
# HEALTHY WORKPLACE TECHNOLOGY USE

## UNDERSTANDING THE FORMATION AND MITIGATION OF TECHNOSTRESS

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# DEDICATION BY PROF. DR. TIM WEITZEL (WIDMUNG)

Die Dissertationsschrift von Dr. Pflügner folgt dem ebenso neuen wie relevanten Fokus der modernen Wirtschaftsinformatik und befasst sich mit dem gesunden Umgang mit Informations- und Kommunikationssystemen. Frau Pflügner reflektiert den seit mindestens einem Jahrzehnt breiter keimenden Diskurs zu nicht-intendierten Folgen der IT-Nutzung bei Individuen („*dark side of IT*“) wie Burnout, Leistungsabfall und IT-Nichtnutzung und zeigt theoretisch und empirisch, welche Eigenschaften von Technologie, Umfeld und vor allem auch dem jeweiligen Individuum Technostress evozieren können und wie man diesen vermeiden oder reduzieren kann. Sie zeigt dabei, dass weniger die Technik sui generis als vielmehr das Zusammenspiel von (Eigenschaften von) Technik und Mensch Technostress auslösen, wobei das Zusammenspiel von Technostressoren und Persönlichkeitseigenschaften sich als so komplex erweist, dass gängige Varianzanalysen an ihre Grenzen stoßen.

Im Geiste einer solchen soziotechnischen und systemischen Perspektive auf Technostress bei IT-Nutzung kann Frau Pflügner zeigen, dass hohe Technostressor-Ausprägungen (selbst bei Fokus auf Hindrance-Stressoren) nicht stets negative Implikationen haben müssen und zu hohem Technostrain (Burnout, Leistungsabfall) führen, sondern dass hier komplexe Interdependenzen wirken, die darüber hinaus von individuellen Dispositionen beeinflusst werden. Insbesondere die Erkenntnis zum Zusammenspiel psychometrischer Faktoren ist ein wichtiger Schritt in Richtung der besseren Identifikation von individueller Technostressanfälligkeit und auch von wirksameren Gegenmaßnahmen, welche wohlgemeint aber schlechtverstanden zu erheblichen, erneut nicht-intendierten, Nebenwirkungen führen können.

Auf Alice Kahn geht der Satz zurück: "*For a list of all the ways technology has failed to improve the quality of life, please press three*". Dies macht Frau Pflügner in ihren hier gesammelten Forschungsarbeiten und geht einen wichtigen Schritt weiter, indem sie genauer als die bisherige Literatur auch noch das „warum?“ und ein „was jetzt?“ für Individuen und Organisationen adressiert. **Healthy Workplace Technology Use - Understanding the Formation and Mitigation of Technostress** ist damit eine wertvolle Lektüre für jeden, der an modernen Methoden und Ansätzen für einen besseren Umgang mit IT interessiert ist.

Tim Weitzel

Dedicated to my parents

**Gaby and Michael**

# ACKNOWLEDGMENTS

Along the way of this dissertation, I have been blessed with the support, guidance, and encouragement of many people. I would like to express my heartfelt gratitude to them.

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Last, but certainly not least, I am grateful to my friends and family. Thanks to my friends for taking care of my work-life balance and for your encouragement all along the PhD years. Finally, a heartfelt thank you to my parents, brother, and boyfriend, whose unconditional love, care, and unwavering support made me navigate the challenges of PhD life and finish my dissertation. I could not be happier to have you by my side.

Katharina Pflügner

# ZUSAMMENFASSUNG (GERMAN SUMMARY)

Die Nutzung von Technologien am Arbeitsplatz kann bei Beschäftigten durch Aspekte wie ständige Erreichbarkeit, Überflutung und Unterbrechungen durch einkommende E-Mails oder anhaltende Softwareänderungen Stress verursachen. Dieser wird in der Forschung als Technostress bezeichnet (Tarafdar et al., 2019). In Deutschland erlebt jeder fünfte Arbeitnehmende Technostress (Gimpel et al., 2019). Unternehmen und Arbeitnehmende werden dadurch vor große Herausforderungen gestellt, da die Gesundheit von Beschäftigten und die Produktivität von Unternehmen beeinträchtigen werden. Technostress impliziert beispielsweise negative Konsequenzen wie Erschöpfung bis hin zu Burnout und eine reduzierte Arbeitsleistung (Maier et al., 2019). Daher beschäftigt sich die vorliegende Arbeit mit Technostress am Arbeitsplatz und verfolgt zwei Forschungsziele:

**Forschungsziel 1:** Verständnis für die Entstehung von Technostress

**Forschungsziel 2:** Verständnis für die Reduktion von Technostress

Das erste Kapitel der Dissertation fokussiert sich darauf, wie Technostress entsteht, insbesondere welche Einflussfaktoren zusammenspielen. Diese Erkenntnisse bilden die Basis für das zweite Kapitel, das sich damit beschäftigt, wie Technostress reduziert werden kann und welche Grenzen und Schwierigkeiten es hierbei gibt.

Die Ergebnisse des ersten Kapitels zeigen, dass Technostress nicht nur durch die Technologie selbst und deren Eigenschaften, wie z.B. deren Komplexität oder Veränderungsgeschwindigkeit, entsteht (Ayyagari et al., 2011). Auch Eigenschaften der Person, beziehungsweise bestimmte Persönlichkeitsprofile können dazu führen, dass manche Personen anfälliger für Technostress sind als andere Personen. Zudem können sich verschiedene Auslöser von Technostress gegenseitig verstärken, wohingegen die Beschäftigten bestimmte Konstellationen von Auslösern auch tolerieren können. Insgesamt werden psychologische Konsequenzen wie Burnout frühzeitiger, beziehungsweise durch weniger Auslöser hervorgerufen als verhaltensbezogene Konsequenzen wie eine reduzierte Arbeitsleistung.

