as success

Table 4.10.: Search Results for Team Interventions, Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'team interventions' | 3,560 | Google Scholar | Figure B.52 |
| | 87 | Web of Science | Figure B.53 |
| 'team interventions' AND 'agile software development' | 14 | Google Scholar | Figure B.54 |
| | 0 | Web of Science | Figure B.55 |
| 'team interventions' AND 'agile software development' AND ('Germany' | 4 | Google Scholar | Figure B.56 |
| | 0 | Web of Science | Figure B.57 |

*Note.* Status in November 2021

factors of helpful interventions.

For the last ten years (from 2011 to 2021), the current state of research for the query 'team interventions AND agile software development AND Germany' in Google Scholar (googlescholar.com) and Web of Science (webofscience.com) points to a scientific gap on this topic with few entries for all three key words in both search engines (see Table 4.10).

Table 4.11 provides samples of the team interventions literature and research over the past decade to highlight the major contributions as a basis for this research.

Since software product development teams often engage in team interventions due to working with agile methods, the current study focused on investigating whether engaging in team interventions positively influenced the path between TWQ and individual learning for members of software development teams in Germany . To extend the knowledge and replicate the findings for the target software product development employees, the second hypothesis states:

H3: The effect of TWQ on individual learning is moderated by team interventions such that the effects are enhanced when teams engage in team interventions.

Figure 4.3 visualises the presumed paths between the constructs of the second hypothesis.

H4: The effect of HPT on individual learning is moderated by team interventions such that the effects are enhanced when teams engage in team interventions.

Figure 4.4 visualises the presumed paths between the constructs of the second hypothesis.

Based on the prior literature review, the research question for the second main

Table 4.11.: Sample of Team Intervention Reviews

| Source | Approach | Major Contribution(s) |
|---|---|---|
| O'Donovan and McAuliffe (2020, p. 1) | Systematic Literature Review | Teaching interventions use simulations, video presentations, case studies and workshops. Interventions that did not include an educational component used holistic facilitation, forum games and action research meetings. However, no significant results could be derived as to which outcomes these interventions promote. |
| Körner et al. (2015, p. 15) | Systematic Literature Review | Identification of key aspects for Interprofessional teamwork in chronic care (,i.e. 'team member characteristics, common task, communication, cooperation, coordination, responsibility, participation, staff satisfaction, patient satisfaction, and efficiency') Identification of complex intervention programs for all studies analysed, however about the most effective team interventions |

*Note.* Interprofessional teamwork = Interprofessional teamwork

Figure 4.3.: Conceptual Visualisation of the Presumed Moderating Effect of Team Interventions on the Path between Teamwork Quality and Individual Learning

Teamwork Quality   Team Interventions

\+

Team-Level Transformational Leadership - - - - - - - - - - - - → Individual Learning
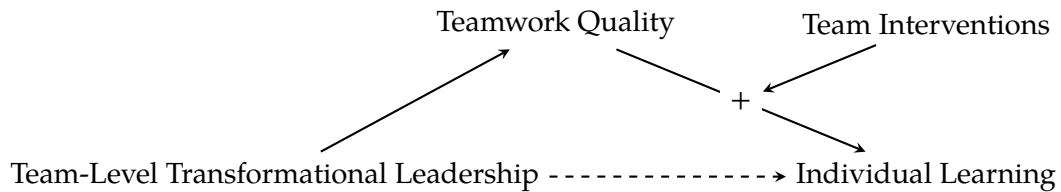
Figure 4.4.: Conceptual Visualization of the Presumed Moderating Effect of Team Interventions on the Path between High-Performing Team and Individual Learning
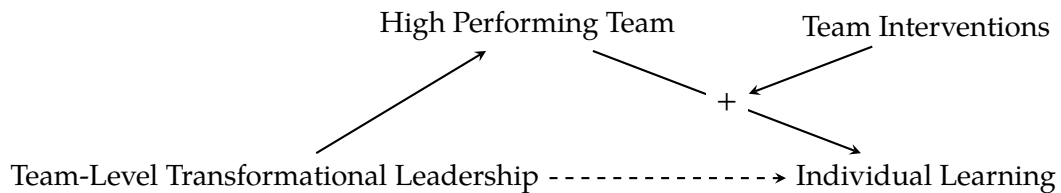
High Performing Team   Team Interventions

\+

Team-Level Transformational Leadership - - - - - - - - - - - - → Individual Learning

study is: Does the perceived organisational psychological safety mediate the path between transformational leadership and organisational initiative for members of software development teams? And is this enhanced when leaders engage in positive leadership behaviours? The next section summarises the research design and hypotheses for the second study.

### 4.1.4. Research Design for the Second Main Study

To give an overview based on the literature review, Table 4.12 summarises the research question and constructs for the second study.

Figure 4.5 visualises the constructs of the second main study in the context of the framework by Mathieu et al. (2017) and Mathieu et al. (2019).

The conceptual model in Figure 4.6 visualises and summarises the constructs, paths, and derived hypotheses of the research design for the second main study.

To stay in line with the style of the research design of the first study, it was decided to test the paths of the mediation hypotheses (H1 and H2) as one hypothesis for each mediation as well as one hypothesis each for the moderation analysis (H3 and H4), instead of testing all linear bivariate regressions separately.

Figure 4.5.: Location of the Constructs of the Second Main Study in the Framework
for Team Research in the model by Mathieu et al. (2017) and Mathieu
et al. (2019)
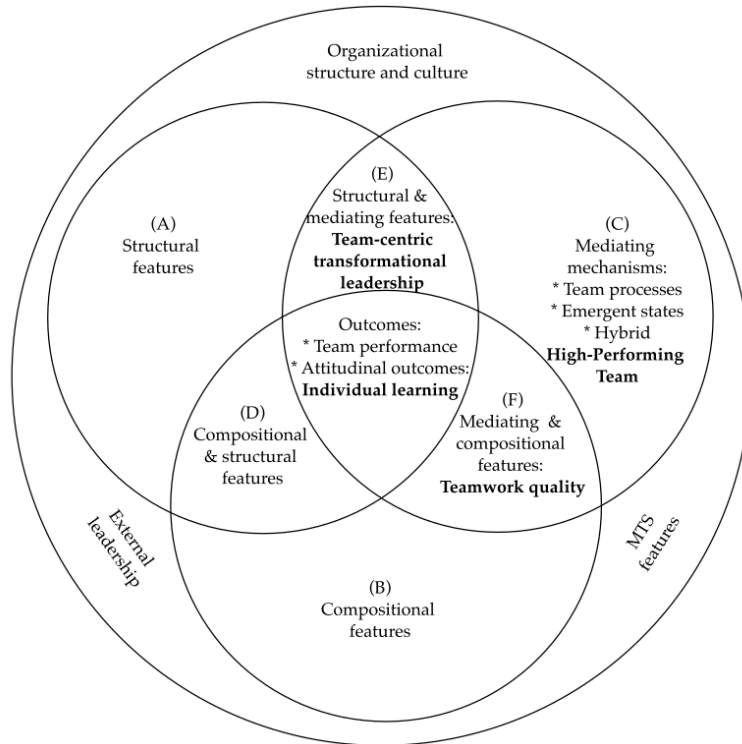


*Note.* Adapted from Mathieu et al. (2017) and Mathieu et al. (2019). Copyright 2017
by the American Psychological Association. Abbreviations: MTS, multiteam systems
.

Figure 4.6.: Research Framework and Derived Hypotheses for the Second Main Study
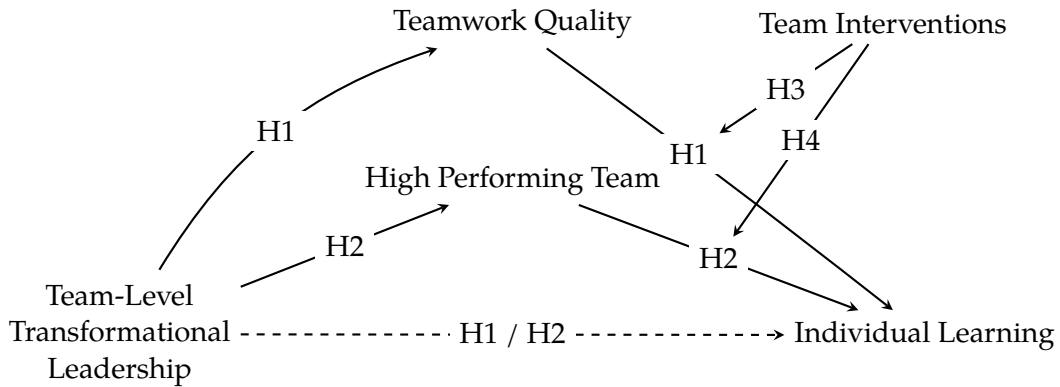
Table 4.12.: Overview of Research Question and Constructs for The Second Study

| Study and Research Question |
| --- |
| Study 2 |
| Is the relationship between the perceived team-level transformational leadership and individual learning mediated by TWQ respectively working in a HPT for members of software development teams? Do team interventions moderate the mediating effect of TWQ respectively HPT on individual learning? |

**Constructs**

- Team-level transformational leadership

- Teamwork quality

- High-performing team

- Individual learning

- Team interventions

*Note.* TWQ = teamwork quality, HPT = high-performing team

## 4.2. METHODS

This section describes all the methods used in this study: inclusions and exclusions, participants characteristics, sampling procedure, sample size, power and precision, measures and covariates, data collection, quality of measurement, conditions and research design, data diagnostics and analysis strategy.

### 4.2.1. Inclusions, Exclusions, and Participant Characteristics

Similar to the first study, only participants working in software product development teams were accepted. Datasets of participants not working in teams but by themselves were defined to be excluded. Furthermore, the surveys contained the information for the regional focus on Germany. And therefore again, only participants working in Germany took part. To evaluate and exclude outliers, boxplots were planned to be analysed to examine univariate outliers (JASP Team, 2020). Datasets with more than two standard deviations faster than the mean of duration with regards to participation were set to be excluded. Datasets with more than one and a half standard deviations from the mean of one of the variables will be excluded with regards to the interquartile range method. Additional multivariate, model fit, and prediction outlier analysis were analysed in RStudio and SmartPLS to remove the outliers and improve the accuracy of the model for SEM (Ringle, Wende & Becker, 2015; RStudio Team, 2020). Cook's distance was specified to be evaluated for further outliers in R

and the threshold for outliers is based on F distribution, with the observations away from a scatter plot (Aguinis, Gottfredson & Joo, 2013; R Core Team, 2020).

Overall, participants were asked for their socio-demographic data: gender, age, role, education, duration of professional activity, company size, division, length of current employment, whether they work in a team or alone, team size, working method, whether they engage in team interventions, whether they had rated differently before the pandemic, and the leader's gender.

The study was conducted with developers, agile coaches, Scrum masters, user experience (UX) designers as well as project leads/project managers, (team) assistants, and leadership roles, all working in the area of software product development. Among the 224 participants included in the final analysis, 29.02 % were female and 70.98 % were male. Participants' were aged between 21 years and 65 years ( $M =$ 37.81, $SD = 8.27$ ). Most represented roles were developers (35.54 %), product owners (15.70 %), and leaders (12.40 %) (see Figure 4.7).

Figure 4.7.: Descriptives for the Second Study – Roles of Participants
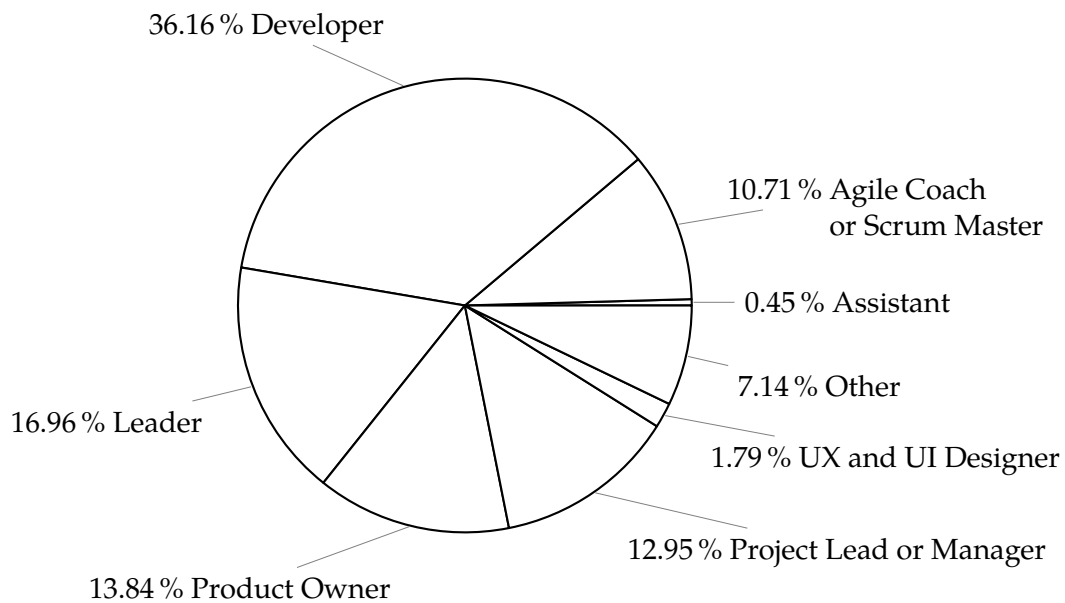


The majority of participants hold a university degree (80.45 %). The duration of the professional activity was up to 40 years ($M = 14.06$, $SD = 8.46$). Most participants worked in large companies with 201 or more employees (58.67 %). The product areas most represented were software (44.44 %), service providers (24.44 %), and online applications and online media (16.44 %). Participants' length of the current employment ranged up to 37 years ($M = 5.73$, $SD = 5.95$). All participants not working in a team were excluded, so every participant of the 224 worked in a team. The team size ranged from two to 30 team members ($M = 8.62$, $SD = 5.04$). The most used working methods were Scrum in an adapted form (41.07 %), Kanban in

Figure 4.8.: Descriptives for the Second Study – Penetration of working methods in Software Development in Germany
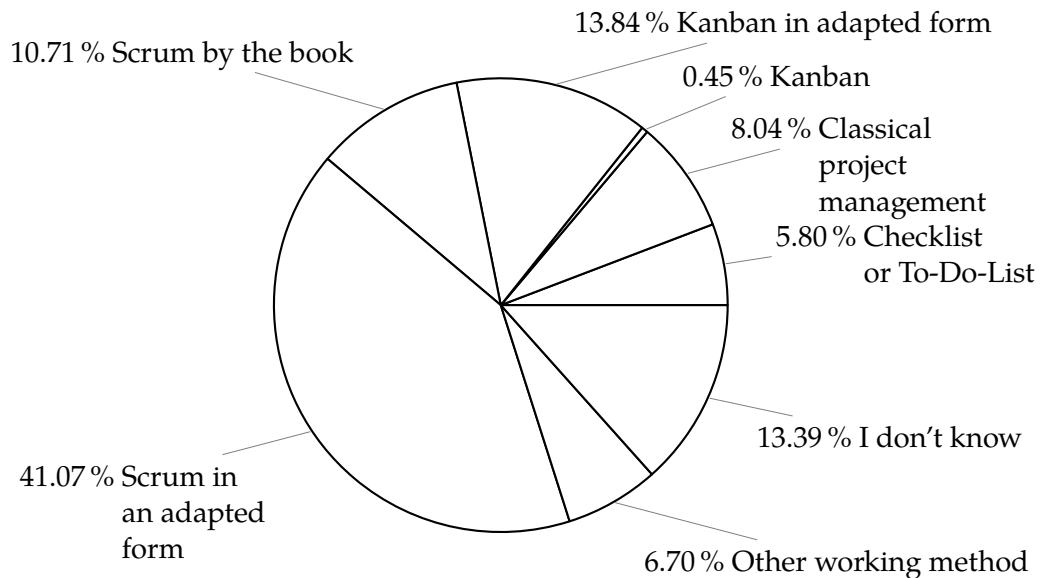


an adapted form (13.84 %), and Scrum by the book (10.71 %) (see Figure 4.8).

It was irritating that 13.39 % stated that they do not know or it is unclear to them which method they are working with. 15.18 % stated that their team does not engage in any kind of team intervention, whereas 84.82 % answered to engage in at least one or more team interventions. The most named interventions were retrospectives (65.63 %), team building activities (35.71 %), peer feedback (28.13 %), and team days (21.88 %).

Regarding the impact of the COVID-19 pandemic on the assessment, the majority stated their answer had been the same before the pandemic (67.41 %) whereas

Figure 4.9.: Descriptives for the Second Study – Team Interventions
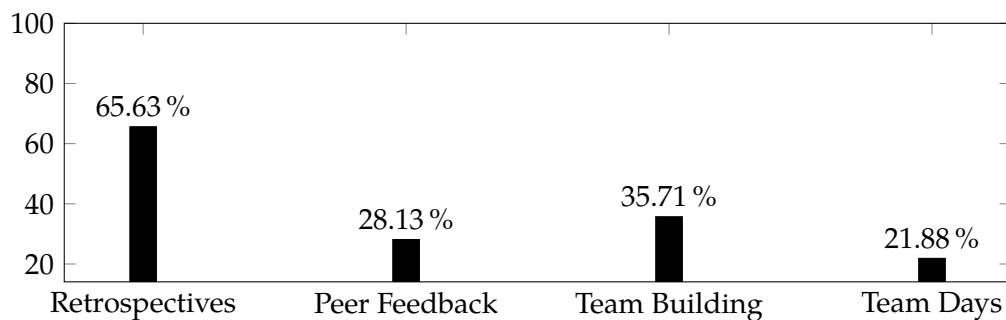
32.59 % stated their assessment had been different before the pandemic. 83.56 % had a male leader and 16.44 % a female leader.

### 4.2.2. Sampling Procedure, Sample Size, and Power

Similar to the first study, all participants answered the questionnaire online. The online link was spread via business networks as well as members of IT teams, who were approached via e-mail or business networks. A pre-test was conducted (N = 9). The participation was voluntary, anonymous, and did not include any incentives. All participants were above 18 years old and gave consent to respect and fulfil the guidelines for good ethical research (see Appendix B in Table B.12). There was no conflict of interest nor financial support to disclose for the study.

With regards to the specific target group of members of software product development teams in Germany, there were only reliable estimates for the expected effect size from the first study of this dissertation. Therefore, those learnings and other indications were used: large effects seemed to be not expectable and small effects seem to be lacking in practical usage. With this, medium effects were aimed at. The goal was a power of .8 for two-sided testing for the directional hypotheses.

For the simple mediation analysis the tables provided by Fritz and MacKinnon (2007), Hair et al. (2019), and Marcoulides and Chin (2013) were considered. For the regressions as part of the moderation analysis, again G*Power in the version 3.1.9.6 was used (Faul et al., 2009). For the simple mediation analysis, Fritz and MacKinnon (2007) recommended a planned sample size of 71 for detecting medium effects when using bias-corrected bootstrapping, as described in subsection 3.2.5. Hair et al. (2019) and Marcoulides and Chin (2013) suggested to plan the sample size using power analysis with respect to the model structure, the expected level of significance, and the awaited effect size: For a minimum $R^2$ of .10, a maximum number of two arrows pointing at a construct and a significance level of 5 %, they suggested a planned sample size of 110. This is close to Cohen (1988) who suggested an $R^2$ value of .13 a medium effect size. For the moderation analysis, a sample size of 55 was suggested (see Table B.3).

With this, the planned net sample size number was the maximum value of all sources of N = 110. To achieve that, based on the expected outliers, the gross planned sample size needed to be enlarged. Oriented to the report on behalf of the Federal Ministry for Work and Social Affairs in Germany, a mark-up of 6 % for the potential participants being (solo-) self-employed and therefore not working in a team in the area of software development was applied (Bonin et al., 2020). To account for further exclusion criteria for which no detailed forecast was possible in advance, a further 10 % was added as a lump sum. Thus, the target was 16 % more participants than the above net sample, resulting in a target gross sample of N = 127. It was planned to stop data collection once this number of participants was reached, at the latest on 31 May 2021.

After finishing the data collection stage, there were 240 questionnaires completed. Thus, the planned size of the gross sample was exceeded. The sample was

cleaned according to the criteria defined before the data collection stage as follows: First, seven cases were excluded, who did not work in a team but alone. Therefore, they did not fit into the target group of this study. Two further cases were excluded due to the sex diverse variable since gender was used as control variable and with such a low amount of participants for the diverse gender, no stable estimations were expected.

Seven cases had to be excluded after boxplot analysis due to a too short duration of participation of one and a half standard deviations from the mean. One case was excluded, since the overall maximum of the length of the current service was longer than the duration of the overall professional activity. Standardised residual plots and Cook's distance did not indicate any further outliers. This resulted in a net sample of N = 224 for the statistical tests, which was slightly more than planned. Since all unfinished datasets were excluded from the analysis, there are no missing data.

### 4.2.3. Measures and Covariates

All survey items were drawn from existing scales and literature. The used scales were available in English and in German. The English version is attached in the Appendix B. All constructs and respectively used scales will be described in this subsection, starting with team-level transformational leadership as a predictor variable, followed by the mediating variable TWQ, the criterion individual learning, and covariates.

*Team-level transformational leadership*

To measure team-level transformational leadership, the subscale group-focused transformational leadership ($\alpha = 0$) from the Dual-Level Transformational Leadership Scale by Wang and Howell (2010) was used in line with slight modification by Klaic, Burtscher and Jonas (2020) from 'my leader to 'my direct supervisor. Participants rated their team leader on a five-point scale consisting of 16 items, from *not at all* to *frequently, if not always*. A sample item is 'My direct supervisor encourages team members to take pride in our team'. Due to copyright issues stated by Klaic, Burtscher and Jonas (2020), the scale could not be included in the Appendix, but was used in consultation with Klaic, Burtscher and Jonas (2020).

The reliability of team-level transformational leadership is $\alpha = .95$.

*Teamwork Quality*

TWQ was measured using the scale of 26 items by Klaic, Burtscher and Jonas (2020), who adapted the TWQ scale by Hoegl and Gemuenden (2001), using the four subscales most relevant for individual learning: communication quality, balance of member contributions, mutual support, and cohesion. Participants rated the perceived TWQ on a five-point scale with 26 items. Responses ranged on a five-point scale from *strongly disagree* to *strongly agree*. A sample item for communication quality as a subcomponent of TWQ is 'The team members communicate often in spontaneous meetings, phone conversations, etc.'. The reliability of TWQ is $\alpha = .88$.

*High-Performing Team*

HPT was measured using the HPTS by Fischer and Hüttermann (2020) in the short version. In this study the short version of the HPTS is used with five items, which are attached in the appendix (see Table B.14). The participants had to state to which degree they agreed with each statement with regards to their perception of their team on a five-point response scale spread from *strongly disagree* to *strongly agree*. The reliability for HPTS is $\alpha = .74$, which is acceptable or even described as high (Taber, 2018). A sample item is 'My team makes an important contribution to the overall success of the organisation' for meaningfulness on the organisation. Due to Fischer, Hüttermann and Siebenaler (2020) the evaluation is done by calculating a non-weighted mean index, which results in a High Performance Team Index. Usually, the HPTS has been used to rate the perception of a whole team and therefore, needed the rating of all team members having set at least half of the items with valid values. This study made use of the HPTS to get an overall perception of working in a software product development team in Germany. The scale was available in German and therefore translated and retranslated by a native speaking person to avoid language differences in the meaning of the items.

*Individual Learning*

Participants rated the perceived individual learning using the adopted scale from Yoon and Kayes (2016) who used the team-level learning scale from Hoegl and Gemuenden (2001). They adjusted the scale to measure learning at the individual-level (Klaic, Burtscher & Jonas, 2020). The rating was made on a five-point scale with five items, from *strongly disagree* to *strongly agree*. A sample item is 'I am able to acquire important know-how through my project(s)'. With regards to reliability there was no satisfying value for individual learning with $\alpha = .65$ (frequent threshold for reliability is $\alpha > .70$ (Taber, 2018). Nevertheless, since the same scale was used and validated by Klaic, Burtscher and Jonas (2020), the scale was used in this study as well.

*Covariates*

In addition to the above-mentioned constructs, control variables were relevant to ensure the quality of the study. Leader's gender, participant's gender, age, and team size were control variables (Bernerth & Aguinis, 2015; Klaic, Burtscher & Jonas, 2020; LePine et al., 2008). Additionally, Mathieu et al. (2019) addressed a need to better understand the role of team size, although the results by Yuan and van Knippenberg (2021) did not support the moderating role of team size. As a results of the moderated mediation, no influences have been found for those four variables.

To control whether the COVID-19 pandemic had an impact on the situation and results, the participants were asked whether they would have assessed the situation differently before the pandemic than at the moment of participation. Due to no validated items at the moment of data collection, the dichotomous answer options

were self-designed and participants had to choose either *No, I would have answered like that before the pandemic* or *Yes, before the pandemic my assessment would have been different*.

### 4.2.4. Data Collection and Diagnostics

Mathieu, Wolfson and Park (2018) and Mathieu et al. (2017) outlined the economic competitiveness and fluidity in general with organisations coping by continuously adapting their team structures. This also goes along with flexibility in team set ups, adjusting based on the task requirements. Continuing the research perspective of chapter 3 this suggests a need to stick to examining individuals' perspectives on the perceived team environment. The online survey included existing, validated scales to ensure the quality of measurement. The scales were used with the permission of the authors to operationalise the constructs or used with regards to Creative Commons (Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) https://creativecommons.org/licenses/by-nc-nd/4.0/).

All data obtained are confidential. All questions were fixed response questions with mandatory items. Again, a multidimensional, multi-organisational study was conducted with a non-experimental, cross-sectional design with self-assessment surveys asking for participants' individual perceptions of aspects of working in software product development.

For the analysis of the data, JASP version 0.14.1 (JASP Team, 2020), R version 4.1.0 (R Core Team, 2020), RStudio version 1.4.1717 (RStudio Team, 2020), and SmartPLS version 3 (Ringle, Wende & Becker, 2015) were used. Gender was recoded (male: 0, female: 1). Due to coding all fields as mandatory items, there were no missing data.

### 4.2.5. Analytic Strategy

Similar to that described in subsection 3.2.5 for the first main study, PLS-SEM was chosen to be used again due to the methodological fit and consistency within this dissertation project (Sarstedt, Ringle & Hair, 2021). This study also contributed to gain more experience in using PLS-SEM due to the suitable circumstances of the comparably small population of members of software product development teams in Germany as part of people working in IT and therefore the derived sample size (Hair et al., 2019; Rigdon, 2016; Sarstedt, Ringle & Hair, 2021). In addition, this study also planned to take a predictive perspective for testing the theoretical framework of Mathieu et al. (2019) with a complex structural model (Hair et al., 2019).

This study is also designed to contribute to the model for embracing complexity by Mathieu et al. (2019): Leadership is again set as a structural feature and external influence but with the difference of focusing on team-level leadership. TWQ was chosen as a mediator, which adds a new construct to the model. Individual learning is used as an outcome. The study hereby also aims to add knowledge to the proposed need to measure constructs triggered by the environment.

With regards to Hayes and Rockwood (2019) this study is designed and the

analysis is planned with respect to and acceptance of the dependency, aiming to get insights on the operation itself and the boundary conditions. The analytic strategy was set up to understand the mechanisms at work of leadership, TWQ and individual learning and to assess when they take place.

With regards to the structural model, bias-corrected bootstrapping was used (5000 samples) as a non-parametric procedure also correcting for skewness (Fritz & MacKinnon, 2007). Moreover, bootstrapping allows testing the statistical significance PLS-SEM results like path coefficients, Cronbach's Alpha, HTMT, and $R^2$ values (Ringle, Wende & Becker, 2015).

## 4.3. RESULTS

This section includes the results of the analyses using the statistical techniques discussed in 4.2.5, following the reporting style of PLS analysis as suggested by Chin (2010) and done in section 3.3. Participant flow and recruitment will be reported, followed by the reliability and validity of the measurement model assessed. Since this dissertation includes evaluating the mediating role of the TWQ between the perceived team-level transformational leadership and individual learning, as well as the moderating role of team interventions, which includes the interaction of TWQ and team interventions, a post-hoc analysis is conducted to investigate these effects. Therefore, the final step is to present the structural model results.

The study started with a short introduction to the scope, boundary conditions and use of the data, making clear that there are no commercial usage or interests. Following this, the participants gave consent to being above 18 years old and agreed to respect the rules of participation. The content scales where ordered from the individual to the team to the leadership perception. Therefore, the first content scale was the *individual learning* by Hoegl and Gemuenden (2001) and Klaic, Burtscher and Jonas (2020), followed by the TWQ scale with the according subscales communication quality, mutual support, cohesion, and balance of contributions. To stick with the perception on the team, the next part was the HPTS by Fischer and Hüttermann (2020), followed by the *team-level transformational leadership* by Klaic, Burtscher and Jonas (2020) and Wang and Howell (2010). The final part was the socio-demographic data. The last page included contact details and further information. Details of the scales are attached in the Appendix B Table B.14.

The data collection took place from April to June 2021 with respect to the sampling procedure described in subsection 4.2.2. The next section includes the results of the measurement model.

### 4.3.1. Evaluation of the Measurement Model

The reporting of the measurement model contains the common method variance and the validation of instruments and psychometrics. Similar to subsection 3.3.1, PLS-SEM analysis starts with the assessment of the measurement followed by the

Table 4.13.: Reliability, and Convergent Validity for the Second Main Study before Eliminating Items due to Factor Analysis

| Construct | $\alpha$ | CR | AVE |
|---|---|---|---|
| Team-level Transformational Leadership | .95 | .95 | .55 |
| Teamwork Quality | .92 | .94 | .42 |
| High Performing Team Survey | .74 | .83 | .49 |
| Individual Learning | .62 | .75 | .40 |

*Note.* N = 111, missing = 0. AVE = Average Variance Extracted, $\alpha$ = Cronbach's Alpha, TLTL = Team-level Transformational Leadership, TWQ = Teamwork Quality, HPTS = High Performing Team Survey, IL = Individual Learning.

structural model. The measurement model examines the reliability and validity of the constructs. Data analysis and reporting the results is consistent again with the reporting style for PLS-SEM analysis suggested by prior research (e. g. Chin, 2010; Hair et al., 2019; Sarstedt, Ringle & Hair, 2021).

CFA was used to evaluate convergent reliability for the four constructs of this study. In contrast to subsection 3.3.1 and Hair, Ringle and Sarstedt (2011), but in line with Gefen and Straub (2005) the cut-off value of 0.60 was chosen for factor loadings. Choosing a cut-off value of 0.70 would have led to the exclusion of nine more items. Loadings below the threshold of 0.60 were the case for items of three constructs, which were removed from the scales (individual learning (IL02, IL04, IL05), TWQ (TWQBC03, TWQC01, TWQC03, TWQCQ01, TWQCQ02, TWQCQ03, TWQCQ04), and team-level transformational leadership (TLTL04). In case an item of a scale was deleted, it was also analysed as to whether there is a substantial increase in reliability upon deletion of an item.

It was found that removing an item did improve or leave all values for the four constructs stable or for the majority improve the values and thereby, increase the quality of the measurement model. Table 4.14 displays the results indicating the satisfying factor loadings of all the remaining reflective indicators. Additionally, Table 4.14 includes the results for reliability and validity for the overall sample. When comparing the results of the four constructs before (see Table 4.13) and after confirmatory factor analysis (see Table 4.14) there is an overall improvement of the measurement model.

Table 4.14.: Loadings, Reliability, and Convergent Validity for the Second Main Study

| Construct | Coding | Loading | α | CR | AVE |
|---|---|---|---|---|---|
| Team-level Transformational Leadership | TLTL01 | .729 | .94 | .95 | .57 |
| | TLTL02 | .772 | | | |
| | TLTL03 | .757 | | | |
| | TLTL05 | .611 | | | |
| | TLTL06 | .744 | | | |
| | TLTL07 | .791 | | | |
| | TLTL08 | .777 | | | |
| | TLTL09 | .687 | | | |
| | TLTL10 | .786 | | | |
| | TLTL11 | .690 | | | |
| | TLTL12 | .785 | | | |
| | TLTL13 | .780 | | | |
| | TLTL14 | .853 | | | |
| | TLTL15 | .833 | | | |
| | TLTL16 | .733 | | | |
| Teamwork Quality | | | .94 | .95 | .49 |
| Balance of Contributions | TWQBC01 | .851 | .72 | .88 | .78 |
| | TWQBC02 | .915 | | | |
| Cohesion | TWQC02 | .735 | .87 | .91 | .66 |
| | TWQC04 | .761 | | | |
| | TWQC05 | .891 | | | |
| | TWQC06 | .872 | | | |
| | TWQC07 | .830 | | | |
| Communication Quality | TWQCQ05 | .760 | .88 | .91 | .62 |
| | TWQCQ06 | .721 | | | |
| | TWQCQ07 | .743 | | | |
| | TWQCQ08 | .829 | | | |
| | TWQCQ09 | .869 | | | |
| | TWQCQ10 | .780 | | | |
| Mutual Support | TWQMS01 | .763 | .89 | .91 | .64 |
| | TWQMS02 | .769 | | | |
| | TWQMS03 | .833 | | | |
| | TWQMS04 | .851 | | | |
| | TWQMS05 | .833 | | | |
| | TWQMS06 | .743 | | | |
| High Performing Team Survey | HTPS01 | .731 | .74 | .83 | .49 |
| | HTPS02 | .634 | | | |
| | HTPS03 | .648 | | | |

to be continued on the next page

Table 4.14.: (continued)

| Construct | Coding | Loading | α | CR | AVE |
|---|---|---|---|---|---|
| | HTPS04 | .781 | | | |
| | HTPS05 | .691 | | | |
| Individual Learning | IL01 | .905 | .80 | .91 | .83 |
| | IL03 | .921 | | | |

*Note.* N = 224, missing = 0. AVE = Average Variance Extracted, α = Cronbach's Alpha, TLTL = Team-level Transformational Leadership, TWQ = Teamwork Quality, BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, HPTS = High Performing Team Survey, IL = Individual Learning.