Während die Persönlichkeitsprofile Hinweise darauf geben, wer besonders gefährdet ist, können diese Profile zur Technostressreduktion nicht verändert werden, da sie über den Zeitverlauf stabil sind (Contrada & Baum, 2011). Das zweite Kapitel der Dissertation zeigt aber, dass es vielfältige andere Strategien gibt. Arbeitnehmende können eine aktive Rolle zur Reduktion ihres Technostresses einnehmen. Beispielsweise führt höhere Achtsamkeit zu weniger Technostress und Betroffene können diese durch systematische Programme aktiv steigern. Ein weiterer Ansatzpunkt liegt im Arbeitsumfeld, das heißt in der Organisation, den arbeitsbezogenen Technologien und dem sozialen Umfeld. Mögliche Strategien sind hierbei beispielsweise die Einführung niederschwelliger Unterstützung durch Kontaktpersonen und einer „Pull not push"-Kultur. Bei einer „Pull not push"-Kultur werden die relevanten Informationen zum gewünschten Zeitpunkt durch technische Unterstützung wie z.B. Chatbots oder interne Wikis eingeholt, anstatt dass Beschäftigte zu einem beliebigen Zeitpunkt damit konfrontiert werden. Weitere Strategien sind die Förderung der Kommunikation zwischen Führungskräften und Mitarbeitenden sowie die Etablierung eines Führungsstils, der den Technostress und die digitale Gesundheit der Mitarbeitenden in den Vordergrund stellt (digital health-oriented leadership).

Allerdings zeigt sich, dass die jeweiligen Strategien zur Technostressreduktion im Arbeitsumfeld auch zu negativen Effekten führen können. Dies kann beispielsweise bedeuten, dass die Strategien zwar die Intensität mancher Auslöser von Technostress reduzieren, aber die Intensität anderer dafür verstärken und dass die Strategien nur für manche Mitarbeitenden eine Erleichterung bringen, aber bei anderen wiederum vermehrt Belastungen herbeiführen.

Durch die im Rahmen der Dissertation erzielten Ergebnisse können Erkenntnisse für die Theorie und Praxis zur Technostressentstehung und -reduktion abgeleitet werden. Insgesamt zeigt sich, dass Technostress durch ein komplexes Zusammenspiel in Form von Komplementarität, Kontingenz und Substitution von verschiedenen Auslösern entsteht und das Technostresserleben individuell abhängig von Persönlichkeitsprofilen ist. Strategien zur Reduktion auf technologischer Ebene können entweder implizieren, dass die stressauslösende Technologie selbst verändert wird (Technologie als Subjekt) oder aber auch, dass zusätzliche Technologie eingeführt wird, beispielsweise eine E-Mailticketsystem oder ein Notfallkanal (Technologie als Objekt). Zudem spielt Kommunikation zwischen den Personengruppen Führungskräfte, Mitarbeitende, Kollegen sowie Kunden eine zentrale Rolle bei der Technostressreduktion. Strategien zielen hierbei entweder darauf ab, das Ausmaß, den Zeitpunkt oder den Kanal der Kommunikation zu verändern. Für die Praxis empfiehlt sich, Maßnahmen zur Technostressreduktion in einen Prozess einzubinden, der damit startet, die betroffenen Personen und Auslöser zu identifizieren. Darauf aufbauend können für die identifizierten Auslöser die effektivsten Strategien ausgewählt und implementiert werden. Da diese wiederum negative Effekte auslösen können, sollten die Strategien nach deren Implementierung evaluiert werden und aufbauend auf dem Evaluationsergebnis angepasst oder mit weiteren Maßnahmen kombiniert werden.

Ein systemischer Ansatz, der sowohl das Zusammenspiel unterschiedlicher Auslöser von Technostress als auch individuelle Unterschiede und mögliche unbeabsichtigte Effekte von Strategien zur Technostressreduktion beachtet, ist die Grundlage für eine erfolgreiche Vorhersage, zielgerichtete Prävention und effektive Reduktion von Technostress.

# Introductory Paper

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## 1 INTRODUCTION

Technostress, defined as stress due to the use of information systems (IS) (Tarafdar et al., 2019), is a process that has specific causes, called technostressors, and is a prevalent phenomenon in many workplaces. In Germany, for instance, one in five employees reports experiencing technostress at work (Gimpel et al., 2019). This high prevalence of technostress is alarming due to its adverse consequences, called technostrain, for employees and organizations. Among others, technostressors can lead to exhaustion or burnout (Maier, Laumer, & Eckhardt, 2015; Maier, Laumer, Weinert, & Weitzel, 2015; Pawlowski et al., 2007; Srivastava et al., 2015), and reduced job performance or low job satisfaction among employees (Tarafdar et al., 2010; Tarafdar et al., 2007). Given these serious adverse consequences, understanding how technostress forms and ways to mitigate technostress has attracted scholarly and practitioners' attention.

Empirical investigations reveal insights into *technostress formation*, which refers to how technostressors come about and lead to technostrain. Research has revealed that specific characteristics of the IS induce technostressors, the causes of technostress (Ayyagari et al., 2011; Ragu-Nathan et al., 2008), including technostressors prevalent at the workplace such as techno-overload, techno-invasion, and techno-uncertainty (Ragu-Nathan et al., 2008). Techno-overload stems from the fact that IS enables huge amounts of information to be stored and transmitted easily, potentially leading employees to feel overwhelmed by the amount of information or interrupted by a constant barrage of notifications and emails (Stich et al., 2019). Techno-invasion stems from IS such as smartphones, virtual private networks (VPN), and video conference tools that enable work arrangements in which employees are permanently connected with work in nonwork contexts and outside of regular business hours (Chen & Karahanna, 2018). Techno-uncertainty relates to the rapid rate of obsoletion of IS, software versions, feature extensions, and digital tools, which may lead employees to feel pressure to update their skills and adjust their work practices in response to frequent changes in the IS they use to complete their work (Tarafdar, D'Arcy, et al., 2015).