Cronbach's Alpha as well as CR were used to assess the reliability of the scales and to analyse internal consistency. The Cronbach's Alpha of the constructs ranged from $\alpha = .74$ to $\alpha = .95$. Referring to Field (2017) or Taber (2018), the results for all constructs exceed the threshold of 0.70. Additionally, before and after factor analysis, all CR values were higher than the recommended value of 0.70 (Netemeyer, Bearden & Sharma, 2003).

After the evaluation of the reliability, the convergent validity of all constructs was examined. Convergent validity ensures all items measure the same construct and thereby, highly agree (converge) regarding their representation of the construct for which they were developed. The threshold for convergent validity is operationalised by values of AVE and CR of 0.50 or above (Fornell & Larcker, 1981). CRs for all constructs were before and after factor analysis above 0.50. The AVE for all constructs besides HPTS increased after the factor analysis The AVE for HPTS and TWQ are below the threshold by 0.01. Overall, the values for CR and AVE indicate acceptable convergent validity with minor limitations (see subsection 4.4.2).

For all metric variables, the mean was above the centre point (2.50) of the five-point scale. Individual learning had the highest value ($M = 4.24$, $SD = 0.72$). It was followed by the subscale of the TWQ mutual support ($M = 4.09$, $SD = 0.66$), HPTS ($M = 3.84$, $SD = 0.63$), overall TWQ ($M = 3.83$, $SD = 0.62$), cohesion ($M = 3.81$, $SD = 0.73$), balance of contributions ($M = 3.78$, $SD = 0.77$), and communication quality ($M = 3.65$, $SD = 0.76$). Team-level transformational leadership had the lowest value ($M = 3.17$, $SD = 0.89$). Hereby, HPTS as well as TWQ are comparably high.

When the determination of convergent and discriminant validity are given, construct validity is established. Considering the value of each indicator's inner VIF value for collinearity statistics being less than the threshold of 3.3, discriminant validity was evaluated. Not only does this suggest the moderated mediation model being without pathological collinearity but also with regards to the model, it can be considered free of common method bias.

Moreover, Fornell-Larcker criterion was used. Table 4.15 includes the square-root of AVE for the constructs being above the inter-construct correlation (Kock, 2015). Another aspect of testing discriminant validity was evaluating the HTMT ratio of

Table 4.15.: Fornell-Larcker Criterion for the Second Main Study Without Subscales of Teamwork Quality

| Variable | Age | G | HPTS | IL | LG | TLITL*LG | TWQ*Age | TWQ*G HTP | TWQ*HTP | TWQ*TI | TWQ*TS | TI | TS | TLITL | TWQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | **1.000** | | | | | | | | | | | | | | |
| G | −0.194 | **1.000** | | | | | | | | | | | | | |
| HPT | 0.042 | 0.001 | **0.699** | | | | | | | | | | | | |
| IL | 0.021 | −0.001 | 0.454 | **0.913** | | | | | | | | | | | |
| LG | −0.012 | −0.230 | −0.010 | 0.000 | **1.000** | | | | | | | | | | |
| TLITL*LG | −0.082 | −0.105 | 0.391 | 0.254 | 0.540 | **0.805** | | | | | | | | | |
| TWQ*Age | −0.111 | −0.033 | 0.046 | −0.223 | 0.042 | −0.036 | **0.281** | | | | | | | | |
| TWQ*G | −0.203 | 0.980 | 0.066 | 0.039 | −0.241 | −0.074 | −0.006 | **0.974** | | | | | | | |
| TWQ*HTP | 0.040 | −0.104 | −0.488 | −0.332 | 0.073 | −0.161 | −0.006 | −0.125 | **0.616** | | | | | | |
| TWQ*TI | 0.012 | 0.089 | 0.418 | 0.311 | −0.091 | 0.199 | 0.040 | 0.126 | −0.264 | **0.928** | | | | | |
| TWQ*TS | 0.048 | 0.078 | −0.159 | −0.158 | 0.027 | −0.087 | −0.052 | 0.071 | 0.253 | −0.068 | **0.621** | | | | |
| TI | 0.016 | 0.113 | 0.193 | 0.227 | −0.100 | 0.092 | −0.005 | 0.122 | −0.117 | 0.934 | −0.026 | **1.000** | | | |
| TS | −0.003 | 0.125 | 0.063 | 0.126 | 0.066 | 0.106 | −0.207 | 0.132 | −0.081 | 0.087 | 0.002 | 0.093 | **1.000** | | |
| TLITL | −0.090 | 0.084 | 0.468 | 0.301 | −0.134 | 0.746 | −0.066 | 0.129 | −0.247 | 0.308 | −0.122 | 0.194 | 0.074 | **0.758** | |
| TWQ | 0.006 | −0.018 | 0.753 | 0.387 | −0.013 | 0.381 | 0.091 | 0.063 | −0.607 | 0.472 | −0.244 | 0.178 | 0.015 | 0.447 | **0.700** |

*Note.* N = 224, missing = 0. ***$p < .001$. Bold diagonal elements are the square root of the average variance extracted of each construct. TLITL = Team-level Transformational Leadership, TWQ = Teamwork Quality, BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, HPT = High Performing Team, IL = Individual Learning.

Table 4.16.: Fornell-Larcker Criterion for the Second Main Study With Subscales of Teamwork Quality

| Variable | HPTS | IL | TWQ BC | TWQ BC* HPT | TWQ BC* TI | TWQ C | TWQ C* HPTS | TWQ C* TI | TWQ CQ | TWQ CQ* HPT | TWQ CQ* TI | TWQ MS | TWQ MS* HPT | TWQ MS* TI | TI | TLITL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HPT | **0.699** | | | | | | | | | | | | | | | |
| IL | 0.455 | **0.913** | | | | | | | | | | | | | | |
| TWQBC | 0.582 | 0.312 | **0.884** | | | | | | | | | | | | | |
| TWQBC*HPT | −0.394 | −0.328 | −0.446 | **0.680** | | | | | | | | | | | | |
| TWQBC*TI | 0.403 | 0.299 | 0.486 | −0.196 | **0.969** | | | | | | | | | | | |
| TWQC | 0.729 | 0.385 | 0.595 | −0.426 | 0.428 | **0.812** | | | | | | | | | | |
| TWQC*HPTS | −0.516 | −0.289 | −0.415 | 0.818 | −0.210 | −0.542 | **0.661** | | | | | | | | | |
| TWQC*TI | 0.450 | 0.328 | 0.317 | −0.209 | 0.919 | 0.585 | −0.265 | **0.952** | | | | | | | | |
| TWQCQ | 0.615 | 0.288 | 0.553 | −0.370 | 0.290 | 0.640 | −0.446 | 0.315 | **0.785** | | | | | | | |
| TWQCQ*HPT | −0.469 | −0.348 | −0.401 | 0.782 | −0.265 | −0.502 | 0.856 | −0.315 | −0.439 | **0.611** | | | | | | |
| TWQCQ*TI | 0.393 | 0.282 | 0.295 | −0.163 | 0.904 | 0.431 | −0.207 | 0.922 | 0.470 | −0.263 | **0.935** | | | | | |
| TWQMS | 0.636 | 0.342 | 0.593 | −0.559 | 0.344 | 0.702 | −0.584 | 0.377 | 0.696 | −0.555 | 0.369 | **0.800** | | | | |
| TWQMS*HPT | −0.447 | −0.308 | −0.472 | 0.868 | −0.221 | −0.505 | 0.915 | −0.244 | −0.435 | 0.863 | −0.196 | −0.625 | **0.671** | | | |
| TWQMS*TI | 0.385 | 0.303 | 0.289 | −0.218 | 0.928 | 0.432 | −0.243 | 0.948 | 0.305 | −0.302 | 0.942 | 0.444 | −0.246 | **0.962** | | |
| TI | 0.193 | 0.227 | 0.115 | −0.081 | 0.898 | 0.230 | −0.081 | 0.904 | 0.110 | −0.188 | 0.899 | 0.134 | −0.081 | 0.932 | **1.000** | |
| TLITL | 0.468 | 0.299 | 0.290 | −0.138 | 0.283 | 0.466 | −0.243 | 0.340 | 0.391 | −0.278 | 0.306 | 0.338 | −0.227 | 0.267 | 0.194 | **0.757** |

*Note.* N = 224, missing = 0. ***$p < .001$. Bold diagonal elements are the square root of the average variance extracted of each construct. TLITL = Team-level Transformational Leadership, TWQ = Teamwork Quality, BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, HPT = High Performing Team, IL = Individual Learning.

correlations (Henseler, Ringle & Sarstedt, 2015). All values besides one (TWQ with HPTS with a value of .89) are above the cut-off value of .90. Therefore, the values indicate ensured discriminant validity. The values of the Fornell-Larcker of the main constructs without subscales are displayed in Table 4.15 and for the HTMT testing in Table 4.17 (Fornell & Larcker, 1981).

Since PLS-SEM analysis does not only include the assessment of the measurement model, the next section gives insights with regards to the structural model, which includes the significance of the hypothesised paths.

Table 4.17.: Heterotrait-Monotrait Ratio

| | Age | G | HPTS | IL | LG | TLITL*LG | TWQ*Age | TWQ*G | TWQ*HTP | TWQ*TI | TWQ*TS | TI | TS | TLITL | TWQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | | | | | | | | | | | | | | | |
| G | 0.194 | | | | | | | | | | | | | | |
| HPT | 0.101 | 0.145 | | | | | | | | | | | | | |
| IL | 0.023 | 0.014 | 0.584 | | | | | | | | | | | | |
| LG | 0.012 | 0.230 | 0.101 | 0.020 | | | | | | | | | | | |
| TLITL*LG | 0.083 | 0.104 | 0.458 | 0.293 | 0.553 | | | | | | | | | | |
| TWQ*Age | 0.246 | 0.088 | 0.147 | 0.087 | 0.064 | 0.102 | | | | | | | | | |
| TWQ*G | 0.201 | 0.987 | 0.148 | 0.027 | 0.231 | 0.081 | 0.083 | | | | | | | | |
| TWQ*HTP | 0.057 | 0.108 | 0.554 | 0.301 | 0.096 | 0.171 | 0.242 | 0.123 | | | | | | | |
| TWQ*TI | 0.028 | 0.089 | 0.491 | 0.345 | 0.091 | 0.201 | 0.091 | 0.128 | 0.245 | | | | | | |
| TWQ*TS | 0.094 | 0.100 | 0.270 | 0.148 | 0.071 | 0.139 | 0.180 | 0.109 | 0.312 | 0.139 | | | | | |
| TI | 0.016 | 0.113 | 0.230 | 0.253 | 0.100 | 0.095 | 0.082 | 0.125 | 0.125 | 0.938 | 0.090 | | | | |
| TS | 0.003 | 0.125 | 0.074 | 0.142 | 0.066 | 0.116 | 0.090 | 0.134 | 0.103 | 0.087 | 0.210 | 0.093 | | | |
| TLITL | 0.093 | 0.092 | 0.558 | 0.347 | 0.142 | 0.779 | 0.098 | 0.122 | 0.257 | 0.316 | 0.184 | 0.200 | 0.097 | | |
| TWQ | 0.075 | 0.075 | 0.893 | 0.431 | 0.074 | 0.383 | 0.142 | 0.092 | 0.604 | 0.481 | 0.334 | 0.175 | 0.072 | 0.452 | |

*Note.* N = 224, missing = 0. BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, G = Gender, HPT = High Performing Team, IL = Individual Learning, TI = Team interventions, TLITL = Team-level Transformational Leadership, TS = Team Size, TWQ = Teamwork Quality.

### 4.3.2. Evaluation of the Statistical Model

This section includes the assessment of the structural model focusing on the significance of the hypothesised relationships. The following hypotheses were proposed to evaluate the relationship of predictor and outcome (see section 4.1):

H1: The perceived TWQ mediates the path between team-level transformational leadership and individual learning.

H2: The perceived HPT mediates the path between team-level transformational leadership and individual learning.

H3: The effect of TWQ on individual learning is moderated by team interventions such that the effects are enhanced when teams engage in team interventions.

H4: The effect of HPT on individual learning is moderated by team interventions such that the effects are enhanced when teams engage in team interventions.

The evaluation of the statistical model includes $R^2$, $Q^2$ for the endogenous variables TWQ and individual learning, and the significance of paths. By evaluating $R^2$ for the dependant variable, the strength of the structural model determines the goodness of the statistical model. However, the cut-off value for an acceptable $R^2$ value is dependent on the study's context (Hair et al., 2012). The results of $R^2$ for TWQ ($R^2 = .21$) and individual learning ($R^2 = .34$) are above .10 indicating the predictive capability. Moreover, $Q^2$ gives information about the predictive relevance of the endogenous constructs with a value above 0 indicating the predictive relevance of the model (Chin, 2010). The values for the current study point to an insignificant prediction of TWQ ($Q^2 = -1.580$) and individual learning ($Q^2 = -0.007$). SRMR indicates an acceptable model fit of the data with a cut-off value below 0.10 for an acceptable model fit. An SRMR value of 0.071 indicates an acceptable model fit for this study (Hair et al., 2016). For evaluation of the mediation and moderation, hypotheses were tested to check the significance of the paths.

*Mediation Analysis*

For the hypothesised effects, paths coefficients, *t*-values and *p*-values were calculated using bootstrapping (5000 samples) testing the statistical significance of path coefficients of the hypothesised effects. To evaluate mediating effects, the procedure described in subsubsection 3.3.2 was applied, which is in line with Nitzl, Roldan and Cepeda (2016) and Sarstedt, Ringle and Hair (2021). Figure 4.10 visualises structural path coefficients and the results of the structural model evaluation for hypothesis testing (see also Table 4.18).

Moreover, the mediation was performed for the sub-scales of TWQ to evaluate differences in the path coefficients for balance of contributions, cohesion, communication quality, and mutual support. Figure 4.11 visualises structural path coefficients

Figure 4.10.: Structural Model with Path Coefficients
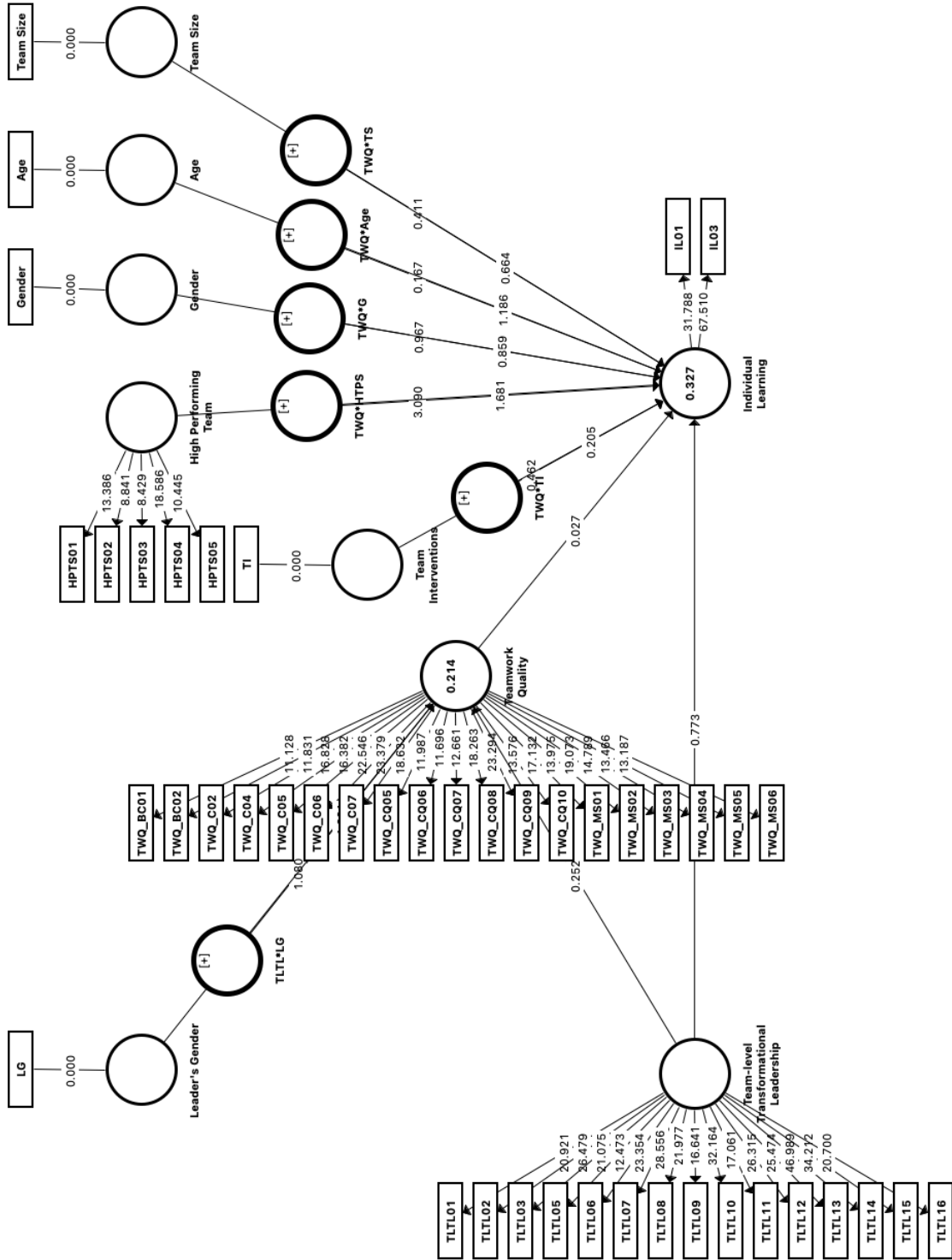
for the sub-scales of TWQ to evaluate the findings (see Table 4.18) in line with Klaic, Burtscher and Jonas (2020).

H1 stated that the perceived TWQ mediates the path between team-level transformational leadership and individual learning. To assess the mediating role of the perceived TWQ mediation analysis was performed. The study's 5000 resamples generate 95 % bias-corrected bootstrapping confidence intervals. A confidence interval not including zero indicates a significant relationship. Figure 4.12 visualises the results for testing the first hypothesis.

Table 4.18 includes the results of the mediation analysis and Figure 4.12 visualises the total effect, the path between team-level transformational leadership and individual learning, ignoring the mediator, was insignificant ($\beta = .05, t = 0.37, p = .709$). The a-path indicated an insignificant effect of the predictor variable team-level transformational leadership on the mediator TWQ ($\beta = -.11, t = 0.26, p = .798$). The b-path from the mediator TWQ to the criterion variable individual learning was insignificant as well ($\beta = -.01, t = 0.03, p = .978$). Furthermore, with the inclusion of the mediating variable (TWQ), the impact of team-level transformational leadership on individual learning did not become insignificant ($\beta = .05, t = 0.75, p = .452$. The indirect effect of team-level transformational leadership on individual learning through TWQ was found to be insignificant ($\beta = .00, t = 0.01, p = .995$).

Therefore, this showed no mediation from the perceived team-level transformational leadership through TWQ on individual learning. Hence, H1 is empirically not substantiated.

H2 suggested that the perceived HPT mediates the path between team-level transformational leadership and individual learning. To evaluate the mediating role of the perceived extend of being a HPT mediation analysis was performed. The study's 5000 resamples generate 95 % bias-corrected bootstrapping confidence intervals. A confidence interval not including zero indicates a significant relationship. Figure 4.13 visualises the results for testing the second hypothesis.

The total effect, the path between team-level transformational leadership and individual learning, ignoring the mediator, was already assessed within the testing of the first hypothesis being insignificant. The a-path indicated a significant effect of the predictor variable team-level transformational leadership on the mediator HPT ($\beta = 0.47, t = 7.89, p < .001$). The b-path from the mediator HPT to the criterion variable individual learning was significant as well ($\beta = -0.31, t = 2.50, p < .010$). Furthermore, with the inclusion of the mediating variable (HPT), the impact of team-level transformational leadership on individual learning did not become significant ($\beta = .05, t = 0.34, p = .44$. The indirect effect of team-level transformational leadership on individual learning through HPT was found to be significant ($\beta = .15, t = 2.45, p < .010$).

Therefore, this showed no mediation from the perceived team-level transformational leadership through HPT on individual learning. Hence, H2 is empirically supported.

Figure 4.11.: Structural Model Including the Subscales of Teamwork Quality with Path Coefficients

Table 4.18.: Results of Structural Model Assessment for Mediation Analysis

| Paths | Paths coefficients | T values | $p$ values | LL | UL |
|---|---|---|---|---|---|
| *Total effects* | | | | | |
| Age -> IL | −0.011 | 0.162 | 0.871 | −0.163 | 0.098 |
| G -> IL | −0.590 | 0.969 | 0.333 | −1.983 | 0.031 |
| HPT -> IL | 0.318 | 3.071 | 0.002 | 0.137 | 0.538 |
| LG -> IL | 0.003 | 0.018 | 0.986 | −0.282 | 0.358 |
| LG -> TWQ | −0.392 | 1.090 | 0.276 | −0.976 | 0.464 |
| TI -> IL | 0.240 | 0.456 | 0.649 | −0.764 | 1.264 |
| TS -> IL | 0.022 | 0.414 | 0.679 | −0.154 | 0.091 |
| TLTL -> IL | 0.052 | 0.374 | 0.709 | −0.269 | 0.323 |
| TLTL -> TWQ | −0.109 | 0.256 | 0.798 | −0.808 | 0.885 |
| TLTL -> HPT | 0.474 | 7.891 | <0.001 | −0.232 | 0.075 |
| TWQ -> IL | −0.007 | 0.027 | 0.978 | −0.508 | 0.468 |
| HPT -> IL | −0.306 | 2.502 | <0.01 | 0.137 | 0.538 |
| *Direct effects* | | | | | |
| Age -> IL | −0.011 | 0.162 | 0.871 | −0.163 | 0.098 |
| G -> IL | −0.590 | 0.969 | 0.333 | −1.983 | 0.031 |
| HPT -> IL | 0.318 | 3.071 | <0.01 | 0.137 | 0.538 |
| LG -> TWQ | −0.392 | 1.090 | 0.276 | −0.976 | 0.464 |
| TI -> IL | 0.240 | 0.456 | 0.649 | −0.764 | 1.264 |
| TS -> IL | 0.022 | 0.414 | 0.679 | −0.154 | 0.091 |
| TLTL-> IL | 0.052 | 0.752 | 0.452 | −0.091 | 0.176 |
| TLTL-> TWQ | −0.109 | 0.256 | 0.798 | −0.808 | 0.885 |
| TLTL -> HPT | 0.051 | 0.336 | 0.435 | −0.242 | 0.074 |
| TWQ -> IL | −0.007 | 0.027 | 0.978 | −0.508 | 0.468 |
| HPT -> IL | | | | | |
| *Indirect effects* | | | | | |
| LG -> TWQ -> IL | 0.003 | 0.018 | 0.986 | −0.282 | 0.358 |
| TLTL-> TWQ -> IL | 0.001 | 0.006 | 0.995 | −0.239 | 0.268 |
| LG -> HPT -> IL | 0.213 | 1.021 | 0.279 | −0.115 | 0.735 |
| TLTL-> HPT -> IL | 0.145 | 2.454 | <0.001 | 0.223 | 0.636 |

*Note.* N = 224, missing = 0. BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, G = Gender, HPT = High Performing Team, IL = Individual Learning, TI = Team interventions, TLTL = Team-level Transformational Leadership, TS = Team Size, TWQ = Teamwork Quality. Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 4.12.: Visualisation of the Results for the First Mediation Analysis for the Second Main Study

Teamwork Quality

$-0.11$ $-0.01$

Team-Level Transformational Leadership ‑ ‑ ‑ ‑ ‑ 0.05 ‑ ‑ ‑ ‑ → Individual Learning

*Note.* Path coefficients. $R^2 = 0.21$ for Teamwork Quality and $R^2 = 0.33$ for Individual Learning.

Figure 4.13.: Visualisation of the Results for the Second Mediation Analysis for the Second Main Study

High-Performing Team

$0.47$ $-0.31$

Team-Level Transformational Leadership ‑ ‑ ‑ ‑ ‑ 0.05 ‑ ‑ ‑ ‑ → Individual Learning

*Note.* Path coefficients. $R^2 = 0.22$ for High-Performing Team and $R^2 = 0.33$ for Individual Learning.

Table 4.19.: Results of Structural Model Assessment for Moderation Analysis

| Paths | Paths coefficients | T values | $p$ values | LL | UL |
|---|---|---|---|---|---|
| TLTL*LG -> TWQ | 0.273 | 1.344 | 0.179 | −0.220 | 0.604 |
| TWQ*Age -> IL | −0.306 | 1.174 | 0.240 | −0.526 | 0.175 |
| TWQ*G -> IL | 0.302 | 0.859 | 0.390 | −0.058 | 1.015 |
| TWQ*TI -> IL | −0.072 | 0.202 | 0.840 | −0.777 | 0.612 |
| TWQ*TS -> IL | −0.074 | 0.695 | 0.487 | −0.184 | 0.356 |

*Note.* N = 224, missing = 0. TLTL = Team-level Transformational Leadership, TWQ = Teamwork Quality, IL = Individual Learning, G = Gender, LG = Leader's Gender, Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 4.14.: Visualisation of the Results for the First Moderation Analysis for the Second Main Study
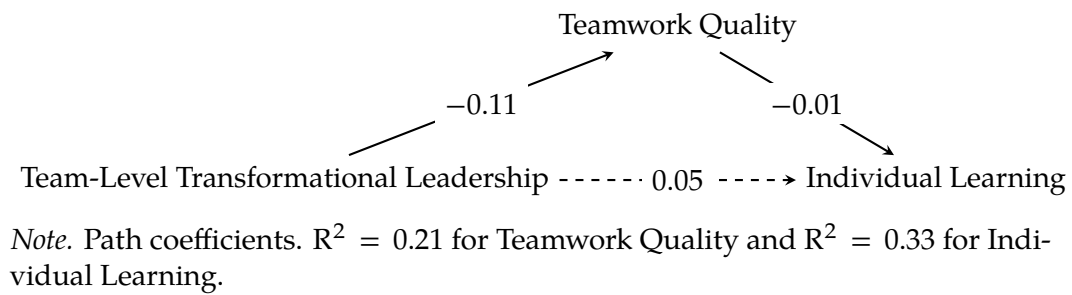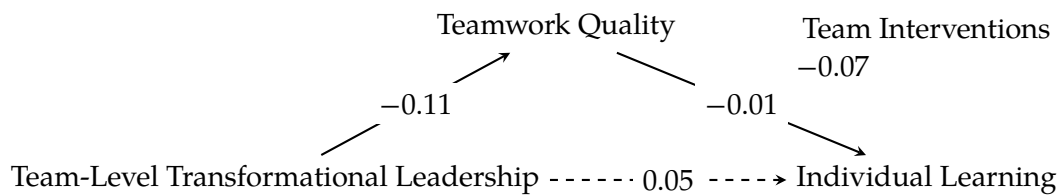


*Note.* Path coefficients. $R^2 = 0.21$ for Teamwork Quality and $R^2 = .33$ for Individual Learning

*Moderation Analysis*

Moderation analysis was performed to evaluate the moderating role of team interventions on the second stage and the control variables of leader's gender on the first stage, as well as age, gender, and team interventions on the second stage.

H3 examined whether team interventions moderated the effect of TWQ on individual learning such that the effect was enhanced when teams engaged in interventions. To assess the moderating role of team interventions, moderation analysis was performed (Hayes, 2015). Figure 4.14 visualises the results for testing the third hypothesis.

Additionally, no significant interaction was found for the second stage with respect to the the three mentioned control variables. This suggests to expect no differences in the effect of TWQ on individual learning for all ages, genders, and team sizes.

The results reveal an insignificant role of team interventions for the effect from TWQ on learning due to an insignificant interaction term (see Table 4.19). Hence, H3
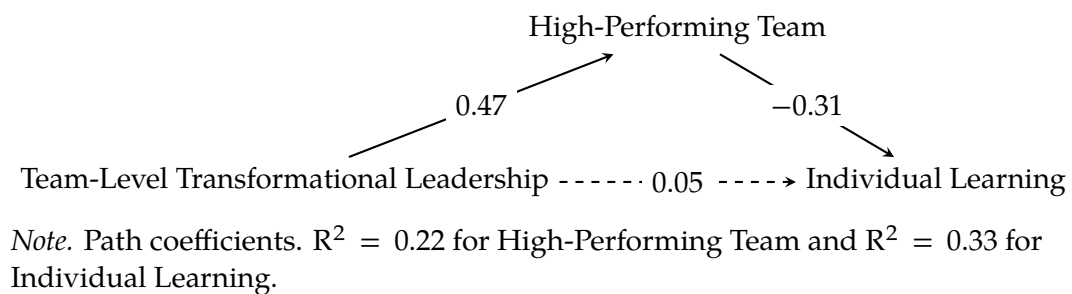
Table 4.20.: Results of Structural Model Assessment for Moderation Analysis

| Paths | Paths coefficients | T values | $p$ values | LL | UL |
|---|---|---|---|---|---|
| HPT*Age -> IL | −0.306 | 1.174 | 0.240 | −0.526 | 0.175 |
| HPT*G -> IL | 0.302 | 0.859 | 0.390 | −0.058 | 1.015 |
| HPT*TI -> IL | 0.151 | 1.212 | 0.228 | −0.217 | 0.063 |
| HPT*TS -> IL | −0.074 | 0.695 | 0.487 | −0.184 | 0.356 |

*Note.* N = 224, missing = 0. TLTL = Team-level Transformational Leadership, HPT = High Performing Team, IL = Individual Learning, G = Gender, LG = Leader's Gender, Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 4.15.: Visualisation of the Results for the Second Moderation Analysis for the Second Main Study
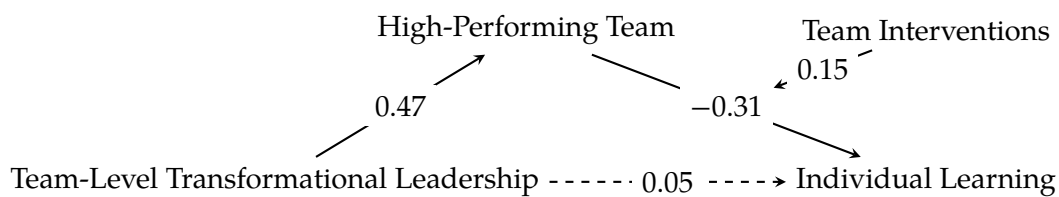


*Note.* Path coefficients. $R^2$ = 0.22 for High-Performing Team and $R^2$ = .33 for Individual Learning

is not supported.

To assess the moderating role of team interventions on the second stage and the control variables of leader's gender on the first stage, as well as age, gender, and team interventions on the second stage, moderation analysis was conducted.

H4 examined whether team interventions moderated the effect of HPT on individual learning such that the effect was enhanced when teams engaged in interventions. Moderation analysis was performed based on Hayes (2015). Figure 4.15 visualises the results for testing the fourth hypothesis.

The results reveal an insignificant role of team interventions for the effect from HPT on learning due to an insignificant interaction term (see **??**) Hence, H4 is not supported.

Similar to the third hypothesis, no moderation was supported by the data for differences in the control variables of age, gender, and team size.

### 4.3.3. Supplementary Post-Hoc Analysis

As TWQ did not mediate the effect between team-level transformational transformational leadership and individual learning (Hypothesis 1), additional post-hoc analyses was performed, after a decomposition of the construct TWQ into its four dimensions (i.e., balance of contributions, cohesion, communication quality, and mutual support). The aim was to examine potential indirect effects of the four TWQ dimensions separately. With this, a multiple-mediator model was tested to examine whether there were differences within the subscales, as was the case for Klaic, Burtscher and Jonas (2020) and the effect on the outcome variable team innovation.

   The results are presented in Table 4.21. Overall, the evaluation of the statistical model includes again $R^2$, $Q^2$ for the endogenous variables TWQ and climate for initiative, and the significance of paths. By evaluating $R^2$ for the dependant variable, the strength of the structural model determines the goodness of the statistical model. However, the cut-off value for an acceptable $R^2$ value is dependent on the study's context (Hair et al., 2012). The results of $R^2$ for TWQ ($R^2 = 0.21$) and individual learning ($R^2 = 0.34$) are above 0.10 indicating the predictive capability. Moreover, $Q^2$ gives information about the predictive relevance of the endogenous constructs with a value above 0 indicating the predictive relevance of the model (Chin, 2010). The values for the current study point to an insignificant prediction of TWQ ($Q^2 = -1.580$) and individual learning ($Q^2 = -0.007$). SRMR indicated no model fit of the data with a cut-off value below 0.10 for an acceptable model fit. An SRMR value of 0.068 indicates an acceptable model fit for this study including all subscales (Hair et al., 2016).

   Table 4.21 includes the results using the subscales of TWQ for a multiple mediation model. The total effect, the path between team-level transformational leadership and individual learning, ignoring the mediator, was insignificant ($\beta = .12$, $t = 0.904$, $p = .709$). The a-path indicated an significant effect of the predictor variable team-level transformational leadership on the mediator.