Extant research into technostress formation has focused on the degree to which certain characteristics of an IS, such as its reliability or usefulness, induce technostressors and thereby lead to technostrain (Ayyagari et al., 2011; Tarafdar et al., 2019; Tarafdar, Pullins, & Ragu-Nathan, 2015). Hence, the main focus has been on how the IS environment, such as in the workplace, influences technostressors. However, general stress literature suggests that stressors arise from the interplay among both environmental and individual characteristics (Cooper et al., 2001; Lazarus & Folkman, 1984). Thus, a more in-depth investigation into the role of users' individual characteristics in technostress formation will influence theory and help practitioners identify users who are more likely to perceive technostressors, and thus develop strategies for technostress mitigation among such users.

Research into technostress formation indicates that technostressors can lead to technostrain (Tarafdar et al., 2019). Most extant research treats multiple technostressors, such as techno-overload, techno-invasion, and techno-uncertainty, as an aggregated construct, focusing on how they collectively lead to technostrain (e.g., Maier et al., 2019; Srivastava et al., 2015). Research into the role, relevance, and interplay among specific technostressors in leading to technostrain is limited. However, these considerations are critical for our understanding of technostress formation. For instance, some technostressors may be more reliable and important sources of technostrain than other technostressors, and individual technostressors may interrelate and influence each other's relationships with technostrain in complex ways. A granular investigation into the role of specific technostressors and combinations of technostressors would influence theory and help practitioners identifying the relative risk of specific technostressors, enabling them to develop technostress mitigation strategies targeted at these (combinations) of technostressors.

To fill the gaps in research into the role of individual characteristics and of specific technostressors and combinations of technostressors in technostress formation in the workplace, one overall research objective (RO) of this dissertation is:

***Research objective 1: Understand how technostressors and technostrain are formed***

Most extant research into *technostress mitigation* focuses on organizational strategies. For instance, organizational helpdesk support and facilitation of technological literacy have been shown to help mitigate technostressors (Tarafdar, Pullins, & Ragu-Nathan, 2015). However, users often have limited influence on these organizational technostress mitigation strategies but may have other means to mitigate technostressors actively and thereby mitigate technostrain (Pirkkalainen et al., 2019). Thus, an investigation of technostress mitigation strategies grounded in non-organizational sources, such as the employees themselves, highlights the active role that they can take and paves the ways for an extended set of strategies for technostress mitigation.

Not all technostress mitigation strategies are equally effective. Initial research shows that the effectiveness of a technostress mitigation strategy can depend on the technostressor perceived by the users (Galluch et al., 2015). A technostress mitigation strategy can be effective in mitigating one technostressor but not another technostressor or even lead to the opposite effect (Galluch et al., 2015). Given that there are a variety of technostressors and users might differ in the technostressors they perceive, it is relevant to reveal which strategy is effective for mitigating which technostressor. Such an investigation would clarify the relative effectiveness, limitations of technostress mitigation strategies, and their potential unintended negative consequences.

To fill the gaps in research into the active role of employees in technostress mitigation and the limitations and potential negative consequences of technostress mitigation strategies, a second overall research objective of this dissertation is:

***Research objective 2: Understand how technostressors and thereby technostrain are mitigated***

This dissertation achieves these two research objectives in an introductory paper and eight research papers. The introductory paper introduces the relevant theoretical background, the research methods used in this dissertation, summarizes the major findings of the eight research papers, and discusses the overall theoretical and practical contributions.

The eight research papers are structured into two chapters. Chapter 1 focuses on technostress formation, i.e., how personality traits as individual characteristics influence technostressor perception (Paper I) and how technostressors lead to technostrain (Paper II). Chapter 2 focuses on technostress mitigation, starting with a review of literature into strategies identified in extant

research (Paper III). Based on the literature review, we investigate active technostress mitigation initiated by users (Papers IV and V) and, more specifically, by managers (Paper VIII). These insights are extended by practice-oriented managerial insights into technostress mitigation revealing its specific limitations and potential negative consequences (Papers VI and VII).

# 2 THEORETICAL FOUNDATION AND RELATED RESEARCH

This section provides background knowledge about the research streams of technostress formation and mitigation.

## 2.1 TECHNOSTRESS FORMATION

Most research into technostress formation is theoretically grounded in the *transactional model of stress* from general stress literature (Lazarus & Folkman, 1984). According to the transactional model of stress, stress is a process involving an individual's transaction with his or her environment. In the IS research setting, therefore, *technostress* refers principally to the process of technostressors leading to technostrain through the interaction of a user with his or her IS environment. *Technostress formation* additionally involves factors relevant before technostressors are perceived, i.e., the antecedents of technostressors. Based on the transactional model of stress and empirical insights in technostress literature, *technostress formation* is a process that involves three aspects: (1) Antecedents in the form of IS characteristics that the users may appraise as (2) technostressors that constitute a threat. These technostressors can lead to (3) adverse consequences, called technostrain (Tarafdar et al., 2019) (Figure 1).

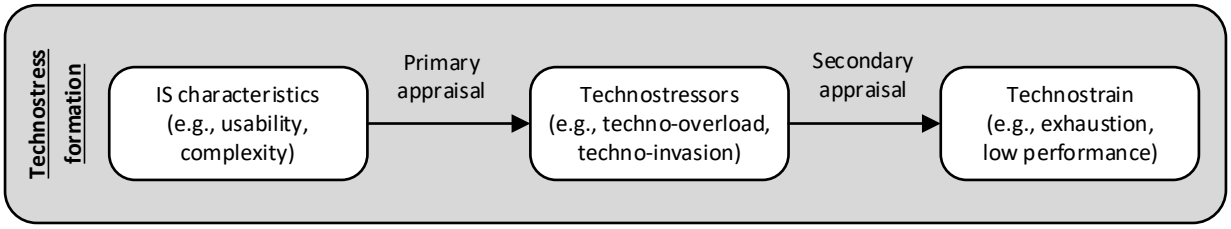



**Figure 1. The formation of technostress drawing on the transactional model of stress (Lazarus & Folkman, 1984) and extant technostress literature (adapted from Tarafdar et al., 2019)**

*IS characteristics*, the starting point of technostress formation, include usability features (e.g., low usefulness of the IS), dynamic features (e.g., pace of changes in the IS), and intrusive features (e.g., monitorability enabled by the IS) (Ayyagari et al., 2011). When these IS characteristics induce stimuli, events or demands that users evaluate as requiring action and constituting a threat in the present or future (primary appraisal), they perceive them as technostressors. Thus, technostressors are the stimuli, events or demands that are induced by the IS characteristics (Ayyagari et al., 2011; Ragu-Nathan et al., 2008) and which are appraised by the user as threatening (Tarafdar et al., 2019).