- balance of contributions ($\beta = .10$, $t = 4.21$, $p < .001$),

- cohesion ($\beta = .47$, $t = 8.17$, $p < .001$),

- communication quality ($\beta = 0.39$, $t = 6.61$, $p < .001$),

- mutual support ($\beta = .34$, $t = 5.60$, $p < .001$),

The b-path from the mediator

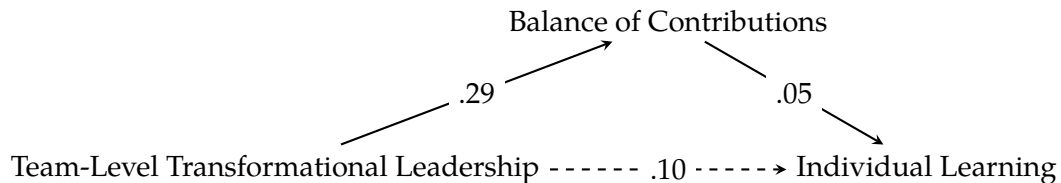- balance of contributions to the criterion variable individual learning was insignificant as well ($\beta = 0.05$, $t = 0.23$, $p = .820$),

- cohesion to the criterion variable individual learning was insignificant as well ($\beta = .09$, $t = 0.28$, $p = .779$),

- communication quality to the criterion variable individual learning was insignificant as well ($\beta = .02$, $t = 0.05$, $p = .963$),

Table 4.21.: Results of Structural Model Assessment for Mediation Analysis with Teamwork Quality Subscales

| Paths | Paths coefficients | T values | *p* values | LL | UL |
|---|---|---|---|---|---|
| *Total effects* | | | | | |
| TLTL-> IL | 0.118 | 0.904 | 0.366 | −0.121 | 0.393 |
| *Direct effects* | | | | | |
| HPTS -> IL | 0.352 | 3.083 | 0.002 | 0.126 | 0.569 |
| TWQBC -> IL | 0.049 | 0.228 | 0.820 | −0.343 | 0.558 |
| TWQC -> IL | 0.087 | 0.281 | 0.779 | −0.534 | 0.662 |
| TWQCQ -> IL | 0.015 | 0.047 | 0.963 | −0.587 | 0.638 |
| TWQMS -> IL | −0.136 | 0.327 | 0.744 | −0.983 | 0.630 |
| TI -> IL | 0.093 | 0.139 | 0.890 | −1.087 | 1.488 |
| TLTL-> IL | 0.103 | 1.308 | 0.191 | −0.031 | 0.280 |
| TLTL-> TWQBC | 0.290 | 4.205 | <0.001 | 0.141 | 0.411 |
| TLTL-> TWQC | 0.466 | 8.173 | <0.001 | 0.334 | 0.564 |
| TLTL-> TWQCQ | 0.391 | 6.606 | <0.001 | 0.258 | 0.492 |
| TLTL-> TWQMS | 0.338 | 5.597 | <0.001 | 0.203 | 0.444 |
| *Indirect effects* | | | | | |
| TLTL-> TWQCQ -> IL | 0.006 | 0.045 | 0.964 | −0.231 | 0.275 |
| TLTL-> TWQMS -> IL | −0.046 | 0.311 | 0.756 | −0.390 | 0.212 |
| TLTL-> TWQC -> IL | 0.041 | 0.273 | 0.785 | −0.253 | 0.321 |
| TLTL-> TWQBC -> IL | 0.014 | 0.218 | 0.828 | −0.104 | 0.180 |

*Note.* N = 224, missing = 0. BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, G = Gender, HPTS = High Performing Team Survey, IL = Individual Learning, TI = Team interventions, TLTL = Team-level Transformational Leadership, TS = Team Size, TWQ = Teamwork Quality. Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 4.16.: Visualisation of the Results for the Mediation Analysis with Balance of
Contributions as Mediating Variable for the Second Main Study



*Note. beta* values. $R^2 = 0.21$ for Teamwork Quality and $R^2 = 0.33$ for Individual
Learning.

- mutual support to the criterion variable individual learning was insignificant as well ($\beta = -.14, t = 0.33, p = .744$),

Furthermore, with the inclusion of the mediating variables the impact of team-level transformational leadership on individual learning was insignificant ($\beta = .10, t = 1.31, p = .191$.

The indirect effect of team-level transformational leadership on individual learning

- through balance of contribution was found insignificant ($\beta = .01, t = 0.22, p = .828$),

- through cohesion was found insignificant ($\beta = .04, t = 0.27, p = .785$),

- through communication quality was found insignificant ($\beta = .01, t = 0.05, p = .964$),

- and through mutual support was found insignificant ($\beta = -.05, t = 0.31, p = .756$).

Therefore, this showed no mediation from the perceived team-level transformational leadership through balance of contributions (see Figure 4.16), cohesion (see Figure 4.17), communication quality (see Figure 4.18), or mutual support (see Figure 4.19) on individual learning. However, the the path between team-level transformational leadership and all four mediating variables was significantly positive.

Moreover, the moderation of the subscales was examined to analyse whether there were differences within the subscales for the moderating variable of team interventions with the subscales of TWQ Klaic, Burtscher and Jonas (2020).

Therefore, this showed no moderating effect between the mediating variable balance of contributions and the moderating variable team interventions on the oath to individual learning, such that the perceived balance of contributions was not higher when teams engaged in team interventions (see Figure 4.20).

Figure 4.17.: Visualisation of the Results for the Mediation Analysis with Cohesion as Mediating Variable for the Second Main Study

Cohesion

.47   .04

Team-Level Transformational Leadership - - - - - - .04 - - - - - → Individual Learning

*Note. beta* values. $R^2 = 0.21$ for Teamwork Quality and $R^2 = 0.33$ for Individual Learning.

Figure 4.18.: Visualisation of the Results for the Mediation Analysis with Communication Quality as Mediating Variable for the Second Main Study

Communication Quality

.39   .02

Team-Level Transformational Leadership - - - - - - .01 - - - - - → Individual Learning

*Note. beta* values. $R^2 = 0.21$ for Teamwork Quality and $R^2 = 0.33$ for Individual Learning.
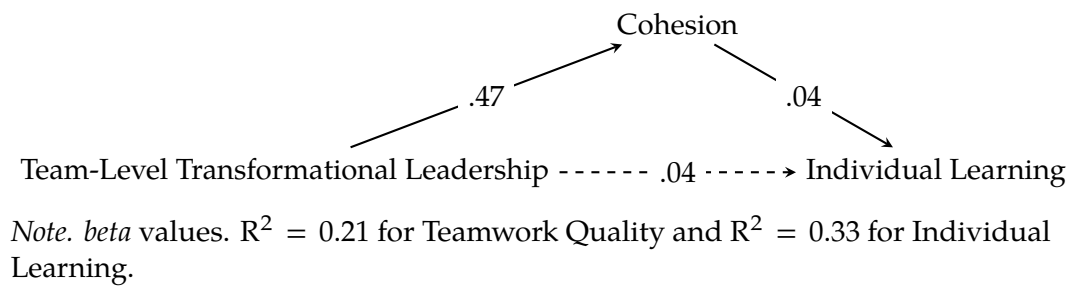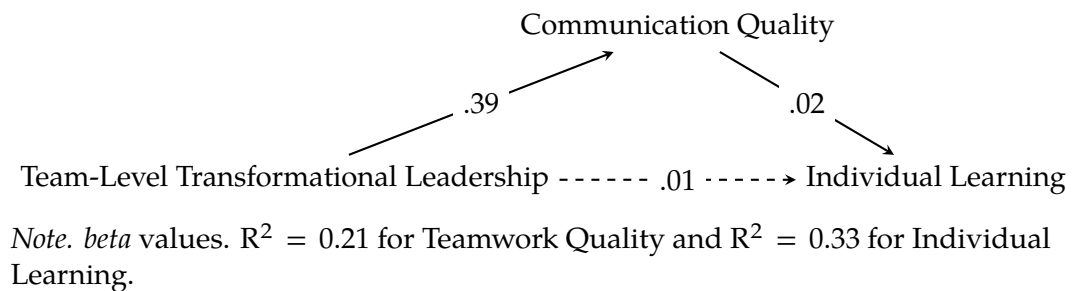
Figure 4.19.: Visualisation of the Results for the Mediation Analysis with Mutual Support as Mediating Variable for the Second Main Study

Mutual Support

.34   −.14

Team-Level Transformational Leadership - - - - - −.05 - - - - → Individual Learning

*Note. t* values. $R^2 = 0.21$ for Teamwork Quality and $R^2 = 0.33$ for Individual Learning.
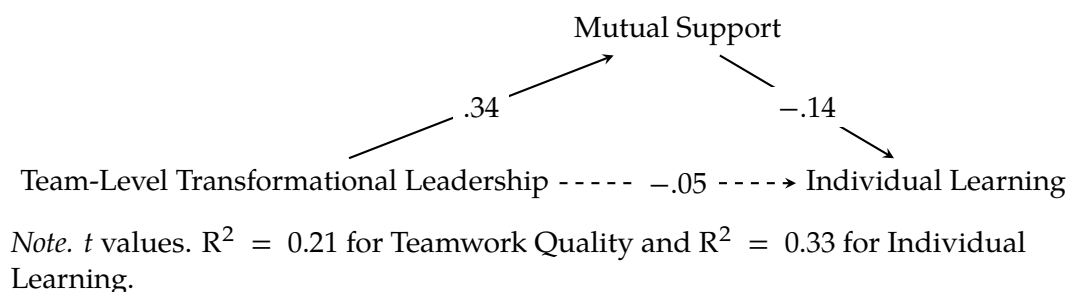
Table 4.22.: Results of Structural Model Assessment for Moderation Analysis with Teamwork Quality Subscales

| Paths | Paths coefficients | T values | *p* values | LL | UL |
|---|---|---|---|---|---|
| TWQBC*TI -> IL | −0.093 | 0.323 | 0.747 | −0.779 | 0.413 |
| TWQC*TI -> IL | −0.043 | 0.106 | 0.915 | −0.810 | 0.788 |
| TWQCQ*TI -> IL | −0.100 | 0.249 | 0.803 | −0.900 | 0.680 |
| TWQMS*TI -> IL | 0.223 | 0.358 | 0.721 | −0.947 | 1.465 |

*Note.* N = 224, missing = 0. BC = Balance of Contributions, C = Cohesion, CQ = Communication Quality, MS = Mutual Support, G = Gender, HPTS = High Performing Team Survey, IL = Individual Learning, TI = Team interventions, TLTL = Team-level Transformational Leadership, TS = Team Size, TWQ = Teamwork Quality. Bias Corrected Confidence Interval of 95 [%] based on bootstrapping (5000 samples), LL = lower level (2.5 [%])
, UL = upper level (97.5 [%])

Figure 4.20.: Visualisation of the Results for the Moderation Analysis for the Second Main Study with the Mediating Variable Balance of Contributions
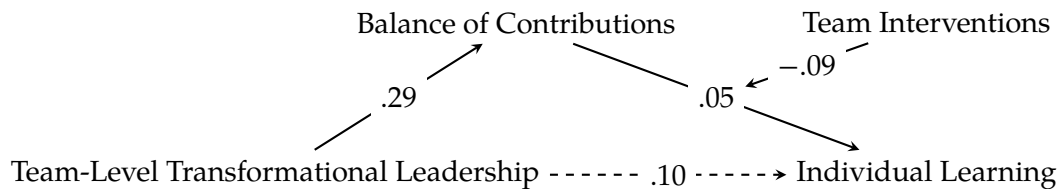


*Note. beta* values. $R^2$ = 0.21 for Teamwork Quality and $R^2$ = .33 for Individual Learning

Figure 4.21.: Visualisation of the Results for the Moderation Analysis for the Second Main Study with the Mediating Variable Cohesion
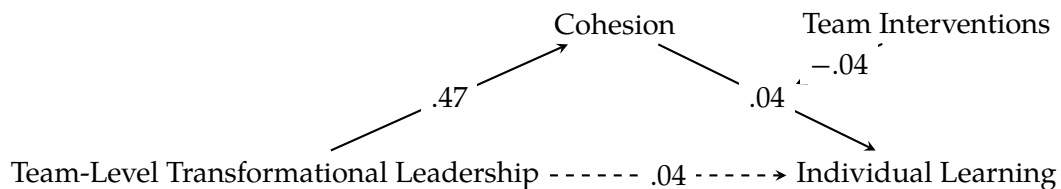


*Note. beta* values. $R^2$ = 0.21 for Teamwork Quality and $R^2$ = .33 for Individual Learning

Figure 4.22.: Visualisation of the Results for the Moderation Analysis for the Second Main Study with the Mediating Variable Communication Quality

Communication Quality     Team Interventions

.39        .02    −.10

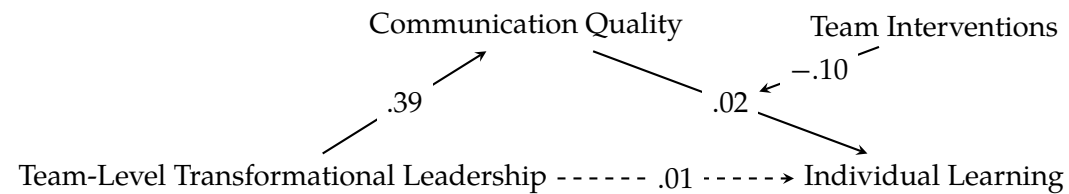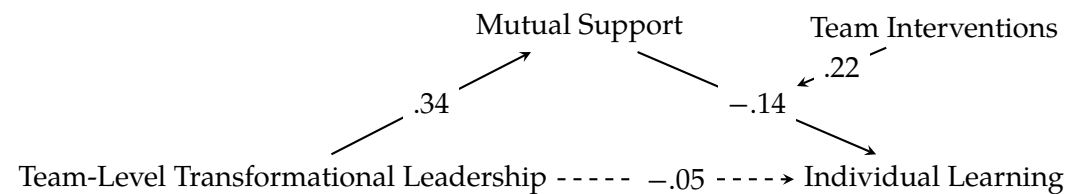Team-Level Transformational Leadership - - - - - - .01 - - - - - → Individual Learning

*Note. beta* values. $R^2 = 0.21$ for Teamwork Quality and $R^2 = .33$ for Individual Learning

Figure 4.23.: Visualisation of the Results for the Moderation Analysis for the Second Main Study with the Mediating Variable Mutual Support

Mutual Support     Team Interventions

.34        −.14    .22

Team-Level Transformational Leadership - - - - - −.05 - - - - → Individual Learning

*Note. beta* values. $R^2 = 0.21$ for Teamwork Quality and $R^2 = .33$ for Individual Learning

 

This was also the case for the mediating variable cohesion and the moderating variable team interventions on the oath to individual learning (see Figure 4.21). The interaction term did not show significance.

For the further two moderation analyses of the mediating variables communication quality (see Figure 4.22) and mutual support (see Figure 4.23) it was the same.

To control for differences regarding leaders' gender for the first stage, and HPTS, participant's gender, age, or team size for the second stage, a moderation analysis was performed to assess the moderating roles for the effect of team-level transformational leadership on TWQ and TWQ on individual learning. For the first stage, the findings revealed an insignificant role of leader's gender for the relationship between team-level transformational leadership and TWQ due to an insignificant interaction term ($\beta = .05, t = 0.76, p = .445$). For the second stage, HPTS also did not indicate a significant role on the path between TWQ and individual learning. No significant moderating role was found for the second stage for participant's gender ($\beta = -.21, t = 2.25, p < .05$), age ($\beta = -.21, t = 1.08, p = .277$) and team size ($\beta = -.21, t = 1.08, p = .277$) due to an insignificant interaction term. After having described the results the next section discusses the results.

## 4.4. DISCUSSION

In this section, first the results of the study are interpreted in the light of the current state of research. Second, the strengths and possible limitations of the current study are discussed. Third, there is an outlook on the need for further research and an exploration of the practical implications of the findings.

The goal of this study was to assess the mediating effect of the perceived team-level transformational leadership through the TWQ on individual learning. Additionally it was examined for the four subscales of TWQ, which are balance of contributions, cohesion, communication quality, and mutual support. Moreover, the study investigated the moderating effect of team interventions on the path between TWQ and individual learning, such that the effect was enhanced when teams engaged in team interventions. Additionally it was evaluated as to whether there were differences of moderating effects for the four subscales of TWQ. The proposed hypotheses drew on prior team research, especially the co-evolving model of team research by Mathieu et al. (2019), Mathieu et al. (2017), Mathieu et al. (2015). To provide a snapshot in the light of the COVID-19 pandemic, data were collected in one wave from employees working in software product development teams in Germany, empirically testing the proposed hypotheses.

### 4.4.1. Interpretation and the Context within the Current State of Research

The findings for the criterion variable individual learning are interpreted, which was different to the expectations. Furthermore, the moderating variable is commented upon, which also showed results contrary to expectations. The results for all variables are set in relation to the current state of research. The research design evaluated individuals' perspectives in a multi-organisational study for the area of software product development.

H1 hypothesised the mediating effect of the perceived TWQ between team-level transformational leadership and individual learning. The insights given in the current study do not enlarge the TWQ as a mediating variable to the co-evolving model by Mathieu et al. (2019) but extend the findings by Klaic, Burtscher and Jonas (2020) in the context of software product development. The findings do not indicate TWQ to be a process facilitating individuals into the desired future state of the attitudinal outcome individual learning (Rank, Pace & Frese, 2004), which is discussed in more detail in subsubsection 4.4.1.

H2 suggested the mediating effect of the perceived HPT between team-level transformational leadership and individual learning. The findings within this research do enlarge the HPT construct as a mediating variable to the co-evolving model by Mathieu et al. (2019). The results support HPT to be a process facilitating individuals into the desired future state of the attitudinal outcome individual learning (Rank, Pace & Frese, 2004), which is discussed in more detail in subsubsection 4.4.1.

H3 hypothesised that team interventions moderate the effect between TWQ and individual learning, such that the effect is enhanced when teams engage in team

interventions. A discussion in more depth and with reference to the theoretical framework is given in subsubsection 4.4.1. Moreover, the findings do not support the moderating effect of leader's gender for the first stage nor age, gender, or team size for the second stage.

H4 suggested that team interventions moderate the effect between HPT and individual learning, such that the effect is enhanced when teams engage in team interventions (see subsubsection 4.4.1 for more detail). Additionally, the results do not indicate the moderating effect of leader's gender for the first stage nor age, gender, or team size for the second stage.

Since all moderating effects were not supported in this study and subsubsection 3.3.2, the insights indicate that these variables do not have an influence in the context of software product development. Additionally, it helps leaders and teams to focus on other aspects to set up teams.

From a theoretical perspective, this study suggests the following theoretical implications: By not supporting the effect between team-level transformational leadership via TWQ on individual learning, it contributes to the leadership literature as well as that covering team insights. Therefore, it is necessary to note that recent prior research often focused on perceived team-level mediators and the path to team outcomes, but less on team mediators and the path to individual outcomes or individual-level mediators and team-level outcomes (e. g. Edmondson, 1999; Eisenberger et al., 2005; Klaic, Burtscher & Jonas, 2020; Valls, González-Romá & Tomás, 2016; Xu, Jiang & Wang, 2019). However, the team-level construct of HPT was indicated to mediate the effect between team-level transformational leadership and an individual outcome, which supports prior research.

From a practical perspective, Figure 2.10 showed the organisational structure derived from the literature for the outside-in approach in software product development organisations (see section 2.3). From a theoretical perspective with regards to the second main study, Figure 4.5 visualised the relevant constructs of the second main study in the context of the framework by Mathieu et al. (2017) and Mathieu et al. (2019) (see subsection 3.1.4). To bring both perspectives together with the aim to provide a research-based framework for software product development, Figure 4.24 summarises the measured constructs combined with the practical outside-in organisational structure.

*Interpretation of the Results with regards to Individual Learning*

The results of this study contribute to the literature and the research design is based on the model for embracing complexity by Mathieu et al. (2019). The insights support the role of team-level leadership as a structural and mediating feature, an external influence and a significantly positive effect on the subscales of TWQ, balance of contributions, cohesion, communication quality, and mututal support. There is no support for the effect of the perceived TWQ as a team-level mediating variable on the path between team-level transformational leadership and individual learning as an attitudinal outcome with regards to individual reactions. For the second mediator,

Figure 4.24.: Collaboration Framework for Outside-in Organisational Structures in Software Product Development based on the Results of the Second Main Study
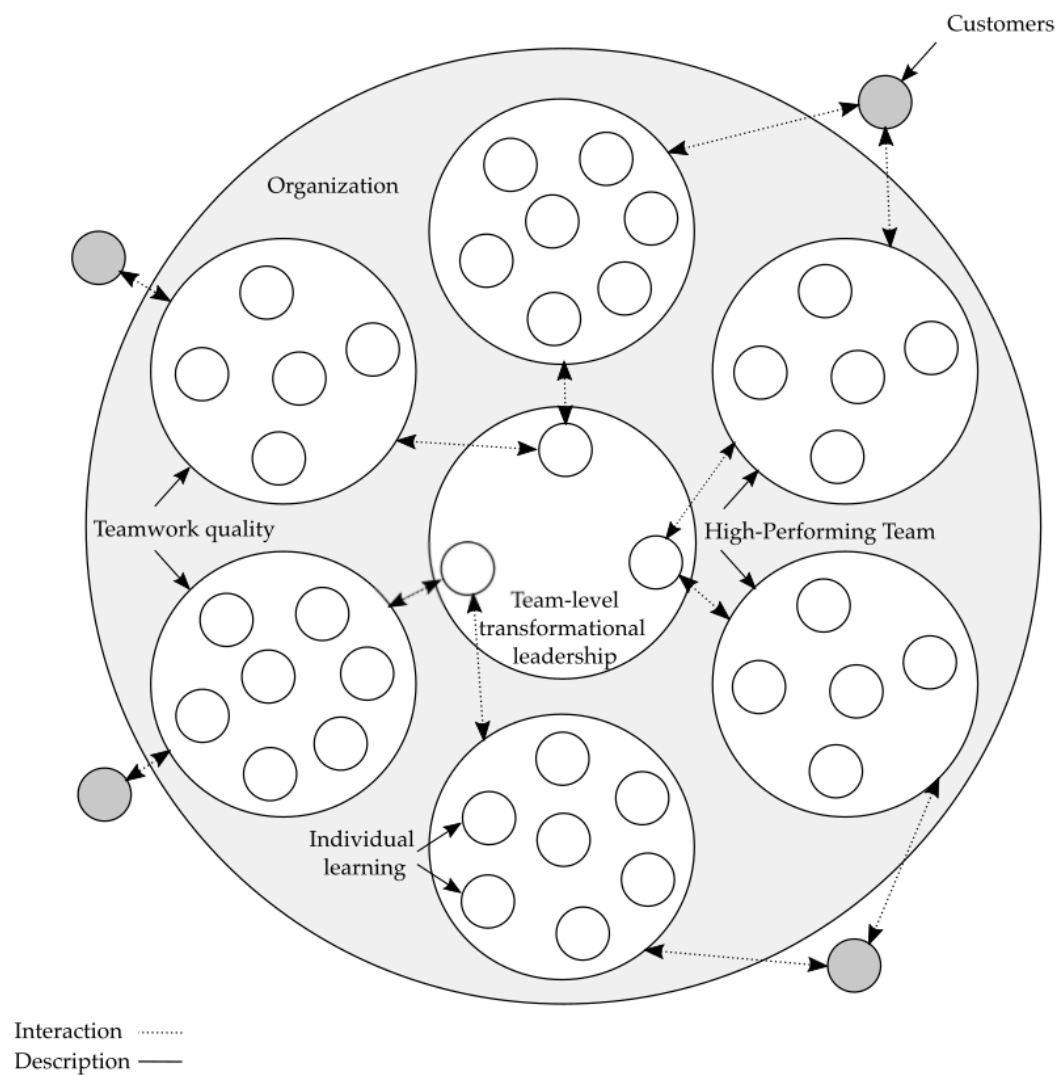
HPT, a significant positive mediation effect was supported for the effect of team-level transformational leadership on individual learning. However, the study adds knowledge to the proposed need to measure constructs triggered by the environment for the context of software product development.

Although learning and the importance of supportive leadership behaviour and work context has been investigated for many years, a lot of research interest still focuses on the aspect of team effectiveness outcomes to be used organisationally, rather than prioritising individual learning and understandings, such as the need to invest in an individual's future. (e.g. Edmondson, 1999; Kozlowski & Ilgen, 2006). Figure 4.25 shows insights given in the second main study with regards to the mediating mechanisms examined. The results of the second main study focus on the team context and point to the relevance of team-level transformational leadership affecting subscales of TWQ but not affecting individual learning through TWQ. Leaders hereby adjust their behaviour with regards to the team's specific needs and foster dimensions of TWQ. Due to the mediating effect of HPT, leaders, organisations, teams, and personal development activities need to support teams to achieve high performance to foster individual learning and make use of it as an organisation. Moreover, the evaluation of the measurement model supports prior findings by Fischer and Hüttermann (2020) to validate the HPTS and enhance knowledge for the target group of software product development.

The results are in contrast to the findings by Klaic, Burtscher and Jonas (2020), who found a positive relationship between team-level transformational leadership and learning, and a mediating effect of specific aspects of TWQ between team-level transformational leadership and individual learning in the context of scientific team members. However, the results of the current study are in line with findings by Jahanshahi, Maghsoudi and Babaei (2020), who concluded for high technology ventures that transformational leadership facilitated the improvement of communication within teams. The descriptive analysis shows the perception of individual learning within the participants of this study being the highest construct (see subsection 4.3.1). These insight support the findings by Dingsoyr et al. (2016), who emphasised the importance of improvements for developing software products.

The results partially support the findings by Nellen, Gijselaers and Grohnert (2019) for team-specific leadership behaviour affecting aspects of teamwork for social and task-related aspects. However, the procedure was different in having the team member's perspective rather than working with nested data of team comparisons. The high value in this study supports the assumption by Klaic, Burtscher and Jonas (2020) for learning to be an essential driver for organisations' success in knowledge-intensive areas.

To answer the first part of the research question for the second main study, the above results and discussions do not support the perceived TWQ mediating the path between team-level transformational leadership and individual learning for members of software development teams, but HPT does so. The next part focuses on the discussion of the results of the current study with regards to team interventions

Figure 4.25.: Mediating Mechanisms within the Collaboration Framework for Outside-in Organisational Structures in Software Product Development based on the Results of the Second Main Study
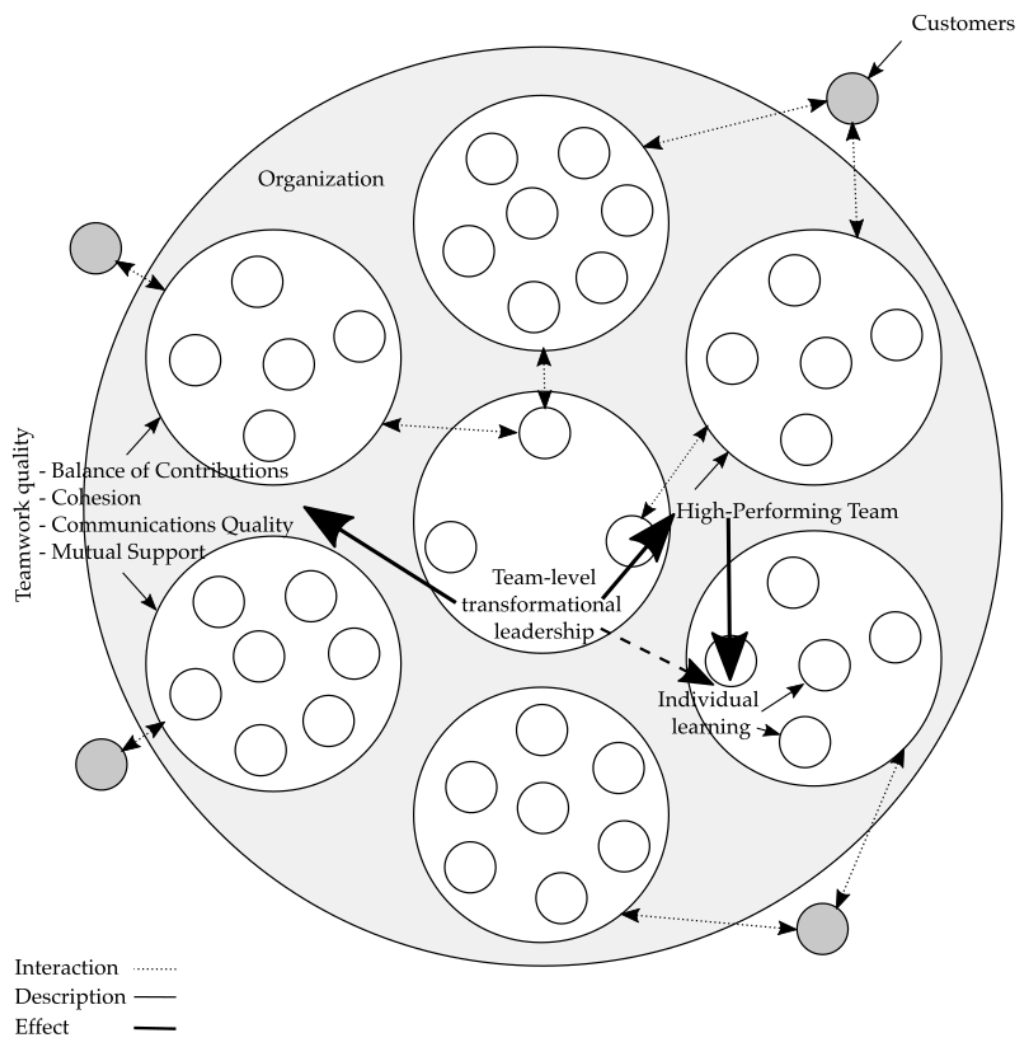
in the light of the current research.

*Interpretation of the Results with regards to Team Interventions*

The insights given by Dingsoyr et al. (2016) pointed to the importance of team building for developing software products. The results of this study support those findings by the majority of participants stating to engage in team interventions (see subsection 4.2.1). The results of 84.82 % of participants stating that their team engages in at least one or more team intervention support Lacerenza et al. (2018) and the assumption that teamwork increases and collaboration gets attentions. Moreover, the ranking and amount of using each kind of team intervention (see subsection 4.2.1) supports the model of social support by Hüffmeier and Hertel (2011) and enlarges their focus of team partners' affective support above the team's performance. With regards to the kind of intervention, the ranking starts with retrospectives as an element of the agile collaboration framework scrum. Retrospectives being the most used team intervention in software development supports the use of developing products for and with the customer and can enhance the team's skills on the way (Zayat & Senvar, 2020).

1. Retrospectives (65.63 %)

2. Team building activities (35.71 %)

3. Peer feedback (28.13 %)

4. Team days (21.88 %)

The dissemination of other team interventions that go beyond the scope of the collaboration method are, according to insights from this study, so far less used. This shows the untapped potential of individual measures or even cross-team measures to expand learning at the individual level to create a self-image as a learning organisation.

Gast, Schildkamp and van der Veen (2017) examined the influence of team-level interventions on individual attitudes and learning as success factors of helpful interventions in the work context of higher education. Due to the high number of participants stating to engage in team interventions, the results support the importance of interventions for the context of software product development. Furthermore, is supports Salas, Reyes and McDaniel (2018), who concluded that a team can not succeed if it does not know how to work well together, including coordinating appropriately and showing helpful communication skills. However, the findings do not support the moderating effect of such interventions in interaction with TWQ as well as HPT increasing the perceived individual learning.

Since this study focuses on an individual outcome and not team outcomes, the proven effect of team interventions being relevant to support transferring team knowledge to individual learning in software product development was not supported with regards to the German hub (e. g. Dingsoyr et al., 2016; Lacerenza et al., 2018).

The results of this study are in line with O'Donovan and McAuliffe (2020) lacking significant empirical results for team interventions influencing other work contextual outcomes. However, since the majority of participants stated their answers had been the same before the pandemic, the high engagement in team interventions seems to be an internalised, established work routine. When being confronted with complex work tasks, the insights given in this study can be used as role model for future collaboration frameworks outside of the area of software product development.

### 4.4.2. Strengths and Limitations

In addition to the above discussion, the current study not only enhances the existing leadership and organisational behaviour literature but also contributes to the need for further research as well as practical, managerial implications. This section points to the need for future research based on the findings of this study to embrace complexity in team research.

Regarding the strengths, the measurement model showed an appropriate fit of the data to the model. Testing reliability and referring to Field (2017) or Taber (2018), all Cronbach's Alpha values are above the threshold of 0.70. Moreover, for all scales, CR is above 0.90, which indicates that all items of the constructs might be only slightly different with satisfying results. The reliability values for team-level transformational leadership (Cronbach's Alpha and CR) were rounded up to .95 which indicates the likelihood of unwanted response behaviour. Since .95 is the lowest border and the values were rounded (up) and all other constructs as well as values of the measurement model are satisfying, reliability was taken as given indicating further research is needed (see subsection 4.4.3). Hair et al. (2019) summarised that Cronbach's Alpha has the potential to be too conservative, whereas CR has the potential to be too liberal, and the truthful reliability of the construct is viewed within these two values, which is unrounded slightly below .95. Therefore, the evaluation of the measurement model was satisfying.

Insights given in this study are evaluated in the context of software development in the German hub. Within this, this study is among the first to provide insights for this specific target group with the potential to be made use of as a role model for collaboration during the pandemic. However, the findings may be utilised by organisations which have not started to use agile methods when tackling complex tasks (Venkatesh et al., 2020). Therefore, the significant positive path between team-level transformational leadership and all subscales of TWQ, i.e., balance of contributions, cohesion, communication quality, and mutual support, provide empirical evidence for practical, managerial use (see subsection 4.4.3).

Additionally, development and validation of the HPTS did not include the target area of software product development. With this, the current study extends prior scientific knowledge for software product development in Germany.

With regards to limitations, the aspects are five-fold. The first aspect is in relation to the timing of conducting the study. The data collection stage took place during the COVID-19 pandemic, when most people were working from home. Therefore, the

current study draws on the individual perspective with cross-sectional data collection to provide practical implications quickly and in a unique situation, risking common method bias. Consequently, the setup needs replication with multi-wave approaches to evaluate the differences and avoid possible biases, without the situational aspect of the pandemic. However, the timing and approach were suitable since the focus was on evaluating the situational, unique timing of the pandemic as an example of global, uncertain, rapid changes. As a result, the findings need to be replicated when individuals, teams and organisations go back to normal work routines. With regards to the influence of the pandemic, the fact of about one third stating that their assessment would have been different before the pandemic, also points to a need to further investigate whether the perception improved or decreased due to the pandemic situation (subsection 4.2.1). Furthermore, there might be a need to improve WFH in virtual teams for members of software product development.

Second, one value for HTMT (0.893) did not reach the threshold of 0.90 (see subsection 4.3.1). Therefore, replication is needed to evaluate discriminant validity.

Third, conducting CFA to evaluate convergent reliability for the four constructs of this study with the threshold of .60 is .10 below the recommendations by Hair, Ringle and Sarstedt (2011), and not in line with subsection 3.3.1. However, it is above the suggested cut-off value of .50 by Hulland (1999) or .60 by Gefen and Straub (2005). Since a cut-off value of .70 would have led to excluding nine more items, the slightly lower cut-off value is valued higher with the consequence of having more items for each scale within the further evaluation. However, all other measurement model assessments and values support this procedure, leading to an acceptable measurement model with the data used in this study.

Fourth, besides the strength of the specific insights for the target group and national focus, the findings of this research do not apply to the technical area in general or the German hub in general. With this, the results need to be handled with caution when seeking to generalise insights beyond this level.

Fifth, taking into account the cross-sectional nature of the research design used, it is impossible to derive definitive causal inferences about the paths reported. For example, it is possible – though unlikely – that individual learning has an impact on team-specific transformational leadership and perceived TWQ or HPT. It will be important for future research to use longitudinal or lagged designs to explore these matters more thoroughly.

### 4.4.3. Further Research and Practical Implications

This section derives the need for future research based on the findings of this study to embrace complexity in team research. Additionally, it deduces practical implications with regards to team-level transformational leadership and collaboration in software product development. First, this section emphasises avenues for future research based on the findings of this study with regards to the constructs examined. Second, with regards to team-level leadership in technology organisations and collaboration in software product development, the results provide empirical evidence for practical

use.

First, to examine the change in post-COVID-19 times and the development over time, as well as avoiding the trap of daily form or other biases like (Debus et al., 2014) showed, this study needs replication as well as longitudinal designs. Secondly, this study neglected the duration of cooperation with the manager and the team. Thus, no conclusions about the moderating role of the duration of the collaboration on the effects studied can be determined. Depending on the duration of the collaboration, the results could be different. This should be controlled for in further studies. Thirdly, this study does not consider the aspect of working from home during the pandemic. Participants were not asked whether they had worked from home or in distributed teams before the pandemic. However, the study did ask whether participants perceived the situation differently than before the pandemic, which was not the case for the majority. Future research should explore the aspect of working from home or in distributed teams in more detail. Fourth, to avoid or control for common-method bias, future studies need to consider multi-wave approaches for data collection, which was not possible within this study due to the intent and scope of collecting a snapshot on the current situation. Additionally, with regards to the reliability of team-level transformational leadership, further research should replicate the findings to make sure that reliability is uncritical for the construct and below the threshold of .95 Fifth, since the results of this study did not support the mediating effect of TWQ mediating the effect between team-level transformtaional leadership and individual learning, further studies should focus on the mediating effect of other team-level outcomes, such as those found for the target group of scientific teams by Klaic, Burtscher and Jonas (2020). Sixth, the insights for members of service firms by Batt-Rawden, Lien Gudbrand and Slaatten (2019), who set up a contextualised framework for team learning using SEM, need to be continued. Their insights indicated a strong positive relationship between (team) learning capability and innovation processes. This indicates that learning not only works as an outcome variable but may also function as a mediator variable, which needs further research to extend the knowledge for the target area of software product development.

Numerous practical or leadership implications arise from the results of the study. However, the recommendations are suitable for the field of software development in Germany, based on data, for the training and development of people in leadership positions in this field. First, it has been shown that it is necessary to continuously improve transformational leadership skills at a team level in order to influence the individual dimensions of TWQ: balance of contributions, cohesion, communication quality, and mutual support. This can be done through, for example, training, coaching, mentoring, facilitated leadership feedback and employee surveys. Since the control of the results does not confirm the moderating effect of the gender of the leader, it is assumed that leadership development can be supported independently of gender and that leaders of all genders can orient themselves to the results.

Second, the level of individual learning in software development in Germany is

high (see section 4.3 and subsubsection 4.4.1), however not due to an effect of TWQ. Focusing on maintaining ongoing learning opportunities by providing challenging but not overwhelming projects needs focus in leadership practice. Additionally, initiatives of sharing knowledge between team members, such as sessions like show and events to showcase what has been learned, may increase this overall level of learning.

Third, due to the mediating effect of HPT, reaching the stage of team members perceiving the stage of team collaboration as performing – beyond forming, norming, and storming – needs support and leadership attention. With this, leaders and other supporting roles within an organisation or team, like the Scrum Master or the human resources department, need to derive suitable supportive actions. Fischer and Hüttermann (2020) recommended the use of the short version of the HPTS repeatedly as a pulse check to evaluate how the status quo of team members' perception from the beginning develops over time, since it takes only one minute to take part in the survey. They suggested the medium and long version for detailed analysis, however due to a longer duration of participation it might be more suitable for assessment at a lesser frequency or at the team level with high team commitment. With this, it is helpful to both analyse team as well as organisational trends in a longitudinal approach. For the team perspective, it can be used, for example, to examine progress within team collaboration with members engaging in team development or when new members join the team. For the organisational perspective, it is useful to analyse, for example, the effectiveness and employees' perception of transformational activities or establishing a new strategic direction in the organisation. All five psychological constructs included in the HPTS scale provide levers to improve team collaboration (Fischer & Hüttermann, 2020, p. 1):

- psychological safety

- dependability and high performance standards

- structure and clarity of roles, plans, and goals

- meaningfulness of work

- impact on the organisation

The insights of this study support Edmondson (1999), who argued that supporting leaders, for example through developing skills suitable for their own everyday leadership, has a positive effect on the perceived level of psychological safety, which is one dimension of HPT, in the team.

Fourth, the data of this study do not support team interventions having a moderating effect on the path between either TWQ or HPT and individual learning. Additionally, neither individual's gender, age, nor team size or the level of perceiving the own team as high-performing had a moderating influence on the same path. For practical use in teamwork, this suggests that there is no need to worry or focus too

much on team setups, and instead focus on setting challenging tasks for the team with a realistic amount of responsibility, time, and budget.

## 4.5.  CONCLUSION AND LINK TO OVERALL DISCUSSION

Continuing the work of the first study and contributing to the ongoing interest in transformational leadership in general, the aims of this study were four-fold: First, the insights given in the second main study emphasise the importance of change and action by supporting not only transformational leadership behaviour overall, but team-level transformational leadership in a more specific manner, as demanded by Carless, Wearing and Mann (2000) or Klaic, Burtscher and Jonas (2020). Despite all criticism, empirically supporting the increasing interest in transformational leadership in general and with a lesser focus on team-level transformational leadership so far, this research enlarges prior knowledge, e. g. by Klaic, Burtscher and Jonas (2020) or Wang and Howell (2010) in the target area of software development. The results of this study show the need for change and action by supporting leaders in showing suitable behaviours to show team-level transformational leadership, as well as thereby guiding teams towards high performance. The findings indicate a starting point for precise and measurable actions for people, especially leaders, working in software product development organisations to improve team-level transformational leadership skills.

Second, the results of the current study indicate team-level transformational leadership being helpful for significantly and positively affecting individual learning via HPT but not via TWQ. Therefore, it is a continuation for contributing to the framework of co-evolving features with regards to team collaboration. This study points to a need to go from an organisational-level of interest to people's perception regarding their team and individual person.

Third, although the results do not support the moderating effect of team interventions on the path between TWQ, HPT and individual learning, the descriptive results indicate that engaging in team interventions is already common within teams, especially engaging in retrospectives. The results of the current research project indicate that team-level transformational leadership behaviours by all genders seem to be lived and perceived with no differentiation for employees of all ages, making training to develop and highlight these behaviours easier.

Finally, this study showed an approach to handle complexity in a theoretical and practical perspective by not only extending the framework of Mathieu et al. (2019) but also deriving precise and measurable actions for people, especially leaders, working in software product development. From the theoretical perspective, this study provides a scientific approach to handle complexity, as demanded by Mathieu et al. (2019) investigating the used constructs in the categories identified by their framework and enlarging it. To bring the insights of the two main studies together, the next chapter includes an overall discussion.

# 5. OVERALL DISCUSSION

This chapter includes an interpretation of both studies in the context of the current state of research, as well as an interpretation of the results with regards to leadership in software development, the mediating effects of the organisation and team, and initiative and individual learning as outcomes. Following this discussion, the overall strengths and limitations of the two studies will be summarised. This chapter closes with the derivation of further research needs drawn from the research results of the two studies and an exploration of the practical implications of the findings.

The dissertation project contributed to the need raised by Fagerholm et al. (2015) to further examine software development from a human perspective, in addition to the already well-considered technical perspective. The thesis started with the overall question on how employees in software development perceive leadership behaviour, their work environment and individual effects in the German labour market during the COVID-19 pandemic as an example of disruptive change. The results of both studies showed that the majority responded that they would have answered the questions in the same way before the pandemic.

This suggests that either collaboration in software development was already used during disruptive changes or to facilitate working habits like virtual collaboration and distributed teams, which were new for other areas, or that, especially due to self-organised structures, leadership behaviour did not change, since working in software development requires a certain level of self-management and responsibility (George, Lakhani & Puranam, 2020). However both studies indicated (partial) mediating effects, and the findings point to the need for leaders, as well as those in roles focusing on individual, team, or organisational development, in software development teams to be aware of those effects and adjust habits, behaviours, and environments continuously. Being amongst the earliest studies focusing on the area of software development in Germany, especially working with agile methods, both studies contributed to theory and practice in a manner similar to Neumann et al. (2021).

Due to the complexity of software development from a technical perspective, this dissertation project outlined the inherent complexity of collaboration in software development. Since mediating effects were supported, although by self-assessment not experiments, the findings indicate effects between people's perception of different levels at work. Due to the dynamics in software development, as well as the increasing importance during the pandemic, the current research gives a snapshot on how individuals perceived working in this area during those unique times. Following the iterative approach of developing software, the two studies offer a starting point for measuring collaboration in software development from an economic perspective as well as continuing on an organisational or team level to break down findings to more

specific, actionable contexts (Venkatesh et al., 2020).

The main research question of the first study asked whether the perceived organisational psychological safety mediates the path between transformational leadership and organisational initiative for members of software development teams. The results not only indicate such an effect, but also extend the prior literature as well as giving guidance for practical contexts (see subsection 3.4.1). Moreover, the results do not support whether this effect from transformational leadership on organisational psychological safety is enhanced when leaders engage in positive leadership behaviours, which shows differences to prior research (Kelloway et al., 2013). With this, the insights emphasise the difference in collaboration in software development from other areas with more traditional approaches.

The main research questions of the second study focused on whether the relationship between the perceived team-level transformational leadership and individual learning was mediated by TWQ and HPT for members of software development teams. The results do not indicate a mediating effect of TWQ but support a mediating effect of HPT between the perceived team-level transformational leadership and individual learning. However, team interventions did not moderate the mediating effect of TWQ and HPT on individual learning, which suggests need for further research (see subsection 4.4.1). The following section summarises the results in a more detailed way in light of the current state of research.

## 5.1. INTERPRETATION AND CONTEXT WITHIN THE CURRENT STATE OF RESEARCH

This section refers back to the initial context and challenges and puts them into the perspective of the research findings of the two studies for the perception of people working in software development during COVID-19 (section 1.1).

Figure 5.1 visualises the constructs of the first and second main study in the context of the framework by Mathieu et al. (2017) and Mathieu et al. (2019).

The results focusing on short durations of collaboration support the findings by Venkatesh et al. (2020) and Mathieu et al. (2019) for understanding teams as dynamic networks, and small complex systems permanently adapting to change. Moreover, the results of both studies support the findings by Poth, Kottke and Riel (2021). They examined the effects in large software development contexts, which is also true for the majority of participants for both studies. The insights given emphasise the results of the fluency and dynamic when working in this area, which requires flexibility of individuals with regards to team constellations and customer problems. Being used to the dynamics can also be an explanation as to why the majority of participants indicated that they would have answered the same way before the pandemic. This also supports statements by Kozlowski and Ilgen (2006) for individuals and teams developing and adapting in response to changing situational demands. In addition, the findings support (Noll, Razzak & Beecham, 2017, para. 1 ) with the high levels of autonomy in software development as a further possible explanation.

Figure 5.1.: Location of the Constructs of Both Studies in the Framework for Team Research
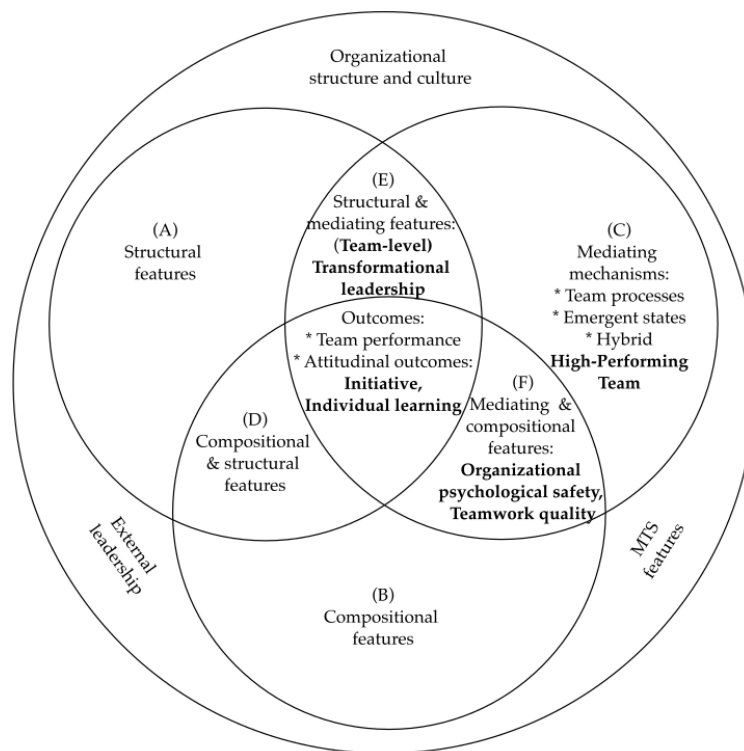


*Note.* Adapted from Mathieu et al. (2017) and Mathieu et al. (2019). Copyright 2017 by the American Psychological Association. Abbreviations: MTS, multiteam systems
.

Table 5.1.: Hypotheses Overview for Both Studies

| Study | Hypothesis | Path Coefficient *beta* | *t* value | Significance | Outcome |
|---|---|---|---|---|---|
| 1 | H1 | 0.549 | 5.668 | p < .001 | Supported |
| | H2 | −0.118 | 1.546 | p = .122 | Not supported |
| 2 | H1 | 0.001 | 0.006 | p = .995 | Not supported |
| | H2 | 0.145 | 2.502 | p < .010 | Supported |
| | H3 | 0.162 | 1.010 | p = .278 | Not supported |
| | H4 | 0.150 | 1.210 | p = .228 | Not supported |

*Note.* For the first study N = 111, missing = 0. For the second study N = 224, missing = 0.

For the first hypothesis of the first study and the second hypothesis of the second study, the results support the strong influence of leadership behaviour on the perception of organisations, team, and individuals (e. g. Carter et al., 2020; Gerlach, Hundeling & Rosing, 2020; Hassi, Rohlfer & Jebsen, 2021; Iqbal, Ahmad & Latif, 2021; Jahanshahi, Maghsoudi & Babaei, 2020; Klaic, Burtscher & Jonas, 2020; van der Voet & Steijn, 2020; Xie et al., 2018). Overall, the results support the findings by Hoda, Salleh and Grundy (2018) for the initial need of the leadership attention to manage change within a work environment and actively promote it.

Table 5.1 summarises the results for testing the hypotheses of both studies.

### 5.1.1. Interpretation of the Results with Regards to Leadership in Software Development

Overall, the findings indicate a need for leaders in software development to not only rely on self-organisation or self-management but to contribute more actively to design the organisational and team environment (Edmondson & Lei, 2014).

As the results of the two studies show, there are at least two aspects to address to get back to the initially derived challenge for change and action subsection 1.1.1: First, as a leader it is necessary to choose appropriate behaviour with regards to creating an organisational psychological safe environment to foster people's initiative. In times of growing importance of software products to solve problems and continuously force organisations to adapt to change, as well as the importance and trend of inter-team collaboration and changing team constellations, there is a need for people looking beyond the boundaries of the team (e. g. Carter et al., 2020; George, Lakhani & Puranam, 2020; Mathieu et al., 2019; Venkatesh et al., 2020; Xie et al., 2018).

Referring to (Carless, Wearing & Mann, 2000) transformational leadership

behaviour included:

- Vision ($M = 3.27$, $SD = 1.17$)

- Staff Development ($M = 3.86$, $SD = 1.19$)

- Supportive Leadership ($M = 3.55$, $SD = 1.23$)

- Empowerment ($M = 3.73$, $SD = 1.23$)

- Innovative Thinking ($M = 3.43$, $SD = 1.23$)

- Leading by Example ($M = 3.41$, $SD = 1.25$)

- Charisma ($M = 3.09$, $SD = 1.23$)

Participants rated the items measuring the perceived transformational leadership behaviour on a five-point Likert scale with higher scores, indicating more perceived transformational leadership from *Rarely or never* to *Very frequently, if not always* ($M = 3.48$, $SD = 0.67$). Those evaluations indicate room for improvement, especially with regards to charisma and vision.

Second, leaders need to (continuously) choose appropriate behaviour in terms of team-level leadership to support HPT and thereby foster individual learning. By doing so, leaders increase group identity, share a group vision, or foster team-building. With this, they can not only improve learning but also innovation (e. g. Hoegl & Gemuenden, 2001; Klaic, Burtscher & Jonas, 2020; Yoon & Kayes, 2016). Participants evaluated the items measuring the perceived team-level transformational leadership behaviour on a five-point scale from *not at all* to *frequently, if not always* (Klaic, Burtscher & Jonas, 2020; Wang & Howell, 2010). The perception of team-level transformational leadership behaviour was above average ($M = 3.11$, $SD = 0.88$. Comparing the results of the two studies gives an indication that people working in software product development perceive slightly more transformational leadership behaviour than team-level transformational leadership behaviour.

Third, despite all contradicting discussions on the advantages and disadvantages of transformational leadership and the redundancy of transformational leadership for newer leadership styles, these studies show the importance and effects of leadership for the self-organised context of agile software development and hereby supports summaries and recommendations by Lee and Edmondson (2017). Additionally, the results are not only relevant for the area of software development, but there may be cultural differences as well. Moreover, Quaquebeke and Felps (2018) stated that, in practice, it is found on a daily basis that all experienced day-to-day behaviour towards staff has an impact. Here, a simple tool that has been little studied scientifically is to ask open-ended questions and listen carefully to the answers.

It is not only relevant to become aware of one's own leadership behaviour, but also to check what and how it is received by the employees and to compare the perception of others with one's own intentions. Both results for the first and second study for the perceived leadership behaviour point to a general need for

improvement in the area of agile software development, which gives a starting point for change and action in the future, to make use of levers for leadership behaviour and thereby positively influence the organisational environmental climate, as well as improve teamwork. Starting with precise communication behaviours as suggested by Quaquebeke and Felps (2018) can be perceived as a small but very effective first step to change one's own leadership behaviour and focus more on the employees.

Fourth, leadership training and development in the area of agile software development needs to focus on relevant behaviours for not only normal and extreme situations, as Hannah et al. (2009) outlined, but also suitable to the challenges during the crisis of the COVID-19 pandemic. This starts with leaders knowing about different leadership styles, reflecting their specific internal and external contexts as well as the teams and specific challenges ahead. Since the majority in both studies stated that they would have rated the perception of their leader, team, organisation and individual the same prior to the pandemic, this is not an excuse for leaders. However, this assessment gives an indication that it is possible that the leadership had room for improvement in the area of agile software development even before the pandemic began, which continued to exist in times of crisis.

The two mediating effects in light of the insights given in the two studies will be discussed in the next section.

### 5.1.2. Interpretation of the Results with Regards to Mediating Effects of the Organisation and the Team

The results of both studies contribute to the framework by Mathieu et al. (2019) (see subsection 1.1.2.) The results of the two studies support the importance of psychological safety to feel comfortable and secure and therefore show behaviour like proactivity or contribution in addition to your team efforts (e. g. Baer & Frese, 2003; Edmondson, 1999; Edmondson & Lei, 2014; Frese et al., 1997; Lee & Edmondson, 2017). Looking at the organisational-level mediating variable, the perceived organisational psychological safety in software product development is above average ($M = 5.37$, $SD = 1.08$). With this, the findings support and enlarge the insights given by Edmondson and Lei (2014) for prior research, which included the relationships to process innovations, organisational learning, organisational performance, knowledge exchange, high-quality relationships and commitment-based human resources practices, by adding individual learning to the relationships examined.

In terms of team-level mediating effects, HPT was also comparably high ($M = 3.73$, $SD = 0.49$) and shows a mediating effect between team-level transformational leadership and individual learning, no matter the leader's gender for the first stage nor team interventions, participant's gender, age, or team size for the second stage.

Both findings indicate the importance of general transformational leadership and the effect on and importance of the organisational environment in the area of agile software development, despite or because of self-organisational structures. The insights highlight the need for awareness and continuous improvement to adapt and prepare the organisation and shape its culture to make it suitable for current and fu-

ture challenges. Not only during the COVID-19 pandemic but also beyond, the results highlight the importance of creating and maintaining suitable work environments, letting employees not only focus on work but also to look left and right.

Moreover, despite all striving for technical and managerial independence in agile software development, the insights of the second study raise the importance of leadership attention and action. Helping the team become a high-performing team can not only be done by Agile Coaches, Scrum Masters or the team itself, but can also be affected by team-specific transformational leadership.

A similarity between organisational psychological safety and the HPT is that HPT also includes the aspect of psychological safety with the item 'Within my team, I can confidently speak openly about problems and mistakes.' (see in Appendix B Table B.14) (Fischer & Hüttermann, 2020). The style of transformational leadership and measuring (organisational) psychological safety in both studies with similar results highlights the importance of awareness from both scientific and practical perspectives for deriving action and further research attention.

In the light of the insights given in the two studies, the two outcome effects will be discussed in the next section.

### 5.1.3. Interpretation of the Results with Regards to Initiative and Individual Learning

Referring to the need for new measures and evaluations, both studies suggest two important outcome measures for software development (see subsection 1.1.3) The results support the demand raised by Fagerholm et al. (2015) to emphasise the human factor in software development. The perceived organisational initiative in the area of software development in Germany is above average ($M = 3.50$, $SD = 0.69$, which indicates long practice and rooting of agile practices in the field based on the underlying manifesto and principles adopted several years ago (van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas, 2001a, 2001b)

The current dissertation project enlarges prior research for both variables, however in different directions: For initiative, prior research often focused on individual levels (e. g. Frese et al., 1997; Rank, Pace & Frese, 2004; Wang & Howell, 2010). However, this study focused on the perception of the organisational level, supporting the direction of results by Hassi, Rohlfer and Jebsen (2021) or Baer and Frese (2003) for the importance of organisational initiative.

Regarding individual learning, the environment of software development, suitable tasks, and internalisation were indicated by the numbers of the highest mean in the second study as being above average ($M = 4.31$, $SD = 0.46$). For prior research often focusing on team-learning, such as Batt-Rawden, Lien Gudbrand and Slaatten (2019), Burmeister et al. (2019) Ramírez Heller, Berger and C. Brodbeck (2014), or Liu and Fu (2011), this study is among the first asking for individual learning (Yoon & Kayes, 2016), especially in the context of software development. Therefore, the

results extend findings by Edmondson (1999) for not only team learning influencing psychological safety, but the prior measured existing organisational psychological safety set, HPT also fostering individual learning. Moreover, the findings by Klaic, Burtscher and Jonas (2020) were adapted for the mediating effect of HPT not TWQ in the context of value-based self-organisational organisation structures. Nevertheless, the second study did not ask for learning from failures directly. The insights given allow speculation as to whether these behaviours also apply in relation to learning from mistakes. The next section highlights the strengths as well as the weaknesses of the studies presented in this thesis (Carmeli & Gittell, 2009).

## 5.2. STRENGTHS AND LIMITATIONS

This dissertation project shows strengths and limitations, which will be outlined in this section. To summarise the strengths of both studies in this dissertation project, they are five-fold: First, the studies are among the earliest to examine the perception of leadership and affecting constructs at the organisational, team, and individual level for the target area of agile software development in Germany. This target group was not only increasingly relevant for the economy and society prior to the pandemic, but became especially important during the pandemic to provide relevant digital products for various use cases, from contact tracing to collaboration, interaction and beyond.

Second, the current research designs were built on the model aiming to embrace complexity in team research designed by Mathieu et al. (2019). The two studies presented here did not only replicate findings for constructs and categories like psychological safety as a mediator, but also enlarged the findings for the target group of people working in agile software development and constructs like initiative or HPT. Additionally, both studies show (partial) mediating effects supporting and enlarging the model for embracing complexity by Mathieu et al. (2019). The current dissertation project not only contributes theoretically but also practically by raising attention for action based on empirical results in the area of agile software development in Germany.

Third, in organisational practice, the impression arises that the influence and relevance of leadership in the context of agile software development is underestimated. There is a tendency towards laissez-faire or non-leadership. For this, both studies show the relevance of both presence and fit of the leadership style for the corresponding work context. In addition, there is scientific support for the far-reaching direct influence that leadership behaviour has on phenomena at both the organisation and team levels. Through the meditating effects identified, it becomes clear not only how complex cooperation is, but also that it is not helpful to simplify reality in research models in order to have the good feeling of mastering it. Rather, the results of the study show that it is crucial, especially for leaders and leadership development, to be aware of the complexity and to look for, implement and measure the effectiveness of appropriate measures in order to continuously improve.

Fourth, both studies included several moderating variables such as team size, gender, age, or team interventions. The findings in both cases do not support mediating effects for any of these variables. On the one hand these insights help to focus on content and effects between constructs, while on the other hand it takes away the possibility of blaming missing team results on these aspects. Thus, it is clear from the studies that, today and in the future, in the self-organised context of agile software development, it is a matter of measuring core aspects of cooperation, such as achieving the phase of a high-performing team.

Fifth, the results indicate that the perception of collaboration is different in the context of agile software development than in classical, more hierarchical organisations and teams. This indicates the need to assess constructs, relationships, and effects for agile software development and to avoid transferring findings regarding leadership, collaboration or perceptions of work from classical, hierarchical organisations without measuring them again for this target group.

Pointing to the limitations of the research design, there are three main aspects to mention, which include and unite both studies. First, for common method bias it cannot be ruled out that this effect does not apply. Due to the one-wave approach used to capture the current mood in the acute phase of the COVID-19 pandemic and to give a flash of perception in the socially and economically important field of software development, common method bias can be seen as critical beyond the calculations and actions taken in each study to avoid it (see section 3.3 and section 4.3), which should be replicated in a multi-wave approach.

Second, results based on self-assessments tend to suffer from bias effects. To prevent this, all data were not only collected anonymously but also with corresponding information in the introduction and in the general introductory texts before each scale. These texts pointed out spontaneous answers and the fact that there were no right or wrong answers, but that one's own perception was of interest.

Third, the statistical approach according to PLS-SEM can be considered critical, as this approach is often accused of working with too small samples. This was taken into account with corresponding preliminary determinations of the sample size. Due to the complexity of the research design, the chosen procedure is still considered helpful.

To make further use of the insights given and to offer guidance, the following section provides an outlook for theory and practice.

## 5.3. FURTHER RESEARCH AND PRACTICAL IMPLICATIONS

This section includes the needed actions derived from this dissertation project, which includes a further research need followed by practical implications for the area of software product development.

### 5.3.1. Further Research

Moving from the scientific arena to the practical part, the following subsection summarises practical implications based on the results of the studies.

First, future research should focus on leadership awareness of how whether their leadership intentions match with what employees perceive the leadership behaviour to be like in the context of agile software development.

The second aspect is that the snapshot in the situation of the COVID-19 pandemic and the according results of both studies need replication in the post pandemic phase of collaboration. With this, It is not only a replication of the chosen constructs of both studies that is of scientific interest, but also people's perceptions as to whether they rate a difference from before and during the pandemic, which does not only give insights on the development itself but also as to whether the perception in retrospect is different than during the situation itself.

Thirdly, longitudinal studies are needed to evaluate development, for example when the leader or team members change or over time of collaboration. These insights are not only of interest for the organisations in the area of software development itself to derive management action, but also to observe the trends and development of this area with a specific form of collaboration and functioning as a role model in collaboration in self-organised environments.

Fourth, suitable experimental designs are needed to test influences and behaviour from leaders and team members in addition to the snapshots that have been self-reported within both studies, which function as a starting point for empirical evaluations in the target area of interest.

The fifth point relates to the fact that TWQ did not mediate the effect between team-level transformational leadership and individual learning, which did not support the findings by Klaic, Burtscher and Jonas (2020) for the context of scientific teams. Therefore, subsequent research needs to examine several aspects to team-level transformational leadership and transformational leadership to investigate whether the effects are also present with the respective other leadership styles, e.g.:

- Does TWQ mediate the effects between transformational leadership and individual learning?

- Does positive leadership enhance the effects of team-level transformational leadership on the perception of being a HPT?

Sixth, the constructs of the first study with psychological safety and initiative aiming on the perception at the organisational level need to be examined at the team and individual level to analyse whether or not there is a difference. Moreover, for the second study, replications should focus on team learning instead of individual learning as an outcome variable, as well adding the perceived team innovation performance, in line with Klaic, Burtscher and Jonas (2020).

Besides giving guidance for further research, the results of this dissertation project give orientation and show levers of managerial and practical use, which is outlined in the following section.

### 5.3.2. Practical Implications

Based on the results of the two studies, with the target group of people working in software product development, the insights emphasise the importance for leaders to show (more) transformational leadership behaviour, which includes on the overall organisational level (Carless, Wearing & Mann, 2000):

- Vision: Communicating a clear and positive vision of the future

- Staff Development: Treating staff as individuals, supporting and encouraging their development

- Supportive Leadership: Giving encouragement and recognition to staff

- Empowerment: Fostering confidence, commitment and teamwork between teammates

- Innovative Thinking: Encouragement to look at problems in new ways and challenge beliefs

- Lead by Example: Being clear about own values and practising what he/she preaches

- Charisma: Instilling pride and respect in others and inspiring them by being highly competent

Due to the examined effects, there needs to be an understanding, acceptance and willingness to continuously ask for feedback, to develop one's own skills and behaviour, actively lead suitable to people's needs, challenge oneself and set expectations to one's own (leadership) highs, even before challenging and having expectations on others.

More specific, team-level transformational leadership behaviour derived from Wang and Howell (2010) and Klaic, Burtscher and Jonas (2020) includes the leader to show the following behaviours:

- supporting all members to be proud of being part of what he/she says and does and emphasising the fact that the team is unique

- sharing the vision and mission, uniting, and communicating to give direction

- acting as team-players and supporting suitable teamwork

- solving conflicts between team members if needed

These aspects can be used to reflect as a leader for the own person, but moreover, to ask for feedback from the team. Besides the use for the leaders themselves, supporting roles focusing on leadership development can help by providing suitable training or coaching activities or moderating feedback sessions between leaders and teams.

From a practical perspective, Figure 2.10 visualised the organisational structure derived from the literature for the outside-in approach in software product development organisations (see section 2.3). From a theoretical perspective, Figure 5.1 summarised the constructs of the first and second main study in the context of the framework by Mathieu et al. (2017) and Mathieu et al. (2019) (see section 5.1). To bring both perspectives together and to derive a research-based framework for software product development, Figure 5.2 shows the measured constructs in the practical outside-in organisational structure.

To underline the importance of this project, Figure 5.2 sets the focus on the mediating mechanisms. The first main study focused on the organisational frame indicating the meaning of overall transformational leadership via organisational psychological safety affecting (organisation-wide) initiative in software product development. With regards to the teams, the results of the second main study point to the relevance of team-level transformational leadership through teamwork quality affecting individual learning.

The following recommendations are based on the summary for Edmondson and Lei (2014). Leaders have a direct influence on the organisational climate. It is important to be aware of this as individuals. In the circle of leaders, it is important to create clarity and to discuss the idea of climate and leadership behaviour and, in case of doubt, to align them. This supports the recommendations by Newman et al. (2020) for fostering innovations by giving guidance with a clear vision. Especially with regard to psychological security, it is important to be aware of the far-reaching effects that begin with the connection to the initiative shown outside of one's own task. It is important to address and resolve perceived insecurities in collaboration, as well as to help manage complexity and support teams to reduce interdependence where possible or promote smooth collaboration where necessary. It is important that the leader's words and actions are congruent in order to increase credibility and thus perceived psychological safety. Since the focus in organisations is always on performance, the positive connections between psychological safety and performance should be emphasised at this point. Also in terms of further development, it can help to create platforms to actively solicit (critical) questions and thus not only promote identification based on contribution, but also make use of collective intelligence. These (critical) voices must then be appreciated and, in case of doubt, endured in order to promote positive learning effects among employees, even if sympathy as the sum of all similarities can be a trap for the manager here. The advantage for the manager is that previous studies have shown the positive correlation between psychological security and aspects such as learning and performance (Edmondson & Lei, 2014).