Previous research commonly distinguishes between five *technostressors* (Maier et al., 2019; Ragu-Nathan et al., 2008; Srivastava et al., 2015; Tarafdar et al., 2010). Techno-overload describes situations in which users face an increase of work amount and speed due to IS. Techno-invasion refers to situations where users feel the need to be permanently connected to work and where the line between work and personal life becomes blurred due to IS. Techno-complexity describes situations where IS-related complexity leads users to feel they lack adequate skills and must invest time and effort to understand the different aspects of IS. Techno-insecurity refers to situations where users fear losing their job due to other employees with better IS skills or fear being replaced by an IS. Finally, techno-uncertainty describes situations where users feel uncertainty because of

ongoing changes in IS and where they are constantly forced to adapt, learn, and educate themselves about new IS (Ragu-Nathan et al., 2008; Tarafdar et al., 2007).

In addition to these five prominent technostressors, further technostressors have been identified, such as techno-unreliability (Fischer et al., 2021; Riedl et al., 2012), interruptions due to IS (Addas & Pinsonneault, 2018; Tams et al., 2018), and techno-conflict (Galluch et al., 2015). Moreover, scholars have identified context-specific technostressors, e.g., security-related technostressors (D'Arcy et al., 2014; Hwang & Cha, 2018), subforms of a specific technostressor, e.g., communication overload as a subform of techno-overload (Harris et al., 2015), and technostressors specific to a certain IS, e.g., email technostressors (Brown et al., 2014; Soucek & Moser, 2010).

If technostressors exceed a user's available resources (secondary appraisal), technostressors lead to *technostrain*, which include the potential psychological, behavioral, and physiological consequences of technostressors (Nastjuk et al., 2023; Tarafdar et al., 2010). Psychologically, technostrain includes negative affect, exhaustion, and burnout (Maier et al., 2019; Srivastava et al., 2015). Technostrain can be observed behaviorally in terms of decreased performance or nonadherence to IS use requirements (D'Arcy et al., 2014; Tarafdar et al., 2010). Physiologically, technostrain can be measured by endocrinological changes, such as an increase of stress hormones (Galluch et al., 2015; Tams et al., 2014). A summary of technostrain caused by technostressors on these three levels is provided in the Appendix, Table 13.

Extant research has also revealed factors that increase the extent to which technostressors lead to technostrain. For example, a normative response pressure in the work environment, i.e., to respond promptly to emails (Brown et al., 2014), as well as the user characteristics of neuroticism and agreeableness (Srivastava et al., 2015) increase the effect of technostressors on technostrain. Moreover, extant research illustrates the specific relevance of the relationship between managers and the employees they manage. A poor relationship between a manager and his or her team, in terms of poor leader-member-exchange, increases the harmful effect of technostressors (Harris et al., 2015).

Beyond such moderating effects, recent research shows that the relationship between technostressors and technostrain is not always linear, i.e., higher technostressors does not always mean greater technostrain. There is evidence that both overly high levels *and overly low* levels of technostressors can lead to technostrain (Maier et al., 2019; Stich et al., 2019). Moreover, research shows that in some forms of technostrain, the relationship between technostressors and technostrain depends on the specific technostressor. For example, techno-invasion can lead to technostrain observable as low employee innovation, while techno-uncertainty can lead to high employee innovation (Chandra et al., 2019).

Applying general research into positive stress or eustress (LePine et al., 2004), recent IS research discusses the potentially positive effects when users are confronted with challenge technostressors (Benlian, 2020; Califf et al., 2020; Maier et al., 2021). Challenge technostressors are technostressors that the user appraises as a positive challenge or opportunity rather than as a threat and are associated with positive consequences (Califf et al., 2020). This dissertation focuses on the formation and mitigation of negative technostress, focusing on hindrance technostressors, which are the technostressors appraised as threatening and associated with negative consequences.

In summary, technostress formation is influenced by IS characteristics that users may appraise as technostressors which, in turn, can lead to adverse consequences, called technostrain.

## 2.2 TECHNOSTRESS MITIGATION

When technostressors are identified as the causes of technostrain such as the causes of job burnout and low job performance, users and managers can implement strategies to mitigate technostressors and thereby technostrain (Salo et al., 2022). When these strategies target the technostressors, they address technostress directly at its roots (Tarafdar, Pullins, & Ragu-Nathan, 2015). Thus, they mitigate perceived technostressors and can thereby indirectly mitigate the experience of technostrain. Such technostress mitigation strategies are most effective when they are specific to the IS context, since technostressors are different than other types of stressors common in the workplace (Maier, Laumer, & Eckhardt, 2015).

The *person-environment fit theory* is a useful theoretical lens through which technostress mitigation strategies can be viewed (Edwards et al., 1998). According to the person-environment fit theory, the person has specific abilities and personal needs. The environment, in turn, poses specific demands and supplies certain things. Stress or strain decrease the better the person's skills and abilities fit environmental demands or the better the environment's supplies fit the person's personal needs. Mitigation strategies can therefore be directed at the person or at the environment in order to improve the fit between them and mitigate stress. Transferred to technostress (Ayyagari et al., 2011; Stich et al., 2019), technostress mitigation strategies can be grounded in the user, e.g., strengthen certain IS-related abilities of the user, and their environment, e.g., increasing the IS-related supplies that the organization provides (Figure 2).

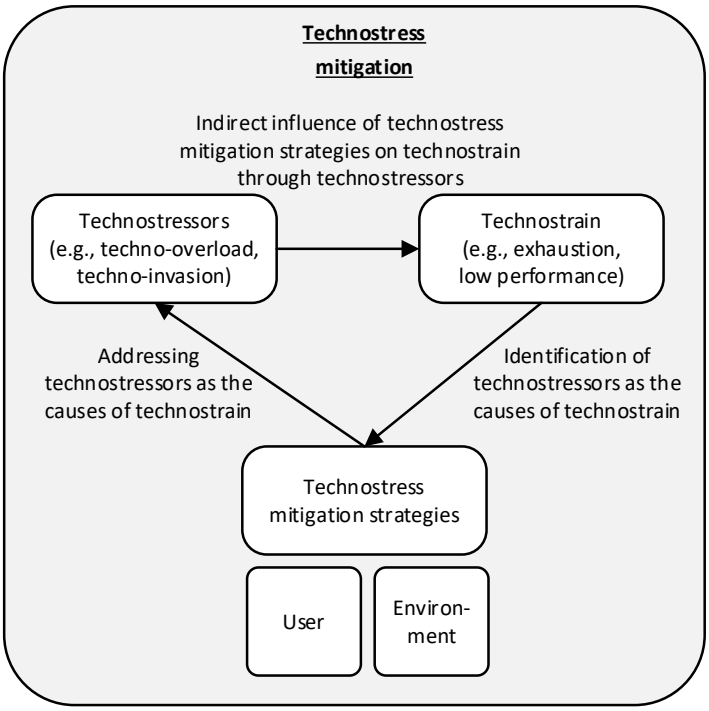



**Figure 2. The mitigation of technostress drawing on the person-environment fit theory (Edwards et al., 1998)**

Overall, most technostress mitigation literature has focused on identifying technostress mitigation strategies grounded in the users' environment, especially the organizational environment. *Organizational technostress mitigation strategies* include providing technical help for users, i.e., technical support provision (Ragu-Nathan et al., 2008; Tarafdar, Pullins, & Ragu-Nathan, 2015), facilitating the sharing of IS knowledge, referred to as literacy facilitation (Ragu-Nathan et al., 2008; Tarafdar, Pullins, & Ragu-Nathan, 2015), and facilitating user involvement in and experimentation with IS, called involvement facilitation (Ragu-Nathan et al., 2008; Tarafdar,

Pullins, & Ragu-Nathan, 2015; Tarafdar et al., 2010). In addition, organizational IS support such as personal assistance, change management support, and training (Sykes, 2015) as well as support in work-home boundary management (Benlian, 2020) can mitigate technostressors' effect and technostrain. Moreover, when users have control over which methods they use to complete work tasks, i.e., method control, and when they take a break from the IS to replenish their resources, referred to as resource control, can also reduce technostressors and technostrain (Galluch et al., 2015). In the technological environment, an example of a *technological technostress mitigation strategy* is to program the IS to allow users to decide when to view and respond to incoming messages, referred to as timing control (Galluch et al., 2015). Finally, sparse empirical investigations highlight the relevance of the social environment that can make organizational technostress mitigation strategies obsolete. An example of a *social technostress mitigation strategy* are peer advice ties, namely informal self-organized support structures offered by fellow employees, which can make organizational IS support obsolete (Sykes, 2015).

In addition to environmental technostress mitigation strategies, recent studies have investigated *strategies grounded in the user*. Users can engage in coping strategies to mitigate technostressors' effect on technostrain by taking actions to minimize or changing their emotional response to technostressors (Pirkkalainen et al., 2019). Examples of coping strategies include distress venting, distancing from IS, positive reinterpretation, IS control (Pirkkalainen et al., 2019), and deleting emails (Addas & Pinsonneault, 2018). Research also shows that certain user characteristics are related to lower technostressors and technostressors' effect on technostrain, such as computer experience (Tams et al., 2018), computer self-efficacy (Tams et al., 2018), personal innovativeness in IT (Maier et al., 2019), and IT mindfulness (Maier et al., 2019).

To help user better handle technostress and other forms of stress, *online programs for stress management* have been developed. These online stress management applications are web-based self-help programs designed to help users learn stress mitigation knowledge and techniques on their own (Ebert et al., 2016; Heber et al., 2017). The content of these applications has been developed and evaluated by mental health experts, is based on medical studies, applies principles of cognitive behavioral therapy, and is supported by text, audio files, videos, among others. Some online stress management applications are unguided while others are guided. In guided applications, users receive web-based guidance from a therapist such as synchronous chat messages or asynchronous text messages while using the self-help program. In unguided applications, users receive no guidance while using the program but can contact a therapist through the application if they have questions or need support. Users and therapists communicate via email, chat, video, or telephone (Ebert et al., 2016; Heber et al., 2017). Randomized control trial studies support the effectiveness of guided and unguided online stress management applications (Drozd et al., 2013) and meta-analytic results show that such applications are effective in reducing stress and related health problems (Heber et al., 2017).

Interestingly, there is initial evidence that technostress mitigation strategies do not always have the intended results. For example, an investigation into how technostress mitigation strategies influence specific technostressors reveals that one and the same strategy can affect the technostressors to a different extent or even reversely. For instance, while resource control, i.e., taking a break, decreases the effect of techno-overload on technostrain, it increases the effect of techno-conflict on technostrain (Galluch et al., 2015). In other words, there are *limitations* to how effective technostress mitigation strategies are, depending on the technostressor.

In summary, some technostress mitigation strategies are grounded in the user and some in the environment (Pflügner, 2022) (for a summary see Appendix, Table 14). Furthermore, technostress mitigation strategies are not a one-size fits all solution for mitigating technostress.