To summarise the dissertation project and contribution to the scientific and practical area, the following chapter gives a conclusion.

Figure 5.2.: Collaboration Framework for Outside-in Organizational Structures in Software Development including Psychological Constructs for Operationalising
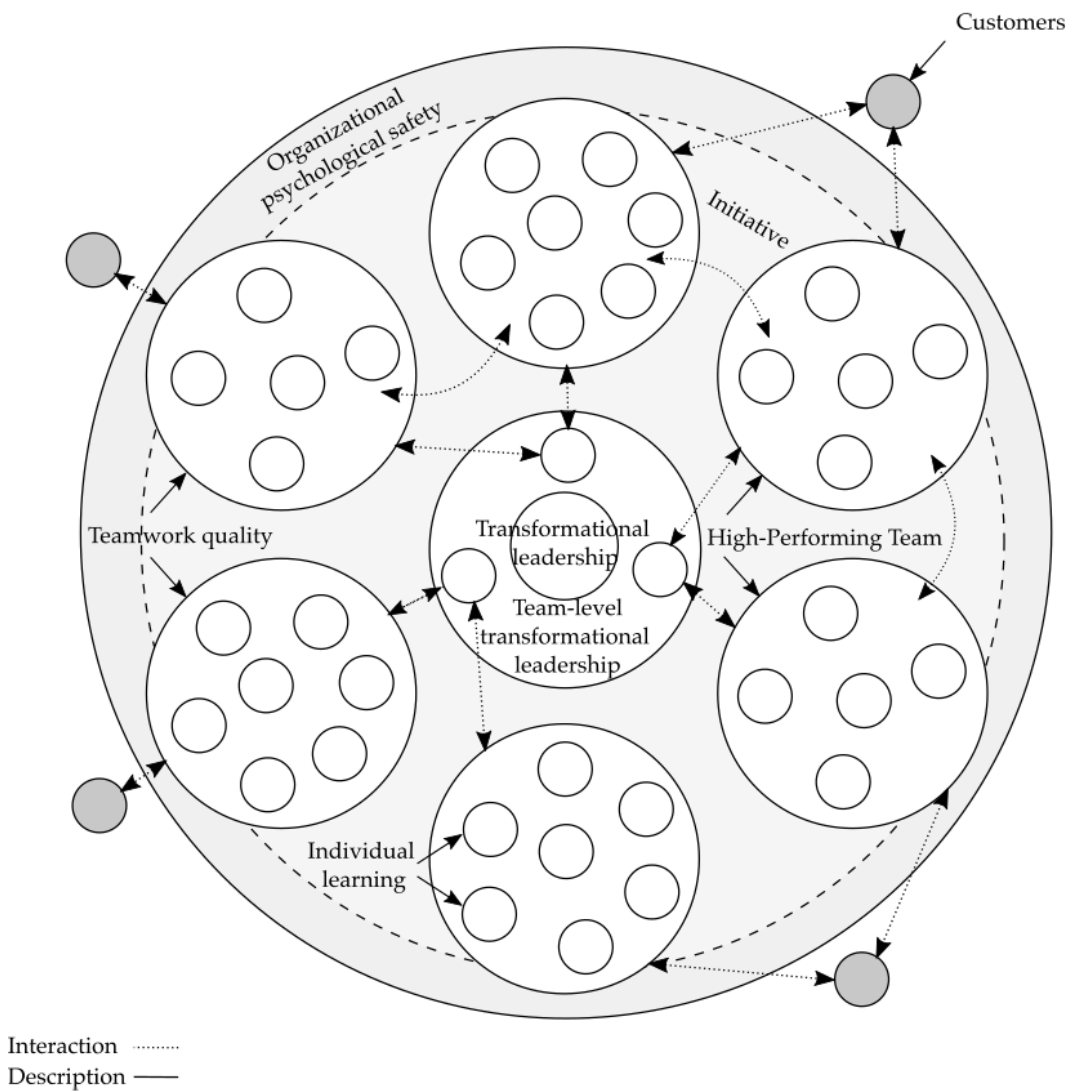


*Note.* Derived from Bailey et al. (2013), Conway (1968), Hoda and Murugesan (2016), Kersten (2017, 2018), Mason and Chakrabarti (2017) and Powell and Bartolome (2020) and Results of the Studies

.

# 6. CONCLUSION

George, Lakhani and Puranam (2020, p. 1757) stated that '[t]here is little doubt that the pandemic has altered the way we live and work'. Moreover, the COVID-19 pandemic emphasised and sped up the need for software products for several kinds of use cases, from contact tracing for medical use to collaboration for work life. However, prior research in the technical area has rarely focused on the socio-emotional aspects of collaboration (Poth, Kottke & Riel, 2021). This dissertation contributed to the need for understanding the perception of people working in the area of software development with regards to several aspects of work.

Especially with the approach of understanding teams as dynamic systems, adjusting to change constantly is characteristic to this dissertation project. Short durations of collaboration were also supported by the results within this dissertation project. The insights given provide the opportunity to not only improve leadership styles or working conditions for individual needs but also to derive actions for dynamic teams and organisational settings (e. g. Bapuji et al., 2020; Mathieu et al., 2019; Mathieu et al., 2017; Mathieu, Wolfson & Park, 2018). Moreover, this dissertation provides general insights and levers for those working in software development teams in Germany. The studies conducted have contributed to the need to better understand individual perspectives of people having those rare yet needed skills of working in software development (Venkatesh et al., 2020).

In general, the results derived from PLS-SEM analysis revealed satisfactory results for the measurement and statistical models of both studies of this dissertation project. Therefore, the data evaluation indicates concrete action points in order to foster suitable leadership behaviour, and change as well as to develop an appropriate environment for collaboration. Table 6.1 summarises the research questions and constructs for both studies.

Overall, the dissertation project followed the question of how employees in software development perceive leadership behaviour, their work environment, and individual effects in the German labour market during the COVID-19 pandemic as an example of disruptive change by splitting it into two studies:

On the organisational level, the results of the first study suggest that transformational leadership behaviours affecting organisational psychology are partially mediated by organisational initiative. With this, employees showing organisational initiative engage beyond working by rule. Leaders therefore need to create and communicate a vision, engage in staff development, provide support, empower employees in general but also be innovative in thinking. Moreover, leaders need awareness of leading by example and practising what they preach, and inherently being charismatic (Carless, Wearing & Mann, 2000).

Within the second study, the results reveal a partially mediating effect of the

Table 6.1.: Overview of Research Questions and Constructs for Each Study

| Study and Research Question |
| --- |
| **Study 1** |
| Does the perceived organisational psychological safety mediate the path between transformational leadership and organisational initiative for members of software development teams? And is this enhanced when leaders engage in positive leadership behaviours? |
| Constructs |
| • Transformational leadership<br><br>• Organisational psychological safety<br><br>• Organisational initiative<br><br>• Positive Leadership |
| **Study 2**<br>Is the relationship between the perceived team-level transformational leadership and individual learning mediated by TWQ respectively working in a HPT for members of software development teams? Do team interventions moderate the mediating effect of TWQ respectively HPT on individual learning? |
| Constructs |
| • Team-level transformational leadership<br><br>• Teamwork quality<br><br>• High-performing team<br><br>• Individual learning<br><br>• Team interventions |

*Note.* TWQ = teamwork quality, HPT = high-performing team

perception of working in a high-performing team between team-level transformational leadership and individual learning. Besides self-organisational structures, leaders can derive awareness on the importance of also paying enough attention to teams by supporting all members with what he/she says and does to be proud of being part of a team and emphasising its uniqueness. Additionally, as a leader, acting like a team-player and supporting suitable teamwork is important. Leaders are needed especially for solving conflicts between team members if needed (Klaic, Burtscher & Jonas, 2020; Wang & Howell, 2010).

However, the results of the second study did not indicate a mediating effect of the quality of teamwork between team-level transformational leadership and individual learning, nor did they support any moderating effects. Both studies open up avenues for future research in an area with an increasing global need and a responsibility, today and in the future. Based on empirical evidence, both studies point to a theoretical contribution for the underlying model of embracing team research by Mathieu et al. (2019) as well as a practical use with regards to leadership behaviour, development, and training, as well as organisational and team improvements within software development.

Additionally, from an individual leadership perspective, leaders can derive actions from the insights given to adjust leadership behaviours favouring collaboration during and post the COVID-19 pandemic (Dirani et al., 2020). This dissertation project therefore has raised awareness on the potential of increasing suitable leadership behaviours for organisational, team, and individual effects. Stoica et al. (2016) emphasised the importance of healthy, motivated people in software development projects, and their knowledge and experiences. The results of the two studies add empirical evidence for the need of suitable leadership behaviour for achieving the project's targets and meeting customer needs.

Overall, the majority of participants in both studies stated that they perceived the situation during the pandemic the same way as before. Whether this is assessed as reassuring in the sense of stable working conditions or alarming in the sense of a lack of adaptation to changing conditions is left to be assessed in the individual context and through future research. However, the majority of participants for both studies used collaboration methods like Scrum or Kanban, or adapted forms of both working methods. Combining the statement of not perceiving differences with regards to the perception of the current situation and insights given by Stoica et al. (2016) supports the rapid adaptability of companies using agile business architectures and flexible solutions.

Figure 6.1 summarises the collaboration framework for software development derived from data collected in Germany during the COVID-19 pandemic, including the effects supported by the data.

Overall, this dissertation is among the first research projects on leadership effects on collaboration for the target area of software development in Germany, especially during the COVID-19 pandemic, giving a snapshot on how people feel working in this area in such a unique yet disruptive time.

Figure 6.1.: Research Based Collaboration Framework for Outside-in Organisational
　　　　　Structures in Software Development
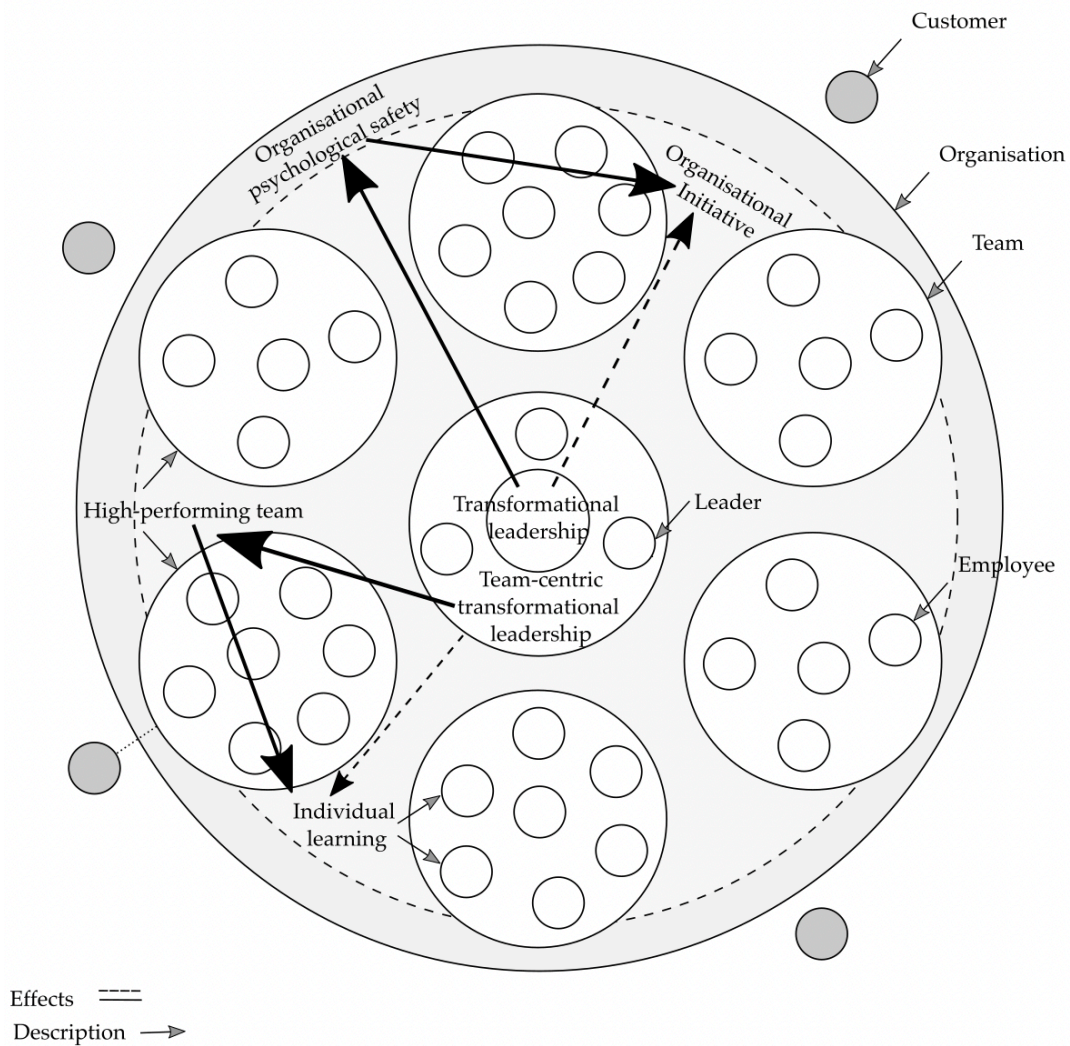


*Note.* Own visualisation based on insights from Bailey et al. (2013), Conway (1968),
Hoda and Murugesan (2016), Kersten (2017, 2018), Mason and Chakrabarti (2017)
and Powell and Bartolome (2020), and results of the dissertation project
.

# A. BIBLIOGRAPHY

Adams, B. G., Meyers, M. C. & Sekaja, L. (2019). Positive leadership: Relationships with employee inclusion, discrimination, and well-being. *Applied Psychology*, *69*(4), 1145–1173. https://doi.org/10.1111/apps.12230

Aguinis, H., Gottfredson, R. K. & Joo, H. (2013). Best-practice recommendations for defining, identifying, and handling outliers. *Organizational Research Methods*, *16*(2), 270–301. https://doi.org/10.1177/1094428112470848

Alvesson, M. & Einola, K. (2019). Warning for excessive positivity: Authentic leadership and other traps in leadership studies. *The Leadership Quarterly*, *30*(4), 383–395. https://doi.org/10.1016/j.leaqua.2019.04.001

Anderson, M. H. & Sun, P. Y. T. (2017). Reviewing leadership styles: Overlaps and the need for a new 'full-range' theory. *International Journal of Management Reviews*, *19*(1), 76–96. https://doi.org/10.1111/ijmr.12082

Anderson, N. R. & West, M. A. (1994). *The team climate inventory: Manual and users' guide.* Windsor : ASE.

Anderson, N., Potočnik, K. & Zhou, J. (2014). Innovation and creativity in organizations. *Journal of Management*, *40*(5), 1297–1333. https://doi.org/10.1177/0149206314527128

Avey, J. B., Avolio, B. J. & Luthans, F. (2011). Experimentally analyzing the impact of leader positivity on follower positivity and performance. *The Leadership Quarterly*, *22*(2), 282–294. https://doi.org/10.1016/j.leaqua.2011.02.004

Baer, M. & Frese, M. (2003). Innovation is not enough: Climates for initiative and psychological safety, process innovations, and firm performance. *Journal of Organizational Behavior*, *24*(1), 45–68. https://doi.org/10.1002/job.179

Bailey, S. E., Godbole, S. S., Knutson, C. D. & Krein, J. L. A decade of conway's law: A literature review from 2003-2012. In: *2013 3rd international workshop on replication in empirical software engineering research*. IEEE. Baltimore, MD, USA: IEEE, 2013, October. https://doi.org/https://doi.org/10.1109/RESER.2013.14.

Bakker, A. B. (2005). Flow among music teachers and their students: The crossover of peak experiences. *Journal of Vocational Behavior*, *66*(1), 26–44. https://doi.org/10.1016/j.jvb.2003.11.001

Banks, G. C., Davis McCauley, K., Gardner, W. L. & Guler, C. E. (2016). A meta-analytic review of authentic and transformational leadership: A test for redundancy. *The Leadership Quarterly*, *27*(4), 634–652. https://doi.org/10.1016/j.leaqua.2016.02.006

Bapuji, H., de Bakker, F. G. A., Brown, J. A., Higgins, C., Rehbein, K. & Spicer, A. (2020). Business and society research in times of the corona crisis. *Business & Society*, *59*(6), 1067–1078. https://doi.org/10.1177/0007650320921172

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. https://doi.org/10.1037//0022-3514.51.6.1173

Bass, B. (1985). *Leadership and performance beyond expectations*. Free Press. https://books.google.de/books?id=NCd-QgAACAAJ

Batt-Rawden, V. H., Lien Gudbrand, L. & Slaatten, T. (2019). Team learning capability – an instrument for innovation ambidexterity? *International Journal of Quality and Service Sciences*, *11*(4), 473–486. https://doi.org/10.1108/IJQSS-02-2019-0026

Beecham, S., Baddoo, N., Hall, T., Robinson, H. & Sharp, H. (2008). Motivation in software engineering: A systematic literature review. *Information and Software Technology*, *50*(9-10), 860–878. https://doi.org/10.1016/j.infsof.2007.09.004

Bernerth, J. B. & Aguinis, H. (2015). A critical review and best-practice recommendations for control variable usage. *Personnel Psychology*, *69*(1), 229–283. https://doi.org/10.1111/peps.12103

Bhavsar, K., Gopalan, S. & Shah, V. (2020). Scrumbanfall: An agile integration of scrum and kanban with waterfall in software engineering [Journal Abbreviation: International Journal of Innovative Technology and Exploring Engineering Publication Title: International Journal of Innovative Technology and Exploring Engineering]. *International Journal of Innovative Technology and Exploring Engineering*, *9*(4). https://doi.org/http://dx.doi.org/10.35940/ijitee.D1437.029420

Birgün, S. & Çerkezoğlu, B. T. (2019). A systematic approach for improving the software management process. *International Journal of Innovation and Technology Management*, *16*(04), 1940006. https://doi.org/10.1142/S0219877019400066

Bonin, H., Krause-Pilatus, A., Rinne, U., Gehlen, A. & Molitor, P. *Research report: Self-employment in germany (2020 update) - short expert report (forschungsbericht: Selbstständige erwerbstätigkeit in deutschland (aktualisierung 2020) – kurzexpertise)*. online. 2020, April. https://www.bmas.de/SharedDocs/Downloads/DE/Publikationen/Forschungsberichte/fb545-selbststaendige-erwerbstaetigkeit-in-deutschland.pdf?__blob=publicationFile&v=1

Brodbeck, F. C., Anderson, N. & West, M. A. (2000). *Das teamklima-inventar: Handanweisung und validierung der deutschsprachigen version [the team climate inventory: Manual and validation of the german version]*. Hogrefe. http://www.psy.lmu.de/wirtschaftspsychologie_en/forschung/working_paper/wop_working_paper_2000_2.pdf

Burmeister, A., Li, Y., Wang, M., Shi, J. & Jin, Y. (2019). Team knowledge exchange: How and when does transformational leadership have an effect? *Journal of Organizational Behavior*, *41*(1), 17–31. https://doi.org/http://dx.doi.org/10.1002/job.2411

Carless, S. A., Wearing, A. J. & Mann, L. (2000). A short measure of transformational leadership. *Journal of Business and Psychology*, *14*(3), 389–405. https://doi.org/10.1023/A:1022991115523

Carmeli, A. & Gittell, J. (2009). High-quality relationships, psychological safety, and learning from failures in work organizations. *Journal of Organizational Behavior*, *30*(6), 709–729. https://doi.org/10.1002/job.565

Carter, D. R., Cullen-Lester, K. L., Jones, J. M., Gerbasi, A., Chrobot-Mason, D. & Nae, E. Y. (2020). Functional leadership in interteam contexts: Understanding 'what' in the context of why? where? when? and who? *The Leadership Quarterly*, *31*(1), 101378. https://doi.org/10.1016/j.leaqua.2019.101378

Cha, J., Kim, Y., Lee, J.-Y. & Bachrach, D. G. (2015). Transformational leadership and inter-team collaboration. *Group & Organization Management*, *40*(6), 715–743. https://doi.org/10.1177/1059601114568244

Cheong, M., Yammarino, F. J., Dionne, S. D., Spain, S. M. & Tsai, C.-Y. (2019). A review of the effectiveness of empowering leadership. *The Leadership Quarterly*, *30*(1), 34–58. https://doi.org/10.1016/j.leaqua.2018.08.005

Chin, W. W., Marcolin, B. L. & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a monte carlo simulation study and an electronic-mail emotion / adoption study. *Information Systems Researc*, *14*(2), 189–217. https://doi.org/10.1287/isre.14.2.189.16018

Chin, W. W. (2010). How to write up and report pls analyses. In V. Esposito Vinzi, W. W. Chin, J. Henseler & H. Wang (Eds.), *Handbook of partial least squares: Concepts, methods and applications* (pp. 655–690). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-32827-8_29

Clarke, S. (2012). Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours. *Journal of Occupational and Organizational Psychology*, *86*(1), 22–49. https://doi.org/https://doi-org.pros1.lib.unimi.it/10.1111/j.2044-8325.2012.02064.x

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Conway, M. E. (1968). How do committees invent. *Datamation*, *14*(5), 28–31.

Csikszentmihalyi, M. (1999). If we are so rich, why aren't we happy? *American Psychologist*, *54*(10), 821–827. https://doi.org/10.1037/0003-066X.54.10.821

Cuellar, R. (2012). Agile software development. *The next wave of technologies* (pp. 243–264). John Wiley & Sons, Ltd. https://doi.org/https://doi.org/10.1002/9781119199946.ch14

Daud, W. N. W., Rahim, M. A., Zainol, F. A. & Ismail, A. G. (2018). Leader's qualities and organisational performance: A case of malaysian takaful operator. *International Journal of Business Performance Management*, *19*(2), 189–208. https://doi.org/10.1504/IJBPM.2018.090700

Debus, M. E., Sonnentag, S., Deutsch, W. & Nussbeck, F. W. (2014). Making flow happen: The effects of being recovered on work-related flow between and within days. *The Journal of applied psychology*, *99*(4), 713–722. https://doi.org/10.1037/a0035881

de Freitas, C. P. P., Damásio, B. F., Tobo, P. R., Kamei, H. H. & Koller, S. H. (2016). Systematic review about personal growth initiative. *Anales de Psicología /*

*Annals of Psychology*, 32(3), 770. https://doi.org/http://revistas.um.es/analesps/article/view/analesps.32.3.219101

Denison, D. R. (1996). What is the difference between organizational culture and organizational climate? a native's point of view on a decade of paradigm wars. *The Academy of Management Review*, 21(3), 619–654. https://doi.org/http://dx.doi.org/10.5465/AMR.1996.9702100310

Dingsoyr, T., Faegri, T. E., Dyba, T., Haugset, B. & Lindsjorn, Y. (2016). Team performance in software development: Research results versus agile principles. *IEEE Software*, 33(4), 106–110. https://doi.org/10.1109/MS.2016.100

Dirani, K. M., Abadi, M., Alizadeh, A., Barhate, B., Garza, R. C., Gunasekara, N., Ibrahim, G. & Majzun, Z. (2020). Leadership competencies and the essential role of human resource development in times of crisis: A response to covid-19 pandemic. *Human Resources Development International*, 23(4), 380–394. https://doi.org/https://doi.org/10.1080/13678868.2020.1780078

Dutra, A. C., Prikladnicki, R. & Franca, C. What do we know about high performance teams in software engineering? results from a systematic literature review. In: *2015 41st euromicro conference on software engineering and advanced applications*. IEEE, 2015, August. https://doi.org/10.1109/SEAA.2015.24.

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2), 350–383. https://doi.org/10.2307/2666999

Edmondson, A. C. & Lei, Z. (2014). Psychological safety: The history, renaissance, and future of an interpersonal construct. *Annual Review of Organizational Psychology and Organizational Behavior*, 1(1), 23–43. https://doi.org/10.1146/annurev-orgpsych-031413-091305

Eisenberger, R., Jones, J. R., Stinglhamber, F., Shanock, L. & Randall, A. T. (2005). Flow experiences at work: For high need achievers alone? *Journal of Organizational Behavior*, 26(7), 755–775.

Eva, N., Robin, M., Sendjaya, S., van Dierendonck, D. & Liden, R. C. (2019). Servant leadership: A systematic review and call for future research. *The Leadership Quarterly*, 30(1), 111–132. https://doi.org/http://dx.doi.org/10.1016/j.leaqua.2018.07.004

Fagerholm, F., Ikonen, M., Kettunen, P., Münch, J., Roto, V. & Abrahamsson, P. (2015). Performance alignment work: How software developers experience the continuous adaptation of team performance in lean and agile environments. *Information and Software Technology*, 64, 132–147. https://doi.org/http://dx.doi.org/10.1016/j.infsof.2015.01.010

Faul, F., Erdfelder, E., Buchner, A. & Lang, A.-G. (2009). Statistical power analyses using g∗power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

Field, A. (2017, November 28). *Discovering statistics using IBM SPSS* (5th edition). Sage Publications Ltd.

Fischer, J. A. & Hüttermann, H. (2020). *PsySafety-check (PS-c)*. ZIS - GESIS Leibniz Institute for the Social Sciences. https://doi.org/10.6102/ZIS279

Fischer, J. A., Hüttermann, H. & Siebenaler, T. (2020). *High-performance-team-survey (HPTS)*. ZIS - GESIS Leibniz Institute for the Social Sciences. https://doi.org/10.6102/ZIS291

Fornell, C. & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39. https://doi.org/https://doi.org/10.2307/3151312

Frazier, M. L., Fainshmidt, S., Klinger, R. L., Pezeshkan, A. & Vracheva, V. (2016). Psychological safety: A meta-analytic review and extension. *Personnel Psychology*, *70*(1), 113–165. https://doi.org/https://doi.org/10.1111/peps.12183

Frese, M., Fay, D., Hilburger, T., Leng, K. & Tag, A. (1997). The concept of personal initiative: Operationalization, reliability and validity of two german samples. *Journal of Occupational and Organizational Psychology*, *70*(2), 139–161. https://doi.org/10.1111/j.2044-8325.1997.tb00639.x

Fritz, M. S. & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological science*, *18*(3), 233–239. https://doi.org/10.1111/j.1467-9280.2007.01882.x

Gast, I., Schildkamp, K. & van der Veen, J. T. (2017). Team-based professional development interventions in higher education: A systematic review. *Review of Educational Research*, *87*(4), 736–767. https://doi.org/https://doi.org/10.3102%2F0034654317704306

Gefen, D. & Straub, D. (2005). A practical guide to factorial validity using PLS-graph: Tutorial and annotated example. *Communications of the Association for Information Systems*, *16*. https://doi.org/10.17705/1CAIS.01605

Geier, M. T. (2016). Leadership in extreme contexts. *Journal of Leadership & Organizational Studies*, *23*(3), 234–247. https://doi.org/10.1177/1548051815627359

George, G., Lakhani, K. R. & Puranam, P. (2020). What has changed? the impact of covid pandemic on the technology and innovation management research agenda. *Journal of Management Studies*, *57*(8), 1754–1758. https://doi.org/10.1111/joms.12634

Gerlach, F., Hundeling, M. & Rosing, K. (2020). Ambidextrous leadership and innovation performance: A longitudinal study. *Leadership & Organization Development Journal*, *41*(3), 383–398. https://doi.org/10.1108/LODJ-07-2019-0321

Gino, F., Staats, B. R., Hall, B. J. & Chang, T. Y. (2013, September). *The morning star company: Self-management at work* (H. B. School, Ed.) [Case 914-013]. http://dump.kylewild.com/914013-PDF-ENG.PDF. Retrieved March 12, 2021, from http://dump.kylewild.com/914013-PDF-ENG.PDF

Gren, L., Goldman, A. & Jacobsson, C. (2020). Group-development psychology training: The perceived effects on agile software-development teams. *IEEE SOFTWARE*, *37*(3), 63–69. https://doi.org/10.1109/MS.2019.2955675

Hackman, J. & Morris, C. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. *Advances in Experimental Social Psychology*, *8*, 45–99.

Hackman, J. R. (1987). The design of work teams. In J. Lorsch (Ed.), *Handbook of organizational behavior*. Prentice-Hall.

Hair, J. F., Ringle, C. M. & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. https://doi.org/https://doi.org/10.2753/MTP1069-6679190202

Hair, J. F., Jr., Hult, G. T. M., Ringle, C. & Sarstedt, M. (2016, May 1). *A primer on partial least squares structural equation modeling (PLS-SEM), 2nd edition*.

Hair, J. F., Jr., Risher, J. J., Sarstedt, M. & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J. F., Jr. & Sarstedt, M. (2020). Data, measurement, and causal inferences in machine learning: Opportunities and challenges for marketing. *The Journal of Marketing Theory and Practice*, *29*(1), 1–13. https://doi.org/https://doi.org/10.1080/10696679.2020.1860683

Hair, J. F., Jr., Sarstedt, M., Ringle, C. M. & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6

Hannah, S. T., Uhl-Bien, M., Avolio, B. J. & Cavarretta, F. L. (2009). A framework for examining leadership in extreme contexts. *The Leadership Quarterly*, *20*(6), 897–919. https://doi.org/10.1016/j.leaqua.2009.09.006

Hassi, A., Rohlfer, S. & Jebsen, S. (2021). Empowering leadership and innovative work behavior: The mediating effects of climate for initiative and job autonomy in moroccan SMEs. *EuroMed Journal of Business*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/EMJB-01-2021-0010

Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate behavioral research*, *50*(1), 1–22. https://doi.org/10.1080/00273171.2014.962683

Hayes, A. F. (2017, December 13). *Introduction to mediation, moderation, and conditional process analysis, second edition: A regression-based approach* [Google-Books-ID: 8ZM6DwAAQBAJ]. Guilford Publications.

Hayes, A. F. (2021). *The PROCESS macro for SPSS, SAS, and r*. Retrieved July 21, 2021, from http://processmacro.org/

Hayes, A. F. & Rockwood, N. J. (2019). Conditional process analysis: Concepts, computation, and advances in the modeling of the contingencies of mechanisms. *American Behavioral Scientist*, *64*(1), 19–54. https://doi.org/http://dx.doi.org/10.1177/0002764219859633

Heinze, K. L. & Heinze, J. E. (2020). Individual innovation adoption and the role of organizational culture. *Review of Managerial Science*, *14*(3), 561–586. https://doi.org/10.1007/s11846-018-0300-5

Henseler, J., Ringle, C. & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*, 115–135. https://doi.org/10.1007/s11747-014-0403-8

Highsmith, J. & Cockburn, A. (2001). Agile software development: The business of innovation. *Computer*, *34*(9), 120–127. https://doi.org/https://doi.org/10.1109/2.947100

Hoda, R. & Murugesan, L. K. (2016). Multi-level agile project management challenges: A self-organizing team perspective. *Journal of Systems and Software*, *117*, 245–257. https://doi.org/http://dx.doi.org/10.1016/j.jss.2016.02.049

Hoda, R., Noble, J. & Marshall, S. (2011). The impact of inadequate customer collaboration on self-organizing agile teams. *Information and Software Technology*, *53*(5), 521–534. https://doi.org/10.1016/j.infsof.2010.10.009

Hoda, R., Salleh, N. & Grundy, J. (2018). The Rise and Evolution of Agile Software Development. *IEEE SOFTWARE*, *35*(5), 58–63. https://doi.org/{10.1109/MS.2018.290111318}

Hoegl, M. & Gemuenden, H. G. (2001). Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. *Organization Science*, *12*(4), 435–449. https://doi.org/10.1287/orsc.12.4.435.10635

Hüffmeier, J. & Hertel, G. (2011). Many cheers make light the work: How social support triggers process gains in teams. *Journal of Managerial Psychology*, *26*(3), 185–204. https://doi.org/10.1108/02683941111112631

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, *20*(2), 195–204. https://doi.org/https://doi.org/10.1002/(SICI)1097-0266(199902)20:2%3C195::AID-SMJ13%3E3.0.CO;2-7

Ilgen, D. R., Hollenbeck, J. R., Johnson, M. & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology*, *56*(1), 517–543. https://doi.org/10.1146/annurev.psych.56.091103.070250

Iqbal, A., Ahmad, I. & Latif, K. F. (2021). Servant leadership and organizational deviant behaviour: Interpreting some contradictory results from public sector of pakistan. *Leadership & Organization Development Journal*, *42*(7), 1136–1152. https://doi.org/10.1108/LODJ-07-2020-0305

Jadhav, Prakash K., Nagare, M. R., Konda, Srikant. (2018). Implementing lean manufacturing principle in fabrication: Process- a case study. *International Research Journal of Engineering and Technology* (*IRJET*).

Jahanshahi, A. A., Maghsoudi, T. & Babaei, F. G. A. (2020). What makes teams more innovative in small high-technology ventures the role of leadership. *International Journal of Entrepreneurial Venturing*, *12*(3), 251. https://doi.org/10.1504/IJEV.2020.107933

JASP Team. (2020). *JASP (version 0.14.1) [computer software]* (Version 0.14.1). Department of Psychological Methods University of Amsterdam. Retrieved July 21, 2021, from https://jasp-stats.org/

Jong, B. A. D. & Elfring, T. (2010). How does trust affect the performance of ongoing teams? the mediating role of reflexivity, monitoring, and effort. *Academy of Management Journal*, *53*(3), 535–549. https://doi.org/https://doi.org/10.5465/AMJ.2010.51468649

Judge, T. A. & Piccolo, R. F. (2004). Transformational and transactional leadership: A meta-analytic test of their relative validity. *Journal of Applied Psychology*, *89*(5), 755–768. https://doi.org/10.1037/0021-9010.89.5.755

Kelloway, E. K., Weigand, H., McKee, M. C. & Das, H. (2013). Positive leadership and employee well-being. *Journal of Leadership & Organizational Studies*, *20*(1), 107–117. https://doi.org/10.1177/1548051812465892

Kersten, M. (2017). Value stream architecture. *IEEE Software*, *34*(5), 10–12. https://doi.org/https://doi.org/10.1109/MS.2017.3571573

Kersten, M. (2018). What flows through a software value stream? *IEEE Software*, *35*(4), 8–11. https://doi.org/https://doi.org/10.1109/MS.2018.2801538

Kirkman, B. L. & Rosen, B. (1999). Beyond self-management: Antecedents and consequences of team empowerment. *Academy of Management Journal*, *42*(1), 58–74. https://doi.org/https://doi.org/10.5465/256874

Klaic, A., Burtscher, M. J. & Jonas, K. (2020). Fostering team innovation and learning by means of team–centric transformational leadership: The role of teamwork quality. *Journal of Occupational and Organizational Psychology*, *93*(4), 942–966. https://doi.org/10.1111/joop.12316

Kock, N. (2015). Common method bias in pls-sem: A full collinearity assessment approach. *International Journal of e-Collaboration*, *11*(4), 1–10. https://doi.org/10.4018/ijec.2015100101

Koeslag-Kreunen, M., den Bossche, P. V., Hoven, M., der Klink, M. V. & Gijselaers, W. (2018). When leadership powers team learning: A meta-analysis. *Small Group Research*, *49*(4), 475–513. https://doi.org/https://doi.org/10.1177%2F1046496418764824

Körner, M., Bütof, S., Müller, C., Zimmermann, L., Becker, S. & Bengel, J. (2015). Interprofessional teamwork and team interventions in chronic care: A systematic review. *Journal of Interprofessional Care*, *30*(1), 15–28. https://doi.org/10.3109/13561820.2015.1051616

Kozlowski, S. & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, *7*, 124–77.

Kuhnert, K. W. & Lewis, P. (1987). Transactional and transformational leadership: A constructive/developmental analysis. *The Academy of Management Review*, *12*(4), 648. https://doi.org/http://dx.doi.org/10.2307/258070

Lacerenza, C. N., Marlow, S. L., Tannenbaum, S. I. & Salas, E. (2018). Team development interventions: Evidence-based approaches for improving teamwork.

*American Psychologist*, *73*(4), 517–531. https://doi.org/https://psycnet.apa.org/doi/10.1037/amp0000295

Lee, M. Y. & Edmondson, A. C. (2017). Self-managing organizations: Exploring the limits of less-hierarchical organizing. *Research in Organizational Behavior*, *37*, 35–58. https://doi.org/10.1016/j.riob.2017.10.002

LePine, J. A., Piccolo, R. F., Jackson, C. L., Mathieu, J. E. & Saul, J. R. (2008). A meta-analysis of teamwork processes: Tests of a multidimensional model and relationships with team effectiveness criteria. *Personnel Psychology*, *61*(2), 273–307. https://psycnet.apa.org/doi/10.1111/j.1744-6570.2008.00114.x

Liu, D. & Fu, P.-P. (2011). Motivating protégés' personal learning in teams: A multi-level investigation of autonomy support and autonomy orientation. *Journal of Applied Psychology*, *96*(6), 1195–1208. https://doi.org/https://doi.apa.org/doi/10.1037/a0024716

Luciano, M. M., DeChurch, L. A. & Mathieu, J. E. (2018). Multiteam systems: A structural framework and meso-theory of system functioning. *Journal of Management*, *44*(3), 1065–1096. https://doi.org/https://doi.org/10.1177%2F0149206315601184

Luthans, F., Avolio, B. J., Avey, J. B. & Norman, S. M. (2007). Positive psychological capital: Measurement and relationship withperformance and satisfaction. *Personnel Psychology*, *60*(3), 541–572. https://doi.org/10.1111/j.1744-6570.2007.00083.x

Machado, V. C. & Tavares, J. Modeling organizations based on value streams. In: *2007 IEEE international conference on industrial engineering and engineering management*. Singapore: IEEE, 2007, December. https://doi.org/https://doi.org/10.1109/IEEM.2007.4419212.

Malinga, K. S., Stander, M. & Nell, W. (2019). Positive leadership: Moving towards an integrated definition and interventions. In R. S. S. Van Zyl L. (Ed.), *Theoretical approaches to multi-cultural positive psychological interventions* (pp. 201–228). Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-030-20583-6_9

Maneva, M., Koceska, N. & Koceski, S. (2017). Measuring agility in agile methodologies. *Journal of Applied Economics and Business*, *2017*(5), 21–30.

Marcoulides, G. A. & Chin, W. W. (2013). You write, but others read: Common methodological misunderstandings in pls and related methods (H. Abdi, W. W. Chin, V. Esposito Vinzi, G. Russolillo & L. Trinchera, Eds.), 31–64.

Marks, M. A., Mathieu, J. E. & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *The Academy of Management Review*, *26*(3), 356. https://doi.org/http://dx.doi.org/10.2307/259182

Marzi, G., Ciampi, F., Dalli, D. & Dabic, M. (2021). New product development during the last ten years: The ongoing debate and future avenues [Conference Name: IEEE Transactions on Engineering Management]. *IEEE Transactions on Engineering Management*, *68*(1), 330–344. https://doi.org/10.1109/TEM.2020.2997386

Mason, K. & Chakrabarti, R. (2017). The role of proximity in business model design: Making business models work for those at the bottom of the pyramid. *Industrial Marketing Management*, *61*, 67–80. https://doi.org/10.1016/j.indmarman.2016.08.005

Mathieu, J. E., Gallagher, P. T., Domingo, M. A. & Klock, E. A. (2019). Embracing complexity: Reviewing the past decade of team effectiveness research. *Annual Review of Organizational Psychology and Organizational Behavior*, *6*(1), 17–46. https://doi.org/10.1146/annurev-orgpsych-012218-015106

Mathieu, J. E., Hollenbeck, J. R., van Knippenberg, D. & Ilgen, D. R. (2017). A century of work teams in the journal of applied psychology [Place: US Publisher: American Psychological Association]. *Journal of Applied Psychology*, *102*(3), 452–467. https://doi.org/https://doi.org/10.1037/apl0000128

Mathieu, J. E., Kukenberger, M. R., D'Innocenzo, L. & Reilly, G. (2015). Modeling reciprocal team cohesion–performance relationships, as impacted by shared leadership and members' competence. *Journal of Applied Psychology*, *100*(3), 713–734. https://doi.org/10.1037/a0038898

Mathieu, J. E., Wolfson, M. A. & Park, S. (2018). The evolution of work team research since hawthorne [American Psychological Association]. *American Psychologist*, *73*(4), 308–321. https://doi.org/https://doi.org/10.1037/amp0000255

Maynard, M. T., Gilson, L. L. & Mathieu, J. E. (2012). Empowerment—fad or fab? a multilevel review of the past two decades of research. *Journal of Management*, *38*(4), 1231–1281. https://doi.org/10.1177/0149206312438773

McGrath, J. E. (1964). *Social psychology: A brief introduction*. New York.

Meyer, R. D., Dalal, R. S. & Hermida, R. (2009). A review and synthesis of situational strength in the organizational sciences. *Journal of Management*, *36*(1), 121–140. https://doi.org/https://doi.org/10.1177%2F0149206309349309

Monzani, L. & Dick, R. V. (2020, November). Positive leadership in organizations: A systematic review and integrative multi-level model. *The oxford encyclopedia of industrial and organizational psychology*. Oxford University Press. https://doi.org/https://doi.org/10.1093/acrefore/9780190236557.013.814

Morgeson, F. P. & Humphrey, S. E. (2006). The work design questionnaire (WDQ): Developing and validating a comprehensive measure for assessing job design and the nature of work. *Journal of Applied Psychology*, *91*(6), 1321–1339. https://doi.org/10.1037/0021-9010.91.6.1321

Neal, A., Griffin, M. & Hart, P. (2000). The impact of organizational climate on safety climate and individual behavior. *Safety Science*, *34*(1-3), 99–109. https://doi.org/http://dx.doi.org/10.1016/S0925-7535(00)00008-4

Nellen, L. C., Gijselaers, W. H. & Grohnert, T. (2019). A meta-analytic literature review on organization-level drivers of team learning. *Human Resource Development Review*, *19*(2), 152–182. https://doi.org/https://doi.org/10.1177%2F1534484319894756

Netemeyer, R. G., Bearden, W. O. & Sharma, S. (2003, March 12). *Scaling procedures: Issues and applications* [Google-Books-ID: c2dN7HDbr7kC]. SAGE.

Neumann, M., Bogdanov, Y., Lier, M. & Baumann, L. The sars-cov-2 pandemic and agile methodologies in software development: A multiple case study in germany. In: *Lecture notes in business information processing*. Springer International Publishing, 2021, 40–58. https://doi.org/http://dx.doi.org/10.1007/978-3-030-67084-9_3.

Newman, A., Donohue, R. & Eva, N. (2017). Psychological safety: A systematic review of the literature. *Human Resource Management Review*, *27*(3), 521–535. https://doi.org/http://dx.doi.org/10.1016/j.hrmr.2017.01.001

Newman, A., Round, H., Wang, S. & Mount, M. (2020). Innovation climate: A systematic review of the literature and agenda for future research. *Journal of Occupational and Organizational Psychology*, *93*(1), 73–109. https://doi.org/10.1111/joop.12283

Ng, T. W. H. & Feldman, D. C. (2013). A meta-analysis of the relationships of age and tenure with innovation-related behaviour. *Journal of Occupational and Organizational Psychology*, *86*(4), 585–616. https://doi.org/10.1111/joop.12031

Nitzl, C., Roldan, J. L. & Cepeda, G. (2016). Mediation analysis in partial least squares path modeling. *Industrial Management & Data Systems*, *116*(9), 1849–1864. https://doi.org/http://dx.doi.org/10.1108/IMDS-07-2015-0302

Noll, J., Razzak, M. A. & Beecham, S. (2017). Motivation and autonomy in global software development. *Proceedings of the 21st International Conference on Evaluation and Assessment in Software Engineering*. https://doi.org/https://doi.org/10.1145/3084226.3084277

O'Donovan, R. & McAuliffe, E. (2020). A systematic review exploring the content and outcomes of interventions to improve psychological safety, speaking up and voice behaviour. *BMC Health Services Research*, *20*(1). https://doi.org/https://doi.org/10.1186/s12913-020-4931-2

Omar, M., Khasasi, N., Abdullah, S., Hashim, N. L. & Romli, R. (2018). Defining skill sets requirements for agile scrum team formation. *Journal of Engineering and Applied Sciences*, *13*(3), 784–789. https://doi.org/http://dx.doi.org/10.3923/jeasci.2018.784.789

Pearson, C. M. & Clair, J. A. (1998). Reframing crisis management. *Academy of Management Review*, *23*(1), 59–76. https://doi.org/https://doi.org/10.5465/amr.1998.192960

Pillutla, M. M. & Thau, S. (2013). Organizational sciences' obsession with "that's interesting!" *Organizational Psychology Review*, *3*(2), 187–194. https://doi.org/10.1177/2041386613479963

Poth, A., Kottke, M. & Riel, A. (2021). Measuring teamwork quality in large-scale agile organisations evaluation and integration of the aTWQ approach. *IET Software*. https://doi.org/10.1049/sfw2.12036

Powell, D. J. & Bartolome, C. P. F. Enterprise-wide value stream mapping: From dysfunctional organization to cross-functional, collaborative learning and improvement. In: *2020 IEEE international conference on industrial engineering*

*and engineering management* (*IEEM*). Singapore: IEEE, 2020, December. https: //doi.org/https://doi.org/10.1109/IEEM45057.2020.9309977.

Preacher, K. J. (2015). Advances in mediation analysis: A survey and synthesis of new developments. *Annual review of psychology*, *66*, 825–852. https://doi.org/ 10.1146/annurev-psych-010814-015258

Quaquebeke, N. V. & Felps, W. (2018). Respectful inquiry: A motivational account of leading through asking questions and listening. *The Academy of Management Review*, *43*(1), 5–27. https://doi.org/http://dx.doi.org/10.5465/amr.2014.0537

R Core Team. (2020). *R: A language and environment for statistical computing* (Version 4.1.0). Vienna, Austria, R Foundation for Statistical Computing. https: //cran.r-project.org

Ramírez Heller, B., Berger, R. & C. Brodbeck, F. (2014). Does an adequate team climate for learning predict team effectiveness and innovation potential? a psychometric validation of the team climate questionnaire for learning in an organizational context. *Procedia - Social and Behavioral Sciences*, *114*, 543–550. https://doi.org/10.1016/j.sbspro.2013.12.744

Rank, J., Pace, V. L. & Frese, M. (2004). Three avenues for future research on creativity, innovation, and initiative. *Applied Psychology*, *53*(4), 518–528. https://doi.org/ https://doi.org/10.1111/j.1464-0597.2004.00185.x

Rashid, N. & Khan, S. U. (2018). Using agile methods for the development of green and sustainable software: Success factors for GSD vendors. *Journal of Software: Evolution & Process*, *30*(8), 1.

Rigdon, E. E. (2016). Choosing PLS path modeling as analytical method in european management research: A realist perspective. *European Management Journal*, *34*(6), 598–605. https://doi.org/10.1016/j.emj.2016.05.006

Ringle, C. M., Wende, S. & Becker, J.-M. (2015). *Smartpls 3*. https://www.smartpls.com

Rizzo, J. R., House, R. J. & Lirtzman, S. I. (1970). Role conflict and ambiguity in complex organizations. *Administrative Science Quarterly*, *15*(2), 150. https: //doi.org/https://doi.org/10.2307/2391486

Robillard, P. N., Lavallée, M., Ton-That, Y. & Chiocchio, F. (2014). Taxonomy for software teamwork measurement. *Journal of Software: Evolution and Process*, *26*(10), 910–922. https://doi.org/10.1002/smr.1641

Rosenhead, J., Franco, L. A., Grint, K. & Friedland, B. (2019). Complexity theory and leadership practice: A review, a critique, and some recommendations. *The Leadership Quarterly*, *30*(5), 101304. https://doi.org/10.1016/j.leaqua.2019.07. 002

Royce, W. W. (1970). Managing the development of large software systems: Concepts and techniques [Reprinted in Proceedings of the Ninth International Conference on Software Engineering, March 1987, pp. 328–338]. *Proc. IEEE WESTCON*, 1–9. http://www.cs.umd.edu/class/spring2003/cmsc838p/ Process/waterfall.pdf

RStudio Team. (2020). *RStudio: Integrated development for r. RStudio* (Version 1.4.1717). Boston, MA, RStudio, PBC. Retrieved July 21, 2021, from https://rstudio.com/

Salas, E., Kozlowski, S. W. J. & Chen, G. (2017). A century of progress in industrial and organizational psychology: Discoveries and the next century. *Journal of Applied Psychology, 102*(3), 589–598. https://doi.org/10.1037/apl0000206

Salas, E., Reyes, D. L. & McDaniel, S. H. (2018). The science of teamwork: Progress, reflections, and the road ahead. *American Psychologist, 73*(4), 593–600. https://doi.org/https://psycnet.apa.org/doi/10.1037/amp0000334

Salas, E., Shuffler, M. L., Thayer, A. L., Bedwell, W. L. & Lazzara, E. H. (2014). Understanding and improving teamwork in organizations: A scientifically based practical guide. *Human Resource Management, 54*(4), 599–622. https://doi.org/10.1002/hrm.21628

Sarstedt, M., Hair, J. F., Jr., Nitzl, C., Ringle, C. & Howard, M. (2020). Beyond a tandem analysis of SEM and PROCESS: Use PLS-SEM for mediation analyses! *International Journal of Market Research, 62.* https://doi.org/https://doi.org/10.1177%2F1470785320915686

Sarstedt, M., Ringle, C. M. & Hair, J. F., Jr. (2021). *Partial least squares structural equation modeling.* Springer International Publishing. https://doi.org/10.1007/978-3-319-05542-8_15-2

Schein, E. H. & Bennis, W. G. (1965). *Personal and organizational change through group methods: The laboratory approach.* John Wiley & Son. https://doi.org/https://doi.org/10.1177%2F074171366701700211

Schiepe-Tiska, A. & Engeser, S. (2012). *Advances in flow research* (S. Engeser, Ed.). Springer New York. https://doi.org/10.1007/978-1-4614-2359-1_

Schwaber, K. & Sutherland, J. (2020, November). *The scrum guide: The definitive guide to scrum: The rules of the game.* Retrieved November 4, 2021, from https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf

Seligman, M. E. P. & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5–14. https://doi.org/10.1037/0003-066X.55.1.5

Siangchokyoo, N., Klinger, R. L. & Campion, E. D. (2020). Follower transformation as the linchpin of transformational leadership theory: A systematic review and future research agenda. *The Leadership Quarterly, 31*(1), 101341. https://doi.org/10.1016/j.leaqua.2019.101341

Stoica, M., Ghilic-Micu, B., Mircea, M. & Uscatu, C. R. (2016). Analyzing agile development - from waterfall style to scrumban. *Informatica Economică, 20,* 5–14.

Taber, K. S. (2018). The use of cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Thorgren, S. & Caiman, E. (2019). The role of psychological safety in implementing agile methods across cultures. *Research-Technology Management, 62*(2), 31–39. https://doi.org/10.1080/08956308.2019.1563436

Valls, V., González-Romá, V. & Tomás, I. (2016). Linking educational diversity and team performance: Team communication quality and innovation team climate

matter. *Journal of Occupational and Organizational Psychology*, *89*(4), 751–771. https://doi.org/10.1111/joop.12152

van der Voet, J. & Steijn, B. (2020). Team innovation through collaboration: How visionary leadership spurs innovation via team cohesion. *Public Management Review*, *23*(9), 1275–1294. https://doi.org/http://dx.doi.org/10.1080/14719037.2020.1743344

van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas, K. B. M. B. A. (2001a). *Manifesto for agile software development*. http://www.agilemanifesto.org

van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas, K. B. M. B. A. (2001b). *Principles behind the agile manifesto*. https://agilemanifesto.org/principles.html

van Knippenberg, D. & Sitkin, S. B. (2013). A critical assessment of charismatic—transformational leadership research: Back to the drawing board? *The Academy of Management Annals*, *7*(1), 1–60. https://doi.org/10.1080/19416520.2013.759433

Venkatesh, V., Thong, J. Y. L., Chan, F. K. Y., Hoehle, H. & Spohrer, K. (2020). How agile software development methods reduce work exhaustion: Insights on role perceptions and organizational skills. *Information Systems Journal*, *30*(4), 733–761. https://doi.org/https://doi.org/10.1111/isj.12282

Wageman, R., Hackman, J. R. & Lehman, E. (2005). Team diagnostic survey. *The Journal of Applied Beavioural Science*, *41*(4), 373–398. https://doi.org/10.1177/0021886305281984

Walumbwa, F. O., Avolio, B. J., Gardner, W. L., Wernsing, T. S. & Peterson, S. J. (2007). Authentic leadership: Development and validation of a theory-based measure. *Journal of Management*, *34*(1), 89–126. https://doi.org/10.1177/0149206307308913

Wang, G., Oh, I.-S., Courtright, S. H. & Colbert, A. E. (2011). Transformational leadership and performance across criteria and levels: A meta-analytic review of 25 years of research. *Group & Organization Management*, *36*(2), 223–270. https://doi.org/10.1177/1059601111401017

Wang, X.-H. & Howell, J. M. (2010). Exploring the dual-level effects of transformational leadership on followers. *Journal of Applied Psychology*, *95*(6), 1134–1144. https://doi.org/10.1037/a0020754

Waters, L., Algoe, S. B., Dutton, J., Emmons, R., Fredrickson, B. L., Heaphy, E., Moskowitz, J. T., Neff, K., Niemiec, R., Pury, C. & Steger, M. (2021). Positive psychology in a pandemic: Buffering, bolstering, and building mental health. *The Journal of Positive Psychology*, 1–21. https://doi.org/10.1080/17439760.2021.1871945

Xie, Y., Xue, W., Li, L., Wang, A., Chen, Y., Zheng, Q., Wang, Y. & Li, X. (2018). Leadership style and innovation atmosphere in enterprises: An empirical

study. *Technological Forecasting and Social Change*, *135*, 257–265. https://doi.org/10.1016/j.techfore.2018.05.017

Xu, X., Jiang, L. & Wang, H.-J. (2019). How to build your team for innovation? a cross-level mediation model of team personality, team climate for innovation, creativity, and job crafting. *Journal of Occupational and Organizational Psychology*, *92*(4), 848–872. https://doi.org/10.1111/joop.12277

Yoon, J. & Kayes, D. C. (2016). Employees' self-efficacy and perception of individual learning in teams: The cross-level moderating role of team-learning behavior. *Journal of Organizational Behavior*, *37*(7), 1044–1060. https://doi.org/10.1002/job.2092

Yuan, Y. & van Knippenberg, D. (2021). Leader network centrality and team performance: Team size as moderator and collaboration as mediator. *Journal of Business and Psychology*. https://doi.org/10.1007/s10869-021-09745-4

Zayat, W. & Senvar, O. (2020). Framework study for agile software development via scrum and kanban. *International Journal of Innovation and Technology Management*, *17*(4), 2030002. https://doi.org/10.1142/S0219877020300025

Zickar, M. J. (2020). Measurement development and evaluation. *Annual Review of Organizational Psychology and Organizational Behavior*, *7*(1), 213–232. https://doi.org/https://doi.org/10.1146/annurev-orgpsych-012119-044957

# B. APPENDIX

## FURTHER INFORMATION

**Manifesto for Agile Software Development**

The so called Manifesto for Agile Software Development by van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas (2001a) can be found via (https://agilemanifesto.org) in different languages and says:

> We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:
> - Individuals and interactions over processes and tools
> - Working software over comprehensive documentation
> - Customer collaboration over contract negotiation
> - Responding to change over following a plan
>
> That is, while there is value in the items on the right, we value the items on the left more.

**12 Principles behind the Agile Manifesto**

In addition to section B, van Bennekum; Alistair Cockburn; Ward Cunningham; Martin Fowler; James Grenning; Jim Highsmith; Andrew Hunt; Ron Jeffries; Jon Kern; Brian Marick; Robert C. Martin; Steve Mellor; Ken Schwaber; Jeff Sutherland; Dave Thomas (2001b) defined 12 principles for agile collaboration (https://agilemanifesto.org/principles.html)

> We follow these principles:
>
> 1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
>
> 2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
>
> 3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
>
> 4. Business people and developers must work together daily throughout the project.

5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

7. Working software is the primary measure of progress.

8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

9. Continuous attention to technical excellence and good design enhances agility.

10. Simplicity–the art of maximizing the amount of work not done–is essential.

11. The best architectures, requirements, and designs emerge from self-organizing teams.

12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

# FIGURES

Figure B.1.: Waterfall Approach for Software Development by Royce (1970, p. 330)
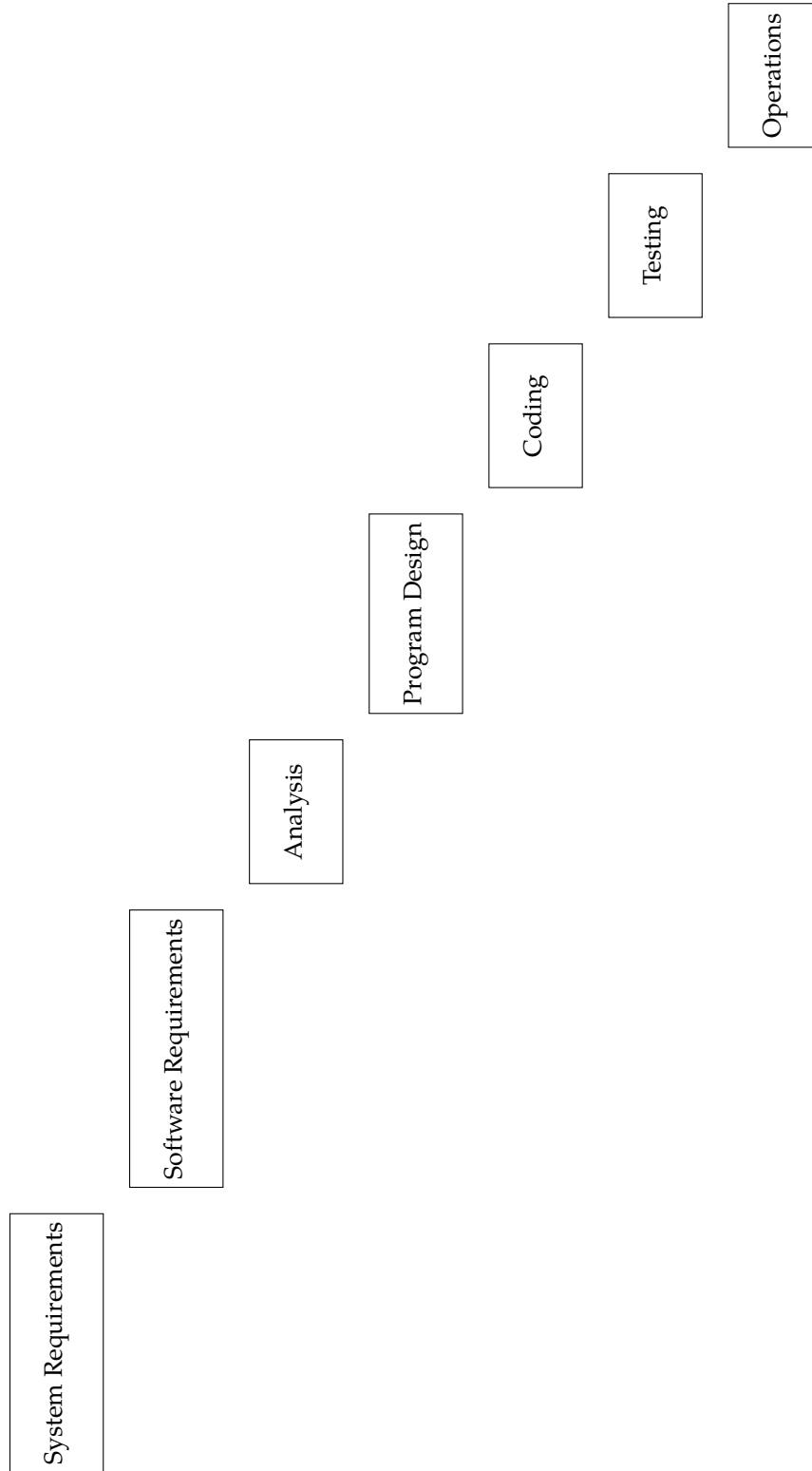
Figure B.2.: Google Scholar Search Results for the Key Words 'agile software development'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com

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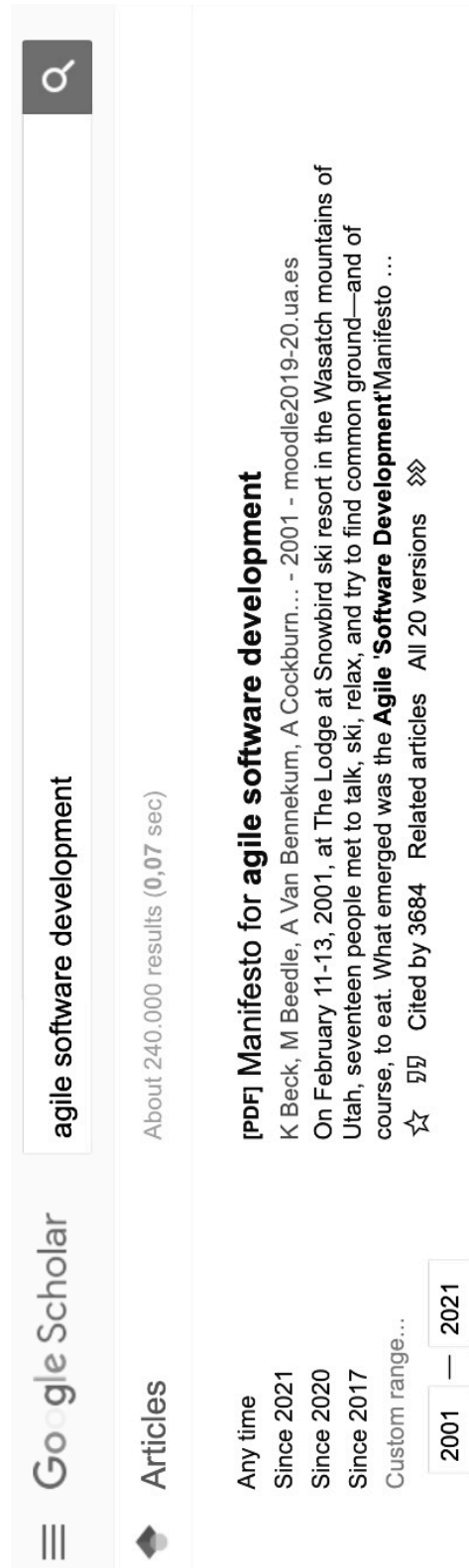
Figure B.3.:: Google Scholar Search Results for the Key Words 'transformational leadership'

≡ Google Scholar    "transformational leadership"    🔍

**Articles**

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**Transformational leadership**    [PDF] kcomacademy.com
HR Diaz-Saenz - The SAGE handbook of leadership, 2011 - books.google.com
Transformational leadership is the process by which a leader fosters group or organizational
performance beyond expectation by virtue of the strong emotional attachment with his or her
followers combined with the collective commitment to a higher moral cause. For the past 30 ...
☆ 🗐 Cite Cited by 268 Related articles All 6 versions

**The emerging role of transformational leadership**    [PDF] archive.org
MS Ghasabeh, C Soosay, C Reaiche - The Journal of Developing ..., 2015 - muse.jhu.edu
This paper presents a literature review of leadership over the years and the emerging role of
**transformational leadership**. We also argue that this form of leadership is appropriate in the
context of globalized markets, where there is increasing diffusion of goods, services, values ...
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**Transformational leadership**
C Luzinski - JONA: The Journal of Nursing Administration, 2011 - journals.lww.com
This month, the director of the Magnet Recognition Program® takes an in-depth look at the
Magnet® model component transformational leadership. The author examines the
expectations for Magnet organizations around this component. What are the qualities that ...
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[PDF] **Transformational leadership** and its predictive effects on leadership    [PDF] ijbssnet.com
effectiveness
A Sadeghi, ZAL Pihie - International Journal of Business and Social ..., 2012 - ijbssnet.com
Academic departments play an important role in the success of institutions of higher
education and success of departments directly depends on effectiveness of their head. This
study is an attempt to determine heads of academic departments' leadership styles and its ...
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*Note.* Screenshot taken in November 2021 on https://scholar.google.com
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Figure B.4.: Web Of Science Search Results for the Key Words 'transformational leadership'

5,713 results from Web of Science Core Collection for:

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| 🔓 Open Access | 1,425 |

**Publication Years**

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|---|---|
| 2021 | 539 |
| 2020 | 809 |
| 2019 | 717 |
| 2018 | 697 |
| 2017 | 536 |

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☐ 1   Achieving High Quality Through Transformational Leadership: A Qualitative Multilevel Analysis of Transformational Leadership and Perceived Professional Quality

Andersen, LB; Bjornholt, B; (...); Holm-Petersen, C
Mar 2018 | PUBLIC PERSONNEL MANAGEMENT **47** (1), **pp.51-72**

Professional quality is an important performance criterion in the public sector, but professionals can have very different understandings of what constitutes professional quality. Leadership is often emphasized as a key element in giving direction to employees, thus enabling the promotion of shared understandings of what professional quality is. Alt ... Show more

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13 Citations

61 References

Related records

☐ 2   THE EFFECTS OF TRANSFORMATIONAL LEADERSHIP ON ORGANIZATIONAL PERFORMANCE - A THEORETICAL APPROACH

El Toufaili, B
International Management Conference on Role of Management in the Economic Paradigm of the XXIst Century
2017 | PROCEEDINGS OF THE 11TH INTERNATIONAL MANAGEMENT CONFERENCE: THE ROLE OF MANAGEMENT IN THE ECONOMIC PARADIGM OF THE XXIST CENTURY (IMC 2017) , **pp.153-163**

Nowadays, managers have to face the complexity of the technological and informational environment, social change, increasing entrepreneurial activity, accelerating technological developments and a more educated and skilled workforce. Leadership has become a critical element in the success of an organization. Transformational leaders ... Show more

58 References

*Note.* Screenshot taken in November 2021 on https://webofscience.com
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Figure B.5.: Google Scholar Search Results for the Key Words 'transformational leadership' AND 'agile software development'

Google Scholar

"transformational leadership" AND "agile software development"   🔍

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An empirical study into social success factors for **agile software development**
E Van Kelle, J Visser, A Plaat... - 2015 IEEE/ACM 8th ..., 2015 - ieeexplore.ieee.org
... We expected that **transformational leadership** is more suitable in Agile projects than transactional leadership, considering the emphasis on people and interactions in **Agile Software Development**. A lack of effective communication and the existence of misunderstanding are ...

[PDF] ru.nl

[PDF] Social Success Factors Affecting Implementation of **Agile Software Development** Methodologies in Software Industry of Pakistan: An Empirical Study
MN Riaz, A Mahboob, A Buriro - International Journal of ..., 2018 - pdfs.semanticscholar.org
... It is our expectations that the **Transformational leadership** is more beneficial than Transactional leadership in **Agile software development** as the latter put more emphasis on well-being of team members as well encourages healthy communication among the team members at ...