## 2.3 RESEARCH QUESTIONS

This section introduces the five research questions at the core of this dissertation (Figure 3) that contribute to the two overall research objectives, which are to understand the formation and mitigation of technostress. In order to mitigate technostressors and thereby technostrain at its roots, the causes, technostressors, must be addressed by applying different strategies. In contrast to technostress in the private IS use context, such as social network site use, IS use at the workplace is often mandatory rather than voluntary, and utilitarian rather than hedonic (Kroenung & Eckhardt, 2015; Laumer et al., 2016). As a result, the technostressors in the workplace differ from those in the private context (Maier, Laumer, Weinert, & Weitzel, 2015), just like the underlying mechanisms (Tarafdar et al., 2020) and consequences (Salo et al., 2019). Therefore, it is necessary to differentiate between technostress formation and mitigation in the private and the work context. The dissertation at hand focuses solely on the work context.

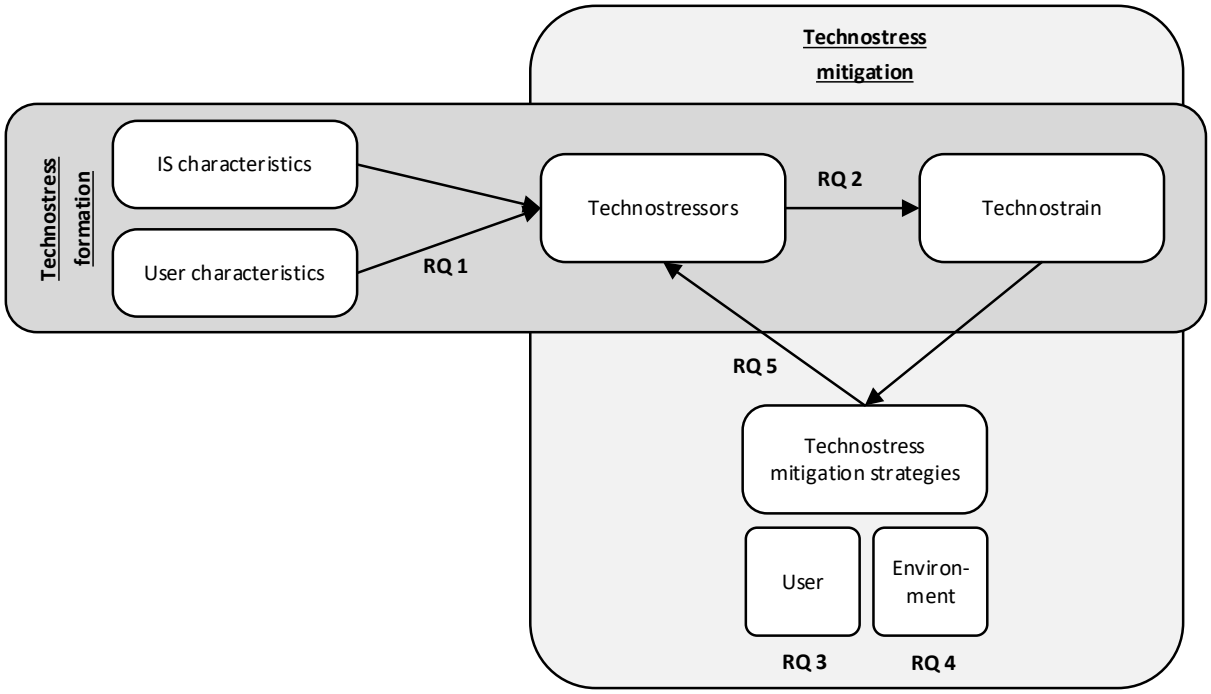



**Figure 3. Overview of research questions (RQ)**

### 2.3.1 Research questions regarding technostress formation

To understand technostress formation (research objective 1), research has mainly focused on how environmental characteristics like IS characteristics induce technostressors and lead to technostrain in the work context (Ayyagari et al., 2011). However, there is evidence that user characteristics such as individual differences also influence the extent to which users perceive technostressors and technostrain (Srivastava et al., 2015; Tams et al., 2018). Following the differential exposure-reactivity model (Bolger & Zuckerman, 1995) that has been developed to understand the relationship between individual differences and stress, personality traits such as the Big Five personality traits (McCrae & Costa, 2008) affect the perception of stressors through differential exposure. Differential exposure means that personality traits influence the occurrence of stressors and the interpretation of a situation as stressful. As applied to technostress, personality traits might predispose to which extent users perceive technostressors. Two users might evaluate the same IS characteristics differently depending on their Big Five personality traits and therefore the perception of technostressors might differ among users. Understanding how personality traits influence the perception of technostressors would help practitioners to identify users who are at risk of perceiving technostressors and to develop strategies to mitigate the technostressors and

avoid technostrain specifically among those users. This dissertation investigates the role of user personality traits in technostress formation to answer the research question:

***Research question 1:*** *How do personality traits predispose users to perceiving technostressors?*

Technostress research shows that multiple technostressors can lead to adverse consequences in the form of technostrain. The general notion of technostress formation in the literature is that the higher the technostressors, the higher the technostrain, such as higher job burnout or lower job performance (Srivastava et al., 2015; Tarafdar, Pullins, & Ragu-Nathan, 2015). However, recent technostress literature suggests that the formation of technostress is more complex, in that high and low technostressors can lead to technostrain (Chandra et al., 2019; Maier et al., 2019; Stich et al., 2019). The general stress literature (Karasek, 1979) and general systems theory (Bertalanffy, 1975) suggest that there might be interdependencies among technostressors leading to technostrain. For example, these interdependencies might lead to instances where a subset of specific technostressors is sufficient, such that users experience technostrain even if some technostressors are not perceived by the users. Similarly, users may be able to tolerate specific technostressors without experiencing technostrain as long as a specific technostressor is not perceived. These interdependencies support the notion of a more complex relationship between technostressors and technostrain, indicating that specific technostressors can play different roles in leading to technostrain. This understanding of technostress formation is relevant to identify which specific technostressors or combinations of technostressors should be addressed by technostress mitigation. Thus, the second research question is:

***Research question 2:*** *How do combinations of technostressors lead to technostrain?*

### 2.3.2 Research questions regarding technostress mitigation

While the Big Five personality traits help in identifying users who need help mitigating technostressors, technostress mitigation strategies cannot aim to change these personality traits, which are stable over time and not subject to change (Contrada & Baum, 2011). In contrast to the stable Big Five personality traits, malleable personality traits might point to an active role users can use to mitigate technostressors and technostrain (research objective 2). Insights from the broader stress literature suggest that mindfulness is a malleable personality trait and applicable to stress mitigation (Hülsheger et al., 2013), which might also hold true for technostress. Mindfulness can be trained individually (Lomas et al., 2017) and enables reperception, meaning that individuals with greater mindfulness are more likely to view situations and resulting emotions and thoughts with greater objectivity and clarity without needing to react immediately (Carmody et al., 2009; Shapiro et al., 2006). Users might be able to take an active role in technostress mitigation by practicing mindfulness. Self-help interventions such as online stress management applications can help individuals increase their mindfulness and reduce stress (Heber et al., 2017; Jayewardene et al., 2017). Despite their effectiveness in increasing mindfulness and reducing stress, their actual use depends on how satisfied the users are with the application. Only users satisfied with the online stress management applications will use the application (DeLone & McLean, 2003; Petter et al., 2012) and engage in this active role. This constraint requires revealing how potential users can be encouraged and are satisfied in using online stress management applications. Hence, the dissertation addresses the research question:

***Research question 3:*** *How can users actively mitigate technostressors and thereby technostrain?*

Given that both the user and the environment play a crucial role in technostress mitigation (Ayyagari et al., 2011), another starting point to mitigate technostressors and technostrain – in addition to the active role of the users themselves – is the organizational, technological, and social environment of the users (Pflügner, 2022). One aspect of the environment that has received little

attention in the technostress mitigation literature is the social environment (Pflügner, 2022). This paucity is surprising because several aspects in the social environment have been shown to *increase* users' perceptions of technostressors and technostrain. For instance, studies show that a perceived pressure associated with responding to emails (Brown et al., 2014) and a poor relationship between managers and their teams (Harris et al., 2015) lead to more technostrain. Managers might also positively shape the team members' environment and have a twofold role in technostress mitigation. Managers, who are also IS users, perceive technostressors themselves (Pflügner, Baumann, & Maier, 2021) and are encouraged to take an active role in their own technostress mitigation. This engagement may also positively affect their team members' environment and thereby contribute to mitigating their team members' perceived technostressors and technostrain. Thus, the dissertation aims to answer the research question:

> ***Research question 4:*** *What mitigation strategies in the work environment effectively mitigate technostressors and thereby technostrain?*

Previous research shows that one and the same organizational strategy to mitigate technostressors' effect on technostrain can have both positive and negative effects (Galluch et al., 2015). For instance, it has been shown that the organizational strategy of resource control, which allows users to take a break when they need one, can positively affect the effect of techno-overload but negatively affect the effect of techno-conflict (Galluch et al., 2015). Such complex efficacy of technostress mitigation strategies are evidence of the limitations of technostress mitigation strategies. In an effort to better understand these limitations and potential negative consequences, we consider the effectiveness of strategies in mitigating specific technostressors and thus technostrain, posing the research question:

> ***Research question 5:*** *What are the limitations and potential negative consequences of various technostress mitigation strategies directed at specific technostressors?*

In summary, the dissertation poses five research questions addressed in eight papers that constitute this cumulative dissertation (Figure 3). The first two research questions provide deeper insights into technostress formation (research objective 1). The remaining three research questions provide a more-nuanced perspective on technostress mitigation (research objective 2) by focusing on strategies grounded in the user and the environment as well as examining their limitations and negative side effects. To answer these research questions, the dissertation uses different methodologies, illustrated in the next sections.

# 3 METHODOLOGY

This dissertation addresses the five distinct research questions by applying a range of theories and methodological approaches. The papers constituting this cumulative dissertation include a literature review, qualitative research, and quantitative research. In our qualitative research, we analyzed data collected in interviews using qualitative content analysis. In our quantitative research, we analyzed data collected using online questionnaires and a Kano questionnaire, applying various techniques that best fit the research question and the underlying theory, including Kano analysis, structural equation modeling (SEM), and qualitative comparative analysis (QCA).

## 3.1 STRUCTURED LITERATURE REVIEW

Structured literature reviews provide an overview of existing knowledge within a predefined context and provide a basis for identifying research gaps and ambiguities and deriving future research avenues (Paré et al., 2015; Webster & Watson, 2002). Structured literature reviews follow pre-defined steps, namely (1) define the scope of the review, (2) conceptualize the topic, (3) identify relevant literature, (4) analyze and synthesize the literature, and (5) develop a research agenda (vom Brocke et al., 2009). In such a systematic literature analysis, the predefined search space is searched systematically using relevant search terms to identify relevant literature. A concept matrix consisting of key concepts and possible concept subdimensions is used to analyze and synthesize the research focus and findings. The research is arranged around these concepts, moving away from an author-centric presentation of the existing literature (Webster & Watson, 2002). By structuring the knowledge around key concepts and synthesizing it in tables and figures, the structured literature review also helps other scholars make sense of and build upon the body of knowledge in a specific context.

Paper III is a structured literature review of the body of knowledge about technostress mitigation.

## 3.2 QUALITATIVE RESEARCH

Qualitative research provides in-depth insights into the cognition, emotions, and behavior of individuals and the context within which they work and live (Myers, 2020). Understanding context is key to explaining why individuals think, feel, and behave the way they do. This often unquantifiable information is typically gained by undertaking qualitative research, which often analyzes data collected in qualitative interviews. While qualitative research is rigorous, it has disadvantages. One disadvantage is insights gained from interviewing a sample cannot readily be generalized to the larger population. However, other forms of generalization are possible, such as the generalization from qualitative research to theory (Myers, 2020). Qualitative research is appropriate in studying the topic of interest in depth, especially in exploratory research on a new topic on which little research has been focused. Qualitative research can involve a range of data collection techniques, such as open-ended questionnaires and qualitative observations. The qualitative research in the papers constituting this dissertation collect data through qualitative interviews.