[PDF] semanticscholar.org

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.6.: Web Of Science Search Results for the Key Words 'transformational leadership' AND 'agile software development'

**1 result from Web of Science Core Collection for:**

ALL=("transformational leadership") AND ALL=("agile software development")

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☐ 1    **An Empirical Study into Social Success Factors for Agile Software Development**

van Kelle, E; van der Wijst, P; (...); Visser, J

8th IEEE/ACM International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE)

2015 | 2015 IEEE/ACM 8TH INTERNATIONAL WORKSHOP ON COOPERATIVE AND HUMAN ASPECTS OF SOFTWARE ENGINEERING

CHASE 2015 , pp.77-80

Though many warn that Agile at larger scale is problematic or at least more challenging than in smaller projects, Agile software

development seems to become the norm, also for large and complex projects.

Based on literature and qualitative interviews, we constructed a conceptual model of social factors th ... Show more

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11

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Figure B.7.: Google Scholar Search Results for the Key Words 'transformational leadership' AND 'agile software development' AND 'Germany'

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"transformational leadership" AND "agile software development" AND "Germ: 🔍

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**Emergent Leadership in Agile Teams—an Initial Exploration**     [PDF] acm.org
L Przybilla, M Wiesche, H Krcmar - ... of the 2019 on Computers and ..., 2019 - dl.acm.org
... A key proposition in **agile software development** is a focus on collaborative teamwork [21].
Credence is lent to this proposition by findings of ... Action-embedded **transformational**
**leadership** in self-managing global information systems development teams. Journal of Strategic ...
☆ ⅅⅅ Cite   Cited by 7   Related articles   All 3 versions

**The link between transformational and servant leadership in DevOps-oriented**     [PDF] acm.org
**organizations**
K Maroukian, SR Gulliver - ... of the 2020 European Symposium on ..., 2020 - dl.acm.org
... Our results also show that certain DevOps adoption leadership characteristics are relevant
to **transformational leadership** and servant ... approaches such as XP [2,3] which eventually
led to **Agile Software Development** [4], which is characterized mainly by lightweight, flexible, ...
☆ ⅅⅅ Cite   Cited by 1   Related articles   All 3 versions

**The Relationship between Transformational Leadership and Employee**
**Engagement in an Agile Environment**
KK Watanabe - 2020 - search.proquest.com
... The **Agile software development** method is a replacement for the typical waterfall process
of software design. Denning (2015b) stated that "Agile in the board sense of an ideology in
which individuals, teams, networks, and ecosystems are continuously delivering new value to ...
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Figure B.8.: Web Of Science Search Results for the Key Words 'transformational leadership' AND 'agile software development' AND 'Germany'

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ALL=("transformational leadership") AND ALL=("agile software development") AND ALL=("Germany")

| Publication Date | ⟩ | 2011-01-01 | to | 2021-11-10 |

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*Note.* Screenshot taken in November 2021 on https://webofscience.com

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Figure B.9.: Google Scholar Search Results for the Key Words 'organizational psychological safety'

≡ **Google Scholar**

"organisational psychological safety"   🔍

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☆ Organisational Climate Conditions of Psychological Safety as Thriving
M Coetzee - Thriving in Digital Workspaces: Emerging Issues for ..., 2019 - books.google.com
... Workplace factors Perceived extent/impact of digital transformation/innovation Perceived **organisational psychological safety** climatePerceived organisational support Perceived supervisor support Perceived co-worker/team ...
☆ 🗐 Cite   Cited by 1   Related articles

☆ To stand back or step in? Exploring the responses of employees who observe workplace bullying
S MacCurtain, C Murphy, M O'Sullivan... - Nursing ..., 2018 - Wiley Online Library
... The main focus of this paper is observers' responses to bullying, specifically the relationship between bystanders' perception of **organisational psychological safety** and their decision to act. Our study suggests that the witnessing of bullying is an occurrence that many ...
☆ 🗐 Cite   Cited by 43   Related articles   All 6 versions

☆ Occupational Safety and Performance of Health workers in Public Hospitals in Uganda: A case of Arua Regional Hospital.
M Chesro - 2018 - umispace.umi.ac.ug         [PDF] umi.ac.ug
This study investigated whether occupational safety influenced performance of health workers at Arua regional public hospital in Uganda. The objectives of the study were to establish the influence of psychological safety on performance of health workers; to find out the of safety ...
☆ 🗐 Cite   Cited by 1   Related articles   All 3 versions   ≫

*Note.* Screenshot taken in November 2021 on https://scholar.google.com

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Figure B.10.: Web Of Science Search Results for the Key Words 'organizational psychological safety'

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ALL=("organisational psychological safety")

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*Note.* Screenshot taken in November 2021 on https://webofscience.com
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Figure B.11.: Google Scholar Search Results for the Key Words 'organizational psychological safety' AND 'agile software development'

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
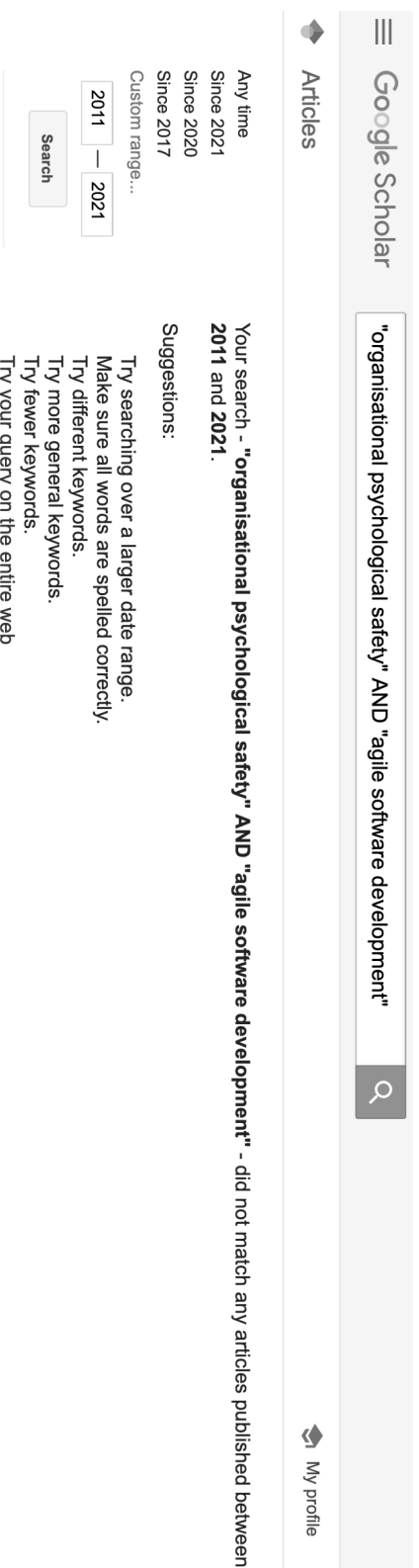
Figure B.12.: Google Scholar Search Results for the Key Words 'organisational initiative'



**≡ Google Scholar** "organisational initiative" 🔍    ♦ My profile ★

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☑ Create alert

Who defines innovation in education? Participatory action research and organisational learning    [PDF] tandfonline.com

M Ukowitz - Educational Action Research, 2021 - Taylor & Francis

… The Educational Lab Carinthia was founded as an inter-**organisational initiative**, where school-teachers, university staff and other professionals in the educational field are committed to innovation in education in a network-like structure. Apart from other topics, which arose …

☆ 🗐 Cite

[PDF] "DOING GENDER" DIFFERENTLY: ACollaborative EXPERIENCE WITH TRÓCAIRE'S DEVELOPMENT EDUCATION AND INTERNATIONAL DEPARTMENTS    [PDF] developmenteducationrevi...

Á O'DRISCOLL, C WRENN - … & Practice: A …, 2019 - developmenteducationreview.com

Abstract: This article explores a cross-**organisational initiative** of creating a Healthy Relationships Youth Manual, which has helped alter the internal dynamic of development education (DE) in Trócaire. The manual is a culmination of multiple elements: it is rooted in DE and …

☆ 🗐 Cite   Cited by 1   Related articles   All 3 versions ≫

[HTML] Do mentoring programmes influence women's careers in the health and medical research sector? A mixed-methods evaluation of Australia's Franklin Women …    [HTML] nih.gov

A Vassallo, K Walker, M Georgousakis, R Joshi - BMJ open, 2021 - ncbi.nlm.nih.gov

… The Franklin Women Mentoring Programme (Programme) is a professionally facilitated, cross-**organisational initiative** designed to support career development for mid-career women. The objective of this study was to evaluate Programme outcomes reported by participants 12 …

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Institutional Factors for Academic Entrepreneurship in Publicly owned Universities in Japan: Transition from a Conservative Anti-industry University Collaboration Culture to a Leading Entrepreneurial University

Yoshioka-Kobayashi, T

Nov 2019 | Oct 2019 (Early Access) | SCIENCE TECHNOLOGY AND SOCIETY 24 (3), pp.423-445

The establishment of university spin-offs differs across schools as a result of the interactions among different intuitional settings. This study examines the role of institutional factors in the context of state-controlled universities, which are the majority in East Asia, but have not been the focus of the exist ... Show more

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Figure B.13.: Web Of Science Search Results for the Key Words 'organisational initiative'

*Note.* Screenshot taken in November 2021 on https://webofscience.com

Figure B.14.: Google Scholar Search Results for the Key Words 'organisational initiative' AND 'agile software development'



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[PDF] Categorising software contexts
D Kirk, S MacDonell - 2014 - researchgate.net
… We adapted this as "The circumstances that form a setting for an **organisational initiative** and in terms of which outcomes can be fully … "'Leagile' software development: An experience report analysis of the application of lean approaches in **agile software development**," …
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D Kirk - academia.edu
… We adapted this as "The circumstances that form a setting for an **organisational initiative** and in terms of which outcomes can be fully … "'Leagile' software development: An experience report analysis of the application of lean approaches in **agile software development**," …
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[PDF] academia.edu

Categorising Software Contexts: Research-in-Progress
D Kirk, SG MacDonell - arXiv preprint arXiv:2102.09154, 2021 - arxiv.org
… We adapted this as "The circumstances that form a setting for an **organisational initiative** and in terms of which outcomes can be fully … "'Leagile' software development: An experience report analysis of the application of lean approaches in **agile software development**," …
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[PDF] arxiv.org

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Figure B.15.: Web Of Science Search Results for the Key Words 'organisational initiative' AND 'agile software development'

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ALL=("organisational initiative") AND ALL=("agile software development")

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*Note.* Screenshot taken in November 2021 on https://webofscience.com

Figure B.16.: Google Scholar Search Results for the Key Words 'organisational initiative' AND 'agile software development' AND 'Germany'

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"organisational initiative" AND "agile software development" AND "Germany"    🔍

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    Try more general keywords.
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    Try your query on the entire web

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Figure B.17.: Google Scholar Search Results for the Key Words 'positive leadership'

☰ Google Scholar    "positive leadership"    🔍    ◆ My profile ★

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[BOOK] **Positive leadership**: Strategies for extraordinary performance    [PDF] bkconnection.com
K Cameron - 2012 - books.google.com
NEW EDITION, REVISED AND UPDATED Beyond Success **Positive Leadership** shows how
to reach beyond ordinary success to achieve extraordinary effectiveness, spectacular
results, and what Kim Cameron calls "positively deviant performance"—performance far ...
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[BOOK] Practicing **positive leadership**: Tools and techniques that create    [PDF] bkconnection.com
extraordinary results
K Cameron - 2013 - books.google.com
The recent emphasis on **positive leadership** has revolutionised traditional approaches to
leading and managing. Producing extraordinarily high performance, generating positively
deviant results-results that are dramatically better than normal-and creating remarkable ...
☆ 💬 Cite   Cited by 149   Related articles   All 4 versions   ≫

**Positive leadership and employee well-being**
EK Kelloway, H Weigand... - Journal of Leadership ..., 2013 - journals.sagepub.com
We report two studies examining the relationship between **positive leadership** behaviors
and employee well-being. In the first, data from 454 nursing home employees showed that
(a) a newly developed measure of **positive leadership** was distinct from transformational ...
☆ 💬 Cite   Cited by 179   Related articles   All 2 versions

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Figure B.18.: Web Of Science Search Results for the Key Words 'positive leadership'

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☐ 0/40

☐ 1    POSITIVE LEADERSHIP
Immler, K
Aug 2014 | AMERICAN JOURNAL OF NURSING 114 (8) , pp.13-13

S·F·X    Full Text at Publisher    •••

0
References

*Note.* Screenshot taken in November 2021 on https://webofscience.com
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Figure B.19.: Google Scholar Search Results for the Key Words 'positive leadership' AND 'agile software development'



Google Scholar

"positive leadership" AND "agile software development"

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JA Ward - Software Quality Professional, 2016 - search.proquest.com
... **Agile Software Development** Koch, Alan ... **Positive Leadership** in Project Management:
A Practical Guide to Enhancing Individual, Team and Organizational Performance Saladis,
Frank P. ...
☆ 𝟗𝟗 Cite

[PDF] **Agile Project Management in Large Scale Software Development**          [PDF] uio.no
SM Ali - 2020 - duo.uio.no
... This paper discussed how **agile software development** bring a sensation of firmness in
software development industry some school of thoughts argue enthusiastically about agile and
others are equally against it, while some school of thoughts consider a mix of agile and plan ...
☆ 𝟗𝟗 Cite   Cited by 1   Related articles   ≫

**Proposing total quality management as a buffer between global software
development challenges and project success**
SD Hashmi, K Shahzad, M Izhar - The TQM Journal, 2021 - emerald.com
... Previously, different researchers have found positive relationship between different **positive
leadership** styles and project success (eg Aga ... (2009) have found that leadership plays an
important role in **agile software development**. Thus, leadership dimension of TQM can help in ...
☆ 𝟗𝟗 Cite   All 2 versions

.

Figure B.20.: Web Of Science Search Results for the Key Words 'positive leadership' AND 'agile software development'



**Your search found no results**

Check the spelling and/or broaden your search parameters
Need more help? Check our walkthrough, videos, or our help pages

More options ▲

Query Preview

Search Help

ALL="positive leadership" AND ALL="agile software development"

Publication Date    >    2011-01-01    to    2021-11-12

✕ Clear    Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com
.

Figure B.21.: Google Scholar Search Results for the Key Words 'positive leadership' AND 'agile software development' AND 'Germany'

≡ Google Scholar    | "positive leadership" AND "agile software development" AND "Germany"    🔍 |

**Articles**    5 results (0,08 sec)

Any time
Since 2021
Since 2020
Since 2017
Custom range...

| 2011 | — | 2021 |

Search

Sort by relevance
Sort by date

Any type
☐ include patents
☐ include citations

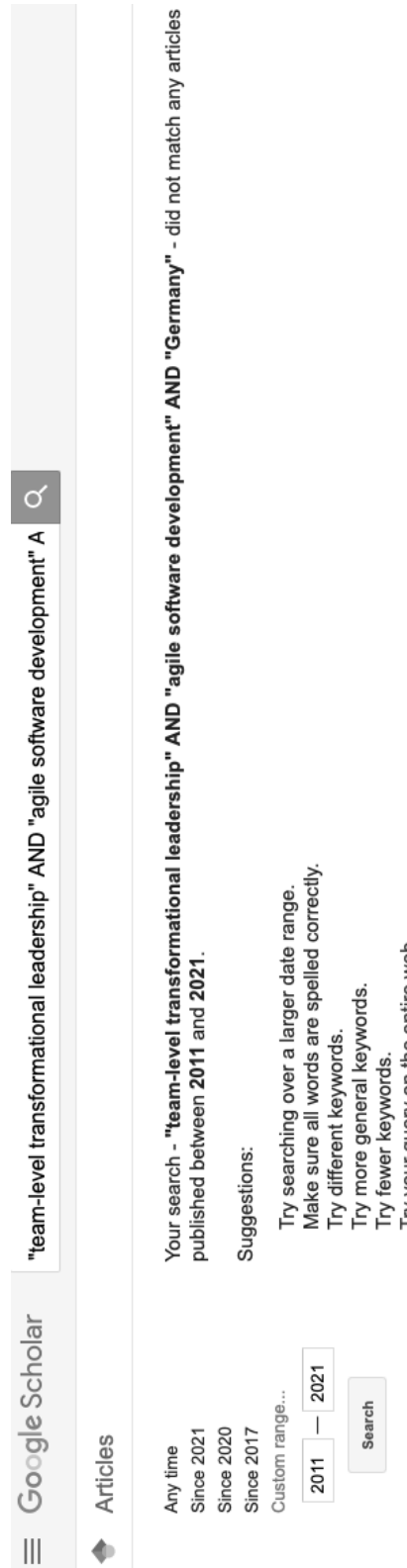☑ Review articles

☑ Create alert

☆  ⫿⫿ Cite    Cited by 5    Related articles    All 4 versions   »

[BOOK] Systems, Software and Services Process Improvement: 24th European Conference, EuroSPI 2017, Ostrava, Czech Republic, September 6–8, 2017 ....
J Stolfa, S Stolfa, RV O'Connor, R Messnarz - 2017 - books.google.com
This volume constitutes the refereed proceedings of the 24th EuroSPI conference, held in Ostrava, Czech Republic, in September 2017. The 56 revised full papers presented were carefully reviewed and selected from 97 submissions. They are organized in topical sections on , , ...
☆  ⫿⫿ Cite    Cited by 1    Related articles    All 3 versions   »

[BOOK] Systems, Software and Services Process Improvement: 26th European Conference, EuroSPI 2019, Edinburgh, UK, September 18–20, 2019, Proceedings
A Walker, RV O'Connor, R Messnarz - 2019 - books.google.com
This volume constitutes the refereed proceedings of the 26th European Conference on Systems, Software and Services Process Improvement, EuroSPI conference, held in Edinburgh, Scotland, in September 2019. The 18 revised full papers presented were carefully reviewed . . ...
☆  ⫿⫿ Cite    Cited by 75    Related articles    All 6 versions   »

[BOOK] Leading virtual project teams: Adapting leadership theories and communications techniques to 21st century organizations                    [PDF] ethernet.edu.et
MR Lee - 2021 - books.google.com
... A field study of two large companies in **Germany** showed that effective virtual team management practices included setting clear goals, tasks, and outcome interdependencies [20]. It found that the higher the quality of goal-setting processes and task interdependence, the more ...

Figure B.22.: Google Scholar Search Results for the Key Words 'team-level transformational leadership'



≡ Google Scholar

"team-level transformational leadership"

Articles

About 69 results (0,03 sec)

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Sort by relevance
Sort by date

**Transformational leadership and inter-team collaboration: Exploring the mediating role of teamwork quality and moderating role of team size**
J Cha, Y Kim, JY Lee... - Group & Organization ..., 2015 - journals.sagepub.com
... More recently, however, empirical research has revealed potential benefits of **team-level transformational leadership** for achieving team ... This study offers insights into how **team-level transformational leadership** can contribute to higher levels of inter-team collaboration. ...
☆ 〟 Cite  Cited by 75  Related articles  All 4 versions

**Fostering team innovation and learning by means of team-centric transformational leadership: The role of teamwork quality**
A Klaic, MJ Burtscher, K Jonas - Journal of Occupational and ..., 2020 - Wiley Online Library
... In sum, we propose a multilevel model of team leadership in scientific teams (Figure 1), which integrates **team-level transformational leadership** (Wang & Howell, 2010), the teamwork quality model (Hoegl & Gemuenden, 2001), and the team innovation literature (Anderson & ...
☆ 〟 Cite  Cited by 8  Related articles  All 4 versions

[PDF] 160.85.104.64

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.23.: Web Of Science Search Results for the Key Words 'team-level transformational leadership'

*Note.* Screenshot taken in November 2021 on https://webofscience.com
.

Figure B.24.: Google Scholar Search Results for the Key Words 'team-level transformational leadership' AND 'agile software development'



= Google Scholar

"team-level transformational leadership" AND "agile software development"

◆ Articles

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Your search - **"team-level transformational leadership" AND "agile software development"** - did not match any articles published between **2011** and **2021**.

Suggestions:

Try searching over a larger date range.
Make sure all words are spelled correctly.
Try different keywords.
Try more general keywords.
Try fewer keywords.
Try your query on the entire web

*Note.* Screenshot taken in November 2021 on https://scholar.google.com

.

Figure B.25.: Web Of Science Search Results for the Key Words 'team-level transformational leadership' AND 'agile software development'

**Your search found no results**

Need more help? Check our walkthrough, videos, or our help pages
Check the spelling and/or broaden your search parameters

Search Help

More options ▲
Query Preview

ALL=("team-level transformational leadership") AND ALL=("agile software development")

⊖ | Publication Date | ∨ | 2011-01-01 | to | 2021-11-09 | ✕ Clear | Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com
.

Figure B.26.: Google Scholar Search Results for the Key Words 'team-level transformational leadership' AND 'agile software development' AND 'Germany'



≡ Google Scholar

"team-level transformational leadership" AND "agile software development" A 🔍

◆ Articles

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Your search - **"team-level transformational leadership" AND "agile software development" AND "Germany"** - did not match any articles published between **2011** and **2021**.

Suggestions:

Try searching over a larger date range.
Make sure all words are spelled correctly.
Try different keywords.
Try more general keywords.
Try fewer keywords.
Try your query on the entire web

*Note.* Screenshot taken in November 2021 on https://scholar.google.com

.

Figure B.27.: Web Of Science Search Results for the Key Words 'team-level transformational leadership' AND 'agile software development' AND 'Germany'



**Your search found no results**

Check the spelling and/or broaden your search parameters

Need more help? Check our walkthrough, videos, or our help pages
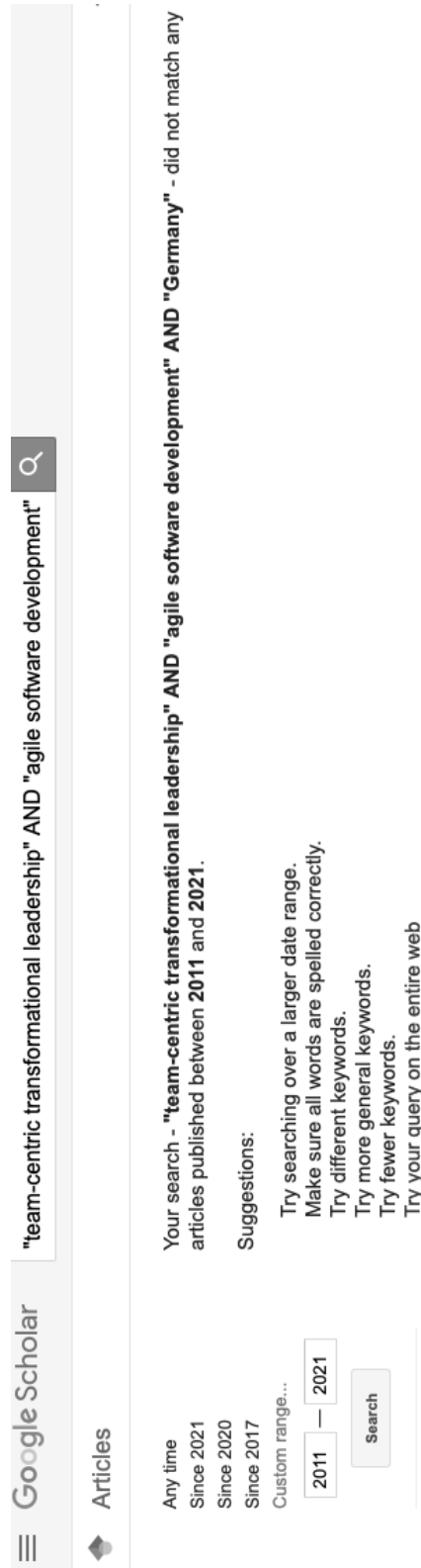
More options ▲

Query Preview

ALL=("team-level transformational leadership") AND ALL=("agile software development") AND ALL=("Germany")

Search Help

Publication Date     ˅     2011-01-01    to    2021-11-09

✕ Clear    Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com

.

Figure B.28.: Google Scholar Search Results for the Key Words 'team-centric transformational leadership'

≡ Google Scholar

**"team-centric transformational leadership"**     🔍

◆ Articles

About 13 results (0,03 sec)

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Sort by relevance
Sort by date

**Fostering team innovation and learning by means of team-centric transformational leadership**: The role of teamwork quality

A Klaic, MJ Burtscher, K Jonas - Journal of Occupational and ..., 2020 - Wiley Online Library

Team innovation is an important factor for organizational effectiveness. However, fostering innovation in teams remains a major challenge for team leaders. In particular, we still have an incomplete understanding of (1) the effects of team-centric leadership and (2) the role of ...

☆ 〽 Cite  Cited by 8  Related articles  All 4 versions

[PDF] 160.85.104.64

**Is Transformational Leadership Suitable for Future Organizational Needs?**

M Asbari - International Journal of Social, Policy and Law, 2020 - ijospl.org

... (2020) who concluded that **team-centric transformational leadership** was positively associated with team innovation and individual member learning. Klaic et al. (2020) explained that innovation and learning are important drivers of success in organizations, especially in ...

☆ 〽 Cite  Cited by 29  Related articles  All 2 versions  》

[PDF] ijospl.org

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.29.: Web Of Science Search Results for the Key Words 'team-centric transformational leadership'

**1 result from Web of Science Core Collection for:**

ALL=("team-centric transformational leadership")

Copy query link | *Timespan: 2011-01-01 to 2021-11-09 (Publication Date)*

Publications     You may also like....

Analyze Results   Citation Report   Create Alert

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Open Access    1

0/1   Add To Marked List   Export

Relevance   <   1   of 1   >

1   Fostering team innovation and learning by means of team-centric transformational leadership: The role of teamwork quality

Klaic, A; Burtscher, MJ and Jonas, K

Dec 2020 | Jun 2020 (Early Access) | JOURNAL OF OCCUPATIONAL AND ORGANIZATIONAL PSYCHOLOGY 93 (4), pp.942-966

Team innovation is an important factor for organizational effectiveness. However, fostering innovation in teams remains a major challenge for team leaders. In particular, we still have an incomplete understanding of (1) the effects of team-centric leadership and (2) the role of teamwork for the relationship between leadership and innovation and l ... Show more

3 Citations

99 References

Figure B.30.: Google Scholar Search Results for the Key Words 'team-centric transformational leadership' AND 'agile software development'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com

**Your search found no results**

Check the spelling and/or broaden your search parameters

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More options ▲

Query Preview

ALL=("team-centric transformational leadership") AND ALL=("agile software development")

Search Help

⊖ Publication Date    ˅    2011-01-01    to    2021-11-09

✕ Clear    Search
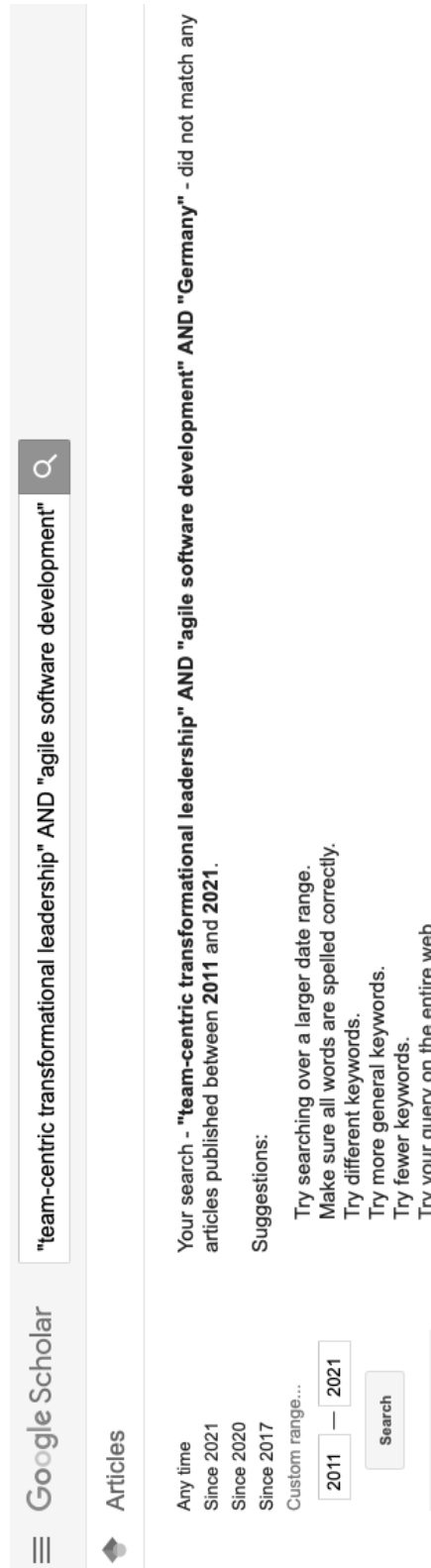
Figure B.31.: Web Of Science Search Results for the Key Words 'team-centric transformational leadership' AND 'agile software development' AND 'Germany'

*Note.* Screenshot taken in November 2021 on https://webofscience.com

.

Figure B.32.: Google Scholar Search Results for the Key Words 'team-centric transformational leadership' AND 'agile software development' AND 'Germany'



≡ Google Scholar

**"team-centric transformational leadership" AND "agile software development"**

◆ Articles

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Your search - **"team-centric transformational leadership" AND "agile software development" AND "Germany"** - did not match any articles published between **2011** and **2021**.

Suggestions:

Try searching over a larger date range.
Make sure all words are spelled correctly.
Try different keywords.
Try more general keywords.
Try fewer keywords.
Try your query on the entire web

*Note.* Screenshot taken in November 2021 on https://scholar.google.com

.

Figure B.33.: Web Of Science Search Results for the Key Words 'team-centric transformational leadership' AND 'agile software development' AND 'Germany'

**Your search found no results**

Check the spelling and/or broaden your search parameters

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More options ▲

Query Preview

ALL=("team-centric transformational leadership") AND ALL=("agile software development") AND ALL=("Germany")

Search Help

Publication Date          ‹          2011-01-01          to          2021-11-09          ✕ Clear          Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com

Figure B.34.: Google Scholar Search Results for the Key Words 'teamwork quality'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.35.: Web Of Science Search Results for the Key Words 'teamwork quality'

**30 results from Science Citation Index Expanded (SCI-EXPANDED):**

ALL=("teamwork quality")

Analyze Results   Citation Report   🔔 Create Alert

🔗 Copy query link | *Timespan: 2011-01-01 to 2021-11-08 (Publication Date)*

Publications    You may also like....

**Refine results**

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☐ ⊕ Open Access   15

**Publication Years** ‹

**Search for Publication Years**

☑ Select all    Date ⌄

☑ 2021   5
☑ 2020   5
☑ 2019   6
☑ 2018   4
☑ 2016   3
☑ 2014   4
☑ 2013   1
☑ 2012   1
☑ 2011   1

☐ 0/30   Add To Marked List   Export ⌄

Relevance ⌄   ‹ ___ 1 of 1 ›

☐ 1   ⊕ **Teamwork quality and project success in software development: A survey of agile development teams**
Lindsjørn, Y; Sjøberg, DIK; (...); Dybå, T
Dec 2016 | JOURNAL OF SYSTEMS AND SOFTWARE 122 , **pp.274-286**

Small, self-directed teams are central in agile development. This article investigates the effect of teamwork quality on team performance, learning and work satisfaction in agile software teams, and whether this effect differs from that of traditional software teams. A survey was administered to 477 respondents from 71 agile software teams in 26 cor ... Show more

𝒮·ᖆ·x   Free Full Text From Publisher •••     Related records

**74** Citations
**52** References

☐ 2   ⊕ ⏱ **Measuring teamwork quality in large-scale agile organisations evaluation and integration of the aTWQ approach**
Poth, A; Kottke, M and Riel, A
Aug 2021 (Early Access) | IET SOFTWARE

The maturity of organisations is measured using process assessment models like the International Organization for Standardization (ISO)/IEC 33001. Product quality is refined with internal and external product quality characteristics based on models like the ISO/IEC 25010. With the shift from the Tailorism-driven process orientation to a more ... Show more

𝒮·ᖆ·x   Free Full Text from Publisher •••     Related records

**1** Citation
**44** References

☐ 3   **Assessing Perceptions of Teamwork Quality Among Perioperative Team Members**
Muller, P; Tschan, F; (...); Semmer, NK
Sep 2018 | AORN JOURNAL 108 (3) , pp.251-262

Successful surgery depends on collaboration and mutual trust among interdisciplinary team members. We compared

**3** Citations
**50**

*Note.* Screenshot taken in November 2021 on https://webofscience.com

Figure B.36.: Google Scholar Search Results for the Key Words 'teamwork quality' AND 'agile software development'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com

**1 result from Science Citation Index Expanded (SCI-EXPANDED):**

🔍 ALL=("teamwork quality") AND ALL=("agile software development")

∞ Copy query link | *Timespan:2011-01-01 to 2021-11-08 (Publication Date)*

Publications     You may also like...

    Analyze Results    Citation Report    🔔 Create Alert

**Refine results**

Search within results for... 🔍

☐ 0/1    Add To Marked List    Export ∨     Relevance ∨   ∧    1   of 1   ∨

**Quick Filters**

☐ 🔓 Open Access    1

☐ 1    ⊞   **Satisfaction and its correlates in agile software development**

Kropp, M; Meier, A; (...); Biddle, R

Jun 2020 | JOURNAL OF SYSTEMS AND SOFTWARE 164

In this paper we address the topic of software development team members satisfaction with their development process. We present an in-depth analysis of the results of a nationwide survey about software development in Switzerland. We wanted to find out if satisfaction relates to the applied development method, and to the use of various practices. ... Show more

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**Publication Years**   ∨

☐ 2020    1

    32 References    <u>Related records</u>

Figure B.37.: Web Of Science Search Results for the Key Words 'teamwork quality'

*Note.* Screenshot taken in November 2021 on https://webofscience.com

Figure B.38.: Google Scholar Search Results for the Key Words 'teamwork quality' AND 'agile software development' AND 'Germany'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com

.

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More options ▲

Query Preview

ALL=("teamwork quality") AND ALL=("agile software development") AND ALL=("Germany")

⊖ Publication Date    ∨    2011-01-01    to    2021-11-09

× Clear    Search

Figure B.39.: Web Of Science Search Results for the Key Words 'teamwork quality' AND 'agile software development' AND 'Germany'

*Note.* Screenshot taken in November 2021 on https://webofscience.com

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Figure B.40.: Google Scholar Search Results for the Key Words 'learning'

≡ Google Scholar

"learning"

♦ Articles

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Sort by relevance
Sort by date

About 954.000 results (0,04 sec)

[BOOK] **Learning** lessons
H Mehan - 2013 - degruyter.com
I write this foreword to **Learning** Lessons from the bi-focal perspective of both long-standing
colleague of the author and, for the ten months described in this book, the subject of his
research. I am the classroom teacher who taught these lessons. As Hugh ('' Bud'') Mehan ...
☆ 〃 Cite   Cited by 8474   Related articles   All 3 versions ≫

[BOOK] The power of mindful **learning**
EJ Langer - 2016 - books.google.com
Radical in its implications, this original and important work may change forever the views we
hold about the nature of **learning**. In The Power of Mindful **Learning**, Ellen Langer uses her
innovative theory of mindulness, introduced in her influential earlier book, to dramatically ...
☆ 〃 Cite   Cited by 2293   Related articles   All 6 versions ≫

[PDF] degruyter.com

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.41.: Web Of Science Search Results for the Key Words 'learning'

**930,726 results from Web of Science Core Collection for:**

ALL=("learning")

∞ Copy query link | Timespan: 2011-01-01 to 2021-11-09 (Publication Date)

Publications    You may also like....

**Analyze Results**    Citation Report    ♠ Create Alert

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☐ 🔥 Hot Papers    226
☐ 📄 Review Articles    28,901
☐ ⏱ Early Access    16,546
☐ 🔓 Open Access    310,422

☐ 0/930,726    Add To Marked List    Export ∨

Relevance ∨    ⟨    1    of 2,000    ⟩

☐ 1    Learning Pulse: a machine learning approach for predicting performance in self-regulated learning using multimodal data

Di Mitri, D; Scheffel, M; (...); Specht, M

2017 | SEVENTH INTERNATIONAL LEARNING ANALYTICS & KNOWLEDGE CONFERENCE (LAK'17) , pp.188-197

7th International Learning Analytics and Knowledge Conference (LAK)

Learning Pulse explores whether using a machine learning approach on multimodal data such as heart rate, step count, weather condition and learning activity can be used to predict learning performance in self-regulated learning settings. An experiment was carried out lasting eight weeks involving PhD students as participants, each of them ... Show more

29
Citations

31
References

*Note.* Screenshot taken in November 2021 on https://webofscience.com
.

Figure B.42.: Google Scholar Search Results for the Key Words 'learning' AND 'agile software development'



Google Scholar

"learning" AND "agile software development"

Articles    About 19.100 results (0,13 sec)

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Sort by relevance
Sort by date

**Embedding reflection and learning into agile software development**
J Babb, R Hoda, J Nørbjerg - IEEE software, 2014 - ieeexplore.ieee.org
The theoretical underpinnings of agile methods emphasize regular reflection as a means to
sustainable development pace and continuous **learning**, but in practice, high iteration
pressure can diminish reflection opportunities. The Reflective Agile **Learning** Model …
☆ 〝 Cite  Cited by 61  Related articles  All 12 versions

[PDF] researchgate.net

**Barriers to learning in agile software development projects**
JS Babb, R Hoda, J Nørbjerg - … conference on agile software development, 2013 - Springer
The adoption of agile methods promises many advantages for individual, team, and
organizational **learning**. However, environmental, structural, and organizational/cultural
constraints often find teams adapting **agile software development** methods rather than …
☆ 〝 Cite  Cited by 24  Related articles  All 4 versions

[PDF] researchgate.net

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.43.: Web Of Science Search Results for the Key Words 'learning'



**168 results from Web of Science Core Collection for:**

ALL=("learning") AND ALL=("agile software development")

∞ Copy query link | *Timespan: 2011-01-01 to 2021-11-09 (Publication Date)*

Publications     You may also like....

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☐ 📄 Review Articles    3
☐ 🕐 Early Access    1
☐ 🔓 Open Access    26

☐ 0/168    Add To Marked List    Export ⌄

Relevance ⌄   ⟨   1   of 4   ⟩

☐ 1   Systematic Mapping of Workshops for Learning Agile Software Development Principles

Washizaki, H; Suzuki, S; (...); Fukazawa, Y

2013 | 2013 INTERNATIONAL CONFERENCE ON EDUCATION AND EDUCATIONAL RESEARCH (EER 2013) 1, pp.102-107

International Conference on Education and Educational Research (EER)

Agile software development is aimed at minimizing overall risk and encouraging rapid and flexible response to specification changes by using an iterative process. There are many workshops for learning agile software development principles (hereafter "agile principles") such as the collaboration with customers and software working. These workshops .... Show more

12
References

Figure B.44.: Google Scholar Search Results for the Key Words 'learning' AND 'agile software development' AND 'Germany'



**Google Scholar**

"learning" AND "agile software development" AND "Germany"

Articles

About 4.800 results (0,03 sec)

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2011 — 2021

Search

Sort by relevance
Sort by date

Any type
☐ include patents
☐ include citations

Review articles

☑ Create alert

[BOOK] Agile Processes in Software Engineering and Extreme Programming: 18th International Conference, XP 2017, Cologne, **Germany**, May 22-26, 2017 ...
H Baumeister, H Lichter, M Riebisch - 2017 - library.oapen.org
... The 18th XP conference was held 2017 in the wonderful city of Cologne, **Germany**. In the spirit of past XP conferences, XP 2017 was a place where researchers and practitioners met to exchange new ideas and present their work. These proceedings contain the full research ...
☆ ⠿ Cite Cited by 8 Related articles All 13 versions ≫

[PDF] oapen.org

Starting out with projects: Experiences with **agile software development** in high schools
P Kastl, U Kiesmüller, R Romeike - Proceedings of the 11th workshop in ..., 2016 - dl.acm.org
... of CS, conducting software projects in schools remains a challenge: In **Germany**, projects typically are conducted at the end of a school year, ... different experiments exploring the application of project-based **learning** early in the **learning** process. The interventions have been put ...
☆ ⠿ Cite Cited by 30 Related articles All 2 versions

[PDF] computingeducation.de

The Sars-Cov-2 pandemic and agile methodologies in software development: A multiple case study in **germany**
M Neumann, Y Bogdanov, M Lier... - ... **Software Development**, 2021 - Springer
... To do this, use the Self-Service Kit (SSK), which the authors define as a combination of various **learning** and training methods. The SSK activates teams and departments at any hierarchical level to share or build up existing and new knowledge, despite distributed ...
☆ ⠿ Cite Cited by 6 Related articles All 2 versions ≫

[PDF] researchgate.net

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.45.: *Web Of Science Search Results for the Key Words 'learning' AND 'agile software development' AND 'Germany'*

## 21 results from Web of Science Core Collection for:

ALL=("learning") AND ALL=("agile software development*") AND ALL=("Germany")

Copy query link | *Timespan: 2011-01-01 to 2021-11-09 (Publication Date)*

| Analyze Results | Citation Report | 🔔 Create Alert |

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☐ 0/21          Add To Marked List          Export ⌄

Relevance ⌄          ⟨          1          of 1          ⟩

☐ 1   **Agile Software Development: What is Left to Do?**
Schnitter, J and Geppert, J
2014 | FUTURE BUSINESS SOFTWARE: CURRENT TRENDS IN BUSINESS SOFTWARE DEVELOPMENT , pp.93-104

Agile software development is about to become mainstream in the software industry. Its introduction requires a significant change of the mindset towards openness, honesty, and flexibility. Therefore, the adoption of agile development by the industry is also a process of cultural change that takes a long time and surfaces many issues which have been | ... Show more

14
References

*Note.* Screenshot taken in November 2021 on https://webofscience.com

.

Figure B.46.: Google Scholar Search Results for the Key Words 'HPT'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com, HPT = High-Performance-Team
.

Figure B.47.: Web Of Science Search Results for the Key Words 'HPT'

**16 results from Web of Science Core Collection for:**

Q ALL=("high-performing team")

⊕ Copy query link | *Timespan: 2011-01-01 to 2021-11-09 (Publication Date)*

Publications     You may also like....

Analyze Results   Citation Report   🔔 Create Alert

**Refine results**

Search within results for...  Q

**Quick Filters**

☐ 📄 Review Articles   1
☐ ⊕ Open Access   3

☐ 0/16   Add To Marked List   Export ˅

Relevance ˅   ‹   1   of 1   ›

☐ 1   THE FIVE SUCCESS FACTORS OF A TRULY HIGH-PERFORMING TEAM
Kruckeberg, K
2017 | ADVANCED LEADERSHIP INSIGHTS: HOW TO LEAD PEOPLE AND ORGANIZATIONS TO ULTIMATE SUCCESS , pp.53-71

**7**
References

*Note.* Screenshot taken in November 2021 on https://webofscience.com, HPT = High-Performance-Team
.

Figure B.48.: Google Scholar Search Results for the Key Words 'HPT' AND 'agile software development'



≡ Google Scholar

"high-performing team" AND "agile software development" 🔍

Articles

About 146 results (0,12 sec)

Any time
Since 2021
Since 2020
Since 2017
Custom range...

2001 — 2021

Search

Sort by relevance
Sort by date

Any type
☐ include patents
☐ include citations

Review articles

☑ Create alert

**Attaining high-performing software teams with agile and lean practices: An empirical case study**
V Oza, P Kettunen, P Abrahamsson... - arXiv preprint arXiv..., 2013 - arxiv.org
... Karhatsu [1] proposes key characteristics of self-organized teams in the context of **agile software development**. We take Karhatsu s ... Table 4-2 shows that most of the **highperforming team** characteristics have some connection to Autonomy and Shared leadership . It was ...
☆ 🗐 Cite Cited by 8 Related articles All 7 versions ≫

[PDF] arxiv.org

**Sensing high-performing software teams: Proposal of an instrument for self-monitoring**
P Kettunen, S Moilanen - ... Conference on Agile Software Development, 2012 - Springer
... Section 4 presents actual profiling findings of real-life **high-performing team** cases, followed by consequent insights and implications in ... The insight here is that once the team members have at least once before experienced a truly **high-performing team**, they can recognize one ...
☆ 🗐 Cite Cited by 10 Related articles All 5 versions

**How do software developers experience team performance in lean and agile environments?**
F Fagerholm, M Ikonen, P Kettunen, J Münch... - Proceedings of the 18th ..., 2014 - dl.acm.org
... All companies have adopted Lean and Agile development principles and use some variant of Lean and **Agile software development** in their ... Based on our findings, a **high-performing team** is one that is exceptionally good at Performance Alignment Work. Not only can it ...
☆ 🗐 Cite Cited by 26 Related articles All 10 versions

[PDF] helsinki.fi

*Note.* Screenshot taken in November 2021 on https://scholar.google.com, HPT = High-Performance-Team .

Figure B.49.: Web Of Science Search Results for the Key Words 'HPT'

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ALL=("high-performing team") AND ALL=("agile software development")

Search Help

⊖ | Publication Date | ∨ | 2011-01-01 | to | 2021-11-09 |     ✕ Clear     Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com, HPT = High-Performance-Team

.

Figure B.50.: Google Scholar Search Results for the Key Words 'HPT' AND 'agile software development' AND 'Germany'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com, HPT = High-Performance-Team
.

Figure B.51.: Web Of Science Search Results for the Key Words 'HPT' AND 'agile software development' AND 'Germany'

*Note.* Screenshot taken in November 2021 on https://webofscience.com, HPT = High-Performance-Team

Figure B.52.: Google Scholar Search Results for the Key Words 'team interventions'



*Note.* Screenshot taken in November 2021 on https://scholar.google.com

Figure B.53.: Web Of Science Search Results for the Key Words 'team interventions'

**87 results from Web of Science Core Collection for:**

🔍 ALL=("team interventions")

∞ Copy query link | *Timespan: 2011-01-01 to 2021-11-09 (Publication Date)*

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| 2019 | 11 |
| 2018 | 9 |

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Interprofessional teamwork and team interventions in chronic care: A systematic review

Korner, M; Butof, S; (...); Bengel, J

Jan 2 2016 | JOURNAL OF INTERPROFESSIONAL CARE 30 (1) , pp.15-28

To identify key features of teamwork and interventions for enhancing interprofessional teamwork (IPT) in chronic care and to develop a framework for further research, we conducted a systematic literature review of IPT in chronic care for the years 2002-2014. Database searches yielded 3217 abstracts, 21 of which fulfilled inclusion criteria. We identified t ... Show more

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**87** Citations
**56** References

☐ 2   🗂
Team interventions in acute hospital contexts: a systematic search of the literature using realist synthesis

Cunningham, U; Ward, ME; (...); McAuliffe, E

Jul 11 2018 | BMC HEALTH SERVICES RESEARCH 18

Background: Research on team effectiveness in healthcare has focussed on whether effective teams yield positive outcomes for patients and on the effectiveness of team interventions to improve performance. Limited understanding exists of what works for whom within an effective team, or how and why the context in which the team operates enables t ... Show more

**9** Citations
**50** References

Figure B.54.: Google Scholar Search Results for the Key Words 'team interventions' AND 'agile software development'

**= Google Scholar**

"team interventions" AND "agile software development"     🔍

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Sort by date

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☐ include patents
☐ include citations

Review articles

**Gauging influence in software development teams**
A Marshall, R Gamble - 2015 IEEE Frontiers in Education ..., 2015 - ieeexplore.ieee.org
... Research in understanding the interplay between sentiments and status can provide reasons
for **team interventions** to reduce any negative ..., or team members to monitor the performance
of individuals in an **agile software development** team, and detect potential problems. ...
☆ 〞 Cite   Cited by 5   Related articles   All 4 versions

**Team video gaming for team building: Effects on team performance**
MJ Keith, G Anderson, J Gaskin... - AIS Transactions on ..., 2018 - aisel.aisnet.org
... For example, in the information systems context, cross-functional and project-based teams
that comprise a mix of personnel who temporarily work away from their usual functional groups
(best perform **agile software development** (Barlow et al., 2011; Keith, Demirkan, & Goul, ...
☆ 〞 Cite   Cited by 16   Related articles   All 5 versions

**[PDF] researchgate.net**

**Give recognition to the impervious**
D Haselberger - Proceedings of the 18th European Conference on ..., 2015 - dl.acm.org
... Further, feedback loops from team performance and **team interventions** to individual and
team characteristics as well as task ... Coplien and Harrison [Coplien and Harrison 2005]
elaborated a collection of organizational patterns of **agile software development**. Beedle [Beedle ...
☆ 〞 Cite   Cited by 4   Related articles

*Note.* Screenshot taken in November 2021 on https://scholar.google.com
.

Figure B.55.: Web Of Science Search Results for the Key Words 'team interventions'

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Query Preview

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ALL=("team interventions") AND ALL=("agile software development")

Search Help

⊖  Publication Date  ∨   2011-01-01   to   2021-11-09           ✕ Clear   Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com
.

Figure B.56.: Google Scholar Search Results for the Key Words 'team interventions' AND 'agile software development' AND 'Germany'



≡ Google Scholar

"team interventions" AND "agile software development" AND "Germany"

◆ Articles

4 results (0,09 sec)

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Since 2020
Since 2017
Custom range...

2011 — 2021

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Sort by date

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☐ include patents
☐ include citations

Review articles

▶ Create alert

**Team video gaming for team building: Effects on team performance**
MJ Keith, G Anderson, J Gaskin... - AIS Transactions on ..., 2018 - aisel.aisnet.org
... For example, in the information systems context, cross-functional and project-based teams
that comprise a mix of personnel who temporarily work away from their usual functional groups
(best perform **agile software development** (Barlow et al., 2011; Keith, Demirkan, & Goul, ...
☆ 🔖 Cite Cited by 16 Related articles All 5 versions

[PDF] researchgate.net

**Give recognition to the impervious**
D Haselberger - Proceedings of the 18th European Conference on ..., 2015 - dl.acm.org
... learning through **team interventions** was elaborated by Tannenbaum, Beard and Salas [Tannenbaum
et al. 1992]. This model takes organizational and situational characteristics into account.
Further, feedback loops from team performance and **team interventions** to individual ...
☆ 🔖 Cite Cited by 4 Related articles

**Teams, time, and technology: Variations of media use over project phases**
L Handke, EM Schulte, K Schneider... - Small group ..., 2019 - journals.sagepub.com
While the notion of task–media fit is inherent to most theories on communication in virtual teams,
past studies have largely concentrated on single, isolated tasks—hence neglecting sequential
and contextual effects of media use. Building on project management frameworks, the ...
☆ 🔖 Cite Cited by 13 Related articles All 2 versions

[PDF] **a culture of Participation in Hierarchically Conditioned Companies**
R DESHPANDE - 2019 - researchgate.net
... a running transformation at an IT technology vendor in **Germany** to test our hypothesis. Chapter
6 ... We see proof of this, for example, in the contexts of **agile software development** (Appelo
2010). ... Also, they must participate in the **team interventions** to continuously raise their self-...
☆ 🔖 Cite Related articles ≫

[PDF] researchgate.net

*Note.* Screenshot taken in November 2021 on https://scholar.google.com

.

Figure B.57.: Web Of Science Search Results for the Key Words 'team interventions' AND 'agile software development' AND 'Germany'

**Your search found no results**

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Query Preview

ALL=("team interventions") AND ALL=("agile software development") AND ALL=("Germany")

Search Help

Ⓘ Publication Date

2011-01-01    to    2021-11-09

✕ Clear    Search

*Note.* Screenshot taken in November 2021 on https://webofscience.com

## TABLES

Table B.1.: Hard and Soft Skills Needed for Software Product Development using the Agile Framework of Scrum Adapted from Omar et al. (2018, pp. 785–786)

| Hard Skills | Soft Skills |
|---|---|
| Programming language(s) | Analytical skills |
| Spoken and written language | Communication |
| Database skills | Facilitation |
| Expert area | Interpersonal skills |
| Role experience | Leadership skills |
| Experience in working methods | Management skills |
| | People skills |
| | Planning skills |
| | Teamwork skills |
| | Thinking skills |

Table B.2.: Search Results for Team-centric Transformational Leadership and Agile Software Development, and Germany in Google Scholar and Web of Science in the Past 10 Years

| Key Words | Number of Articles | Search Engine | Documentation |
|---|---|---|---|
| 'team-centric transformational leadership' | 13 | Google Scholar | Figure B.28 |
| | 1 | Web of Science | Figure B.29 |
| 'team-centric transformational leadership' AND 'agile software development' | 0 | Google Scholar | Figure B.30 |
| | 0 | Web of Science | Figure B.31 |
| 'team-centric transformational leadership' AND 'agile software development' AND ('Germany' | 0 | Google Scholar | Figure B.32 |
| | 0 | Web of Science | Figure B.33 |

*Note.* Status in November 2021

Table B.3.: G*Power Output for Power Analysis – *t* tests – Linear Multiple Regression: Fixed Model, Single Regression Coefficient

| Analysis: | A priori: Compute required sample size | |
|---|---|---|
| Input: | Tail(s) | Two |
| | Effect size $f^2$ | 0.15 |
| | *alpha* err prob | 0.05 |
| | Power (1-β err prob) | 0.8 |
| | Number of predictors | 3 |
| Output: | Non-centrality parameter δ | 2.872 281 3 |
| | Critical *t* | 2.007 583 8 |
| | Df | 51 |

*Note.* G*Power Analysis in line with Faul et al. (2009)

Table B.5.: Frequencies for Gender for First Main Study

| Gender | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Female | 35 | 31.532 | 31.532 | 31.532 |
| Male | 76 | 68.468 | 68.468 | 100.000 |
| Missing | 0 | 0.000 | | |
| Total | 111 | 100.000 | | |

Table B.6.: Frequencies for Role for First Main Study

| Role | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| (Team) Assistant | 13 | 11.712 | 11.712 | 11.712 |
| Agile Coach / Scrum Master | 4 | 3.604 | 3.604 | 15.315 |
| Developer | 41 | 36.937 | 36.937 | 52.252 |
| Leader | 15 | 13.514 | 13.514 | 65.766 |
| Product Ower | 17 | 15.315 | 15.315 | 81.081 |
| Project Lead / Project Manager | 9 | 8.108 | 8.108 | 89.189 |
| Other | 12 | 10.811 | 10.811 | 100.000 |
| Missing | 0 | 0.000 | | |
| Total | 111 | 100.000 | | |

Table B.4.: Descriptive Statistics Participants Characteristics for First Main Study

| | Gender | Age | Role | Edu-ca-tional Level | Pro-fes-sional Activ-ity | Com-pany size – cat-egor-ized | Divi-sion | Em-ploy-ment | Alone or Team | Team Size | Work-ing Method | Dura-tion | Leader's Gender |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M | | 34.514 | | | 11.712 | | | 4.856 | | 8.090 | | 6.327 | |
| SD | | 7.765 | | | 7.576 | | | 4.562 | | 5.183 | | 1.738 | |
| Min. | | 21.000 | | | 1.000 | | | 1.000 | | 2.000 | | 3.130 | |
| Max. | | 54.000 | | | 37.000 | | | 24.000 | | 30.000 | | 12.100 | |

*Note.* Not all values are available for Nominal Text variables. N = 111, no missing values. Length of employment and duration of professional activity in years. Duration of participation in minutes M = Mean, SD = Standard Deviation, Min. = Minimum, Max. = Maximum

Table B.7.: Frequencies for Educational Level for First Main Study

| Educational Level | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| University degree | 77 | 69.369 | 69.369 | 69.369 |
| Vocational training degree | 3 | 2.703 | 2.703 | 72.072 |
| A-Levels (Abitur) | 17 | 15.315 | 15.315 | 87.387 |
| Vocational baccalaureate | 9 | 8.108 | 8.108 | 95.495 |
| Secondary School Certificate (German: Haupt- / Realschulabschluss) | 5 | 4.505 | 4.505 | 100.000 |
| Missing | 0 | 0.000 | | |
| Total | 111 | 100.000 | | |

Table B.8.: Frequencies for Company size – categorized for First Main Study

| Company size – categorized | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Large (min. 201 employees) | 57 | 51.351 | 51.351 | 51.351 |
| Medium (max. 200 employees) | 27 | 24.324 | 24.324 | 75.676 |
| Small (max. 50 employees) | 21 | 18.919 | 18.919 | 94.595 |
| Smallest (max. 10 employees) | 6 | 5.405 | 5.405 | 100.000 |
| Missing | 0 | 0.000 | | |
| Total | 111 | 100.000 | | |

Table B.9.: Frequencies for Division for First Main Study

| Division | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Computer hardware | 1 | 0.901 | 0.901 | 0.901 |
| Computer networks | 2 | 1.802 | 1.802 | 2.703 |
| IT security | 4 | 3.604 | 3.604 | 6.306 |
| IT service provider | 23 | 20.721 | 20.721 | 27.027 |
| Online applications and online media | 15 | 13.514 | 13.514 | 40.541 |
| Software | 46 | 41.441 | 41.441 | 81.982 |
| Other | 20 | 18.018 | 18.018 | 100.000 |
| Missing | 0 | 0.000 | | |
| Total | 111 | 100.000 | | |

Table B.10.: Frequencies for Working Method for First Main Study

| Working_method | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Checklist | 9 | 8.108 | 8.108 | 8.108 |
| Classical project management | 16 | 14.414 | 14.414 | 22.523 |
| Kanban | 1 | 0.901 | 0.901 | 23.423 |
| Kanban in adapted form | 13 | 11.712 | 11.712 | 35.135 |
| Scrum by the book | 7 | 6.306 | 6.306 | 41.441 |
| Scrum in adapted form | 46 | 41.441 | 41.441 | 82.883 |
| Another agile method | 6 | 5.405 | 5.405 | 88.288 |
| Other method not listed | 1 | 0.901 | 0.901 | 89.189 |
| I don't know | 12 | 10.811 | 10.811 | 100.000 |
| Missing | 0 | 0.000 | | |
| Total | 111 | 100.000 | | |

Table B.11.: Frequencies for Gender of the Leadership Person for First Main Study

| Gender Person | Leadership | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Female | | 13 | 11.712 | 11.712 | 11.712 |
| Male | | 98 | 88.288 | 88.288 | 100.000 |
| Missing | | 0 | 0.000 | | |
| Total | | 111 | 100.000 | | |

Table B.12.: Consent Form for Participating in the Studies

| Dimension | Explanation |
|---|---|
| Voluntariness | Your participation in this study is voluntary. You are free to stop your participation at any time during this study without incurring any disadvantages. |
| Anonymity | Your data is of course confidential, will only be analyzed anonymously and will not be passed on to third parties. Demographic data such as age or gender do not allow any clear conclusions to be drawn about your person. |
| Questions | If you have any questions about this study, you will find an imprint with the contact details of the study leader below. |
| Consent | I hereby confirm that I am at least 18 years of age and that I have read, understood and agree to the informed consent form. |

Table B.13.: Participant Flow of the First Main Study

| Dimension | Information, respectively items | |
| --- | --- | --- |
| Information | This study will explore your assessment of the climate in your company and your perceived behaviour of your manager. The target group is members of software development teams in Germany. There is no "right" and "wrong". It is not about how it should be, but how you currently perceive it. The data is collected anonymously. No user data (no IP addresses, no geo-coordinates, etc.) are stored. Only the length of stay and time are recorded to control the quality of the data. The survey takes about 10 minutes. The survey is being collected as part of a doctoral thesis, there is no commercial interest. The results will be freely published afterwards at https://www.teamagile.org/forschung/. IMPORTANT: Please only take part in the study if you belong to the target group, i.e. if you are a member of a software development team in Germany. If you are familiar with this study, please do not take part again so as not to falsify the results. Thank you for your participation! | |
| Consent | see Table B.12 | |
| Climate for Psychological Safety by Baer and Frese (2003) and Edmondson (1999) | PS01 | In our company some employees are rejected for being different. |
| | PS02 | When someone in our company makes a mistake, it is often held against them. |
| | PS03 | No one in our company would deliberately act in a way that undermines others' efforts. |
| | PS04 | It is difficult to ask others for held in our company. (excluded) |
| | PS05 | In our company one is free to take risks. |
| | PS06 | The people in our company value others' unique skills and talents. |
| | PS07 | As an employee in our company one is able to bring up problems and tough issues.(excluded) |

| Dimension | Information, respectively items | |
|---|---|---|
| Climate for Organisational Initiative by Baer and Frese (2003) and Frese et al. (1997) | CI01 | People in our company actively attack problems. |
| | CI02 | Whenever something goes wrong, people in our company search for a solution immediately. |
| | CI03 | Whenever there is a chance to get actively involved, people in our company take it. |
| | CI04 | People in our company take initiative immediately – more often than in other companies. |
| | CI05 | People in our company use opportunities quickly in order to attain goals. |
| | CI06 | People in our company usually do more than they are asked to do. (excluded) |
| | CI07 | People on our company are particularly good at realizing ideas. |
| Positive Leadership by Kelloway et al. (2013) | During the last four months, how often did your leader | |
| | PL01 | ... thank you? |
| | PL02 | ... praised you for your job performance? |
| | PL03 | ... cheered you up? |
| | PL04 | ... go out of his or her way to help you? |
| | PL05 | ... complimented you? |
| Transformational Leadership by Carless, Wearing and Mann (2000) | My leader ... | |
| | TL01 | communicates a clear and positive vision of the future. (Vision) |
| | TL02 | treats staff as individuals, supports, and encourages their development. (Staff Development) |
| | TL03 | gives encouragement and recognition to staff. (Supportive Leadership) |
| | TL04 | fosters trust, involvement and cooperation among team members. (Empowerment) |
| | TL05 | encourages thinking about problems in new ways and questions assumptions. (Innovative Thinking) |
| | TL06 | is clear about his/her values and practises what he/she preaches. (Lead by Example) |
| | TL07 | instills pride and respect in others and inspires me by being highly competent. (Charisma) |

| Dimension | Information, respectively items |
|---|---|
| Socio-demographic date | Gender |
| | Age |
| | Role |
| | Educational qualification |
| | Duration of professional activity |
| | Company size |
| | Division |
| | Length of service |
| | Team or alone |
| | Team size |
| | Working method |
| Last page | Thank you, contact and further information |

Table B.14.: Participant Flow of the Second Main Study

| Dimension | Information, respectively items | |
|---|---|---|
| Information | In this study, your perception of yourself, your team and your manager will be surveyed. The target group is team members in the context of software product development in Germany. There is no right and wrong. It is not about how it should be but how you currently experience it. It is only important that you answer as accurately and honestly as possible. Answer spontaneously because spontaneous responses are usually the most appropriate. The data is collected anonymously. No user data (no IP addresses, no geo-coordinates, etc.) are stored. Only dwell time and time are recorded to control the quality of the data. Components of this test are protected by copyright. More information can be found at the end of the survey. The survey takes about 10 minutes. The survey is being collected as part of a doctoral thesis, there is no commercial interest. The results will be published afterwards. Information on this can be found at www.teamagile.org/forschung. Important: If you are not working in the context of software product development or if this study seems familiar to you, please do not participate (again) in order not to falsify the results. Do you want to participate in German? Please continue here. Thank you for your participation! | |
| Consent | see Table B.12 | |
| Individual Learning by Hoegl and Gemuenden (2001) and Klaic, Burtscher and Jonas (2020) | IL01 | I am able to acquire important know-how through my project(s). |
| | IL02 | I see my project(s) as a success. |
| | IL03 | I am learning important lessons from my project(s). |
| | IL04 | Teamwork promotes one personally. |
| | IL05 | Teamwork promotes one professionally. |

| Dimension | Information, respectively items | |
| --- | --- | --- |
| Teamwork Quality by Hoegl and Gemuenden (2001) | Communication quality: | |
| | TWQ01 | There is frequent communication within the team. |
| | TWQ02 | The team members communicate often in spontaneous meetings, phone conversations, etc. |
| | TWQ03 | The team members communicate mostly directly and personally with each other. |
| | TWQ04 | There are mediators through whom much communication is conducted. |
| | TWQ05 | Project-relevant information is shared openly by all team members. |
| | TWQ06 | Important information is kept away from other team members in certain situations. |
| | TWQ07 | In our team there are conflicts regarding the openness of the information flow. |
| | TWQ08 | The team members are happy with the timeliness in which they receive information from other team members. |
| | TWQ09 | The team members are happy with the precision of the information received from other team members. |
| | TWQ10 | The team members are happy with the usefulness of the information received from other team members. |
| | Mutual Support: | |
| | TWQ11 | The team members help and support each other as much as they can. |
| | TWQ12 | If conflicts come up, they are easily and quickly resolved. |
| | TWQ13 | Discussions and controversies are conducted constructively. |
| | TWQ14 | Suggestions and contributions of team members are respected. |
| | TWQ15 | Suggestions and contributions of team members are discussed and further developed. |
| | TWQ16 | Our team is able to reach consensus regarding important issues. |
| | Cohesion: | |
| | TWQ17 | All members are fully integrated in our team. |
| | TWQ18 | There are many personal conflicts in our team. |

| Dimension | Information, respectively items | |
|---|---|---|
| | TWQ19 | There is personal attraction between the members of our team. |
| | TWQ20 | Our team is sticking together. |
| | TWQ21 | The members of our team feel proud to be part of the team. |
| | TWQ22 | Every team member feels responsible for maintaining and protecting the team. |
| | Balance of Contributions: | |
| | TWQ23 | The team recognizes the specific potentials (strengths and weaknesses) of individual team members. |
| | TWQ24 | The team members are contributing to the achievement of the team's goals in accordance with their specific potential. |
| | TWQ25 | Imbalance of member contributions causes conflicts in our team. |
| High Performing Team Survey by Fischer, Hüttermann and Siebenaler (2020) | HPTS01 | Within my team, I can confidently speak openly about problems and mistakes. (Psychological Safety) |
| | HTPS02 | Within my team, close attention is paid to ensuring that all members achieve the best possible. Dependability and High Performance Standards |
| | HTPS03 | Within my team, all members are clear about what needs to be done. (Structure and Clarity of Roles, Plans, and Goals) |
| | HTPS04 | My team feels that our work is very important. (Meaningfulness of Work) |
| | HTPS05 | My team makes an important contribution to the overall success of the organisation. (Impact on the Organisation) |
| Team-level Transformational Leadership by Klaic, Burtscher and Jonas (2020) and Wang and Howell (2010) | Items not shareable due to copyright reasons, information by Klaic, Burtscher and Jonas (2020) | |
| Socio-demographic date | Gender | |
| | Age | |
| | Role | |
| | Educational qualification | |
| | Duration of professional activity | |

| Dimension | Information, respectively items |
|---|---|
| | Company size |
| | Division |
| | Length of service |
| | Team or alone |
| | Team size |
| | Working method |
| | Length of Team Collaboration |
| | Team Interventions |
| | Device |
| | Covid-19 Pandemic |
| Last page | Thank you, contact and further information |

Table B.15.: Results of the Durbin-Watson-Tests and width of the VIF for Testing Hypotheses H1, H2, and H3 for the third study

| Hypothesis | Durbin-Watson-Test | VIF |
|---|---|---|
| 1 | 2.02 | 1.00 |
| 2 | 1.93 | 1.00 |
| 3 | 1.99 | 1.00 |

*Note.* VIF = Variance Inflation Factor