### 3.2.1 Data collection: Qualitative interviews

Interviews are frequently used to collect data in qualitative research because they provide deep insights into the experiences and interpretations of participants (Eisenhardt & Graebner, 2007). Qualitative interviews can differ in terms of their level of standardization, i.e., the interviews can be unstructured, semi-structured, and structured (Myers, 2020). The qualitative research conducted for this dissertation relies on semi-structured interviews. In contrast to unstructured interviews, semi-structured interviews use a semi-structured interview guideline with predefined questions, which guarantees a certain level of consistency across multiple interviews. In contrast to structured interviews, however, researchers holding semi-structured interviews can ask follow-up questions or change the order of questions (Recker, 2021). This flexibility provides additional insights. The predefined questions of the interview guideline reflect the content of the research endeavor and the research question, and are tested and refined based on pilot interviews. Interviews are conducted until theoretical saturation is reached, i.e., until additional interviews provide no new insights (Myers, 2013).

Papers VI, VII, and VIII analyze qualitative data collected in a total of over 80 semi-structured interviews of multiple workplace IS users and stakeholders, such as managers, team members, and IS professionals.

### 3.2.2 Data analysis: Qualitative content analysis

The research in this dissertation analyzes qualitative data using qualitative content analysis, a popular qualitative data analysis technique (Kuckartz & Rädiker, 2022; Mayring, 2015). In qualitative content analysis, the data is interpreted qualitatively, so it can be applied flexibly to a variety of research questions. This technique is useful in analyzing large data volumes systematically (Mayring, 2015). The process involves defining categories, called codes, which are summarized in a codebook, and assigning the codes to the text passages. Such codes can be derived deductively from existing literature (theory-driven) and/or inductively based on the empirical qualitative interview data (Kuckartz & Rädiker, 2022). The qualitative data is analyzed in four steps: descriptive coding, interpretive coding, review of interpretive coding, and categorizing (Myers, 2013). Descriptive coding involves identifying relevant text passages and themes to generate initial codes from the interview data. Interpretive coding of these descriptive codes involves identifying broader themes among the initial descriptive codes. To ensure objectivity, interpretive codes are reviewed by at least one other researcher. A portion of the interviews is also coded by a second researcher and intercoder reliability is calculated as well as uncertainties and coding discrepancies are discussed between the two researchers until they agree on the most appropriate matching code. In a final step, the interpretive codes are categorized by defining and naming them.

Three papers (Papers VI, VII, and VIII) apply qualitative content analysis to analyze data collected in interviews, deriving codes both inductively and deductively.

## 3.3 QUANTITATIVE RESEARCH

To leverage the advantages and consider the disadvantages of various research approaches, this cumulative dissertation combines qualitative and quantitative research, taking multiple perspectives on the formation and mitigation of technostress. Quantitative research is appropriate for studying a phenomenon across many participants or organizations and generalizing from a large sample to a large population (Schreier, 2018). Quantitative research makes it possible to isolate specific aspects of a phenomenon and identify patterns across multiple situations. Rather than considering subjective contextual information, quantitative research focuses on numbers that represent the intensity of theoretical constructs and provide empirical evidence how a phenomenon works (Myers, 2020). Quantitative research analyzes data collected using (online) questionnaires and Kano questionnaires, among others.

### 3.3.1 Data collection: Online questionnaires

Quantitative data can be collected using a questionnaire distributed and held online. Online questionnaires are developed using well-established scales that have been used and validated in existing literature. In online questionnaires, the constructs of interest are assessed via multiple items measuring the same construct (Jarvis et al., 2003). Online questionnaires can be cross-sectional or longitudinal. In the context of this dissertation, cross-sectional questionnaires that collect data on participants' self-rated current perceptions and behaviors at one specific point in time play an important role. An exception is Paper II, where we analyzed data collected at two different points in time. Such an approach takes into account causal relationships of influencing factors on outcomes (Maier et al., 2019). In many online questionnaires, participants are asked to indicate their level of agreement to each item, often on a 7-point Likert scale. Depending on the specific item, these are typically agreement or frequency scales, with 1 indicating a low agreement or frequency and 7 indicating a high agreement or frequency. Eliminating data collected by participants who fail so-called attention checks, such as requiring participants to choose a specific option, assures high data quality.

Papers I, II, IV, and VI use an online questionnaire to collect quantitative data collected from a total of over 700 participants.

### 3.3.2 Data collection: Kano questionnaires

The Kano questionnaire is a specific subform of quantitative questionnaires, grounded in the Kano model. The underlying notion of the Kano model is that the relationship between the fulfillment of product features (in our case IS features) and customer or user satisfaction does not need to be linear (Kano et al., 1984). Following this rationale, a Kano questionnaire assigns those features to different categories, which influence user satisfaction in different ways. These five categories are called must-be, attractive, one-dimensional, indifferent, and reverse (Figure 4). Must-be features (M) are basic requirements. If M features are not fulfilled, users are dissatisfied. However, the fulfillment of these features prevents dissatisfaction but does not lead to satisfaction. Attractive features (A) are optional requirements and not expected by users. When A features are not fulfilled, users are not dissatisfied but when they are fulfilled, users are satisfied. One-dimensional features (O) are directly linked to satisfaction. The more the feature is fulfilled, the more satisfied the user is, and vice versa. The fulfillment or non-fulfillment of indifferent features (I) has no influence on user satisfaction. Reverse features (R) are the opposite of one-dimensional features, meaning that the more this feature is fulfilled, the less satisfied the user is (Matzler & Hinterhuber, 1998). Conducting a Kano questionnaire enables IS features to be assigned to these categories and thereby reveal the features' relationship with user satisfaction that might be linear, asymmetrical or non-existent.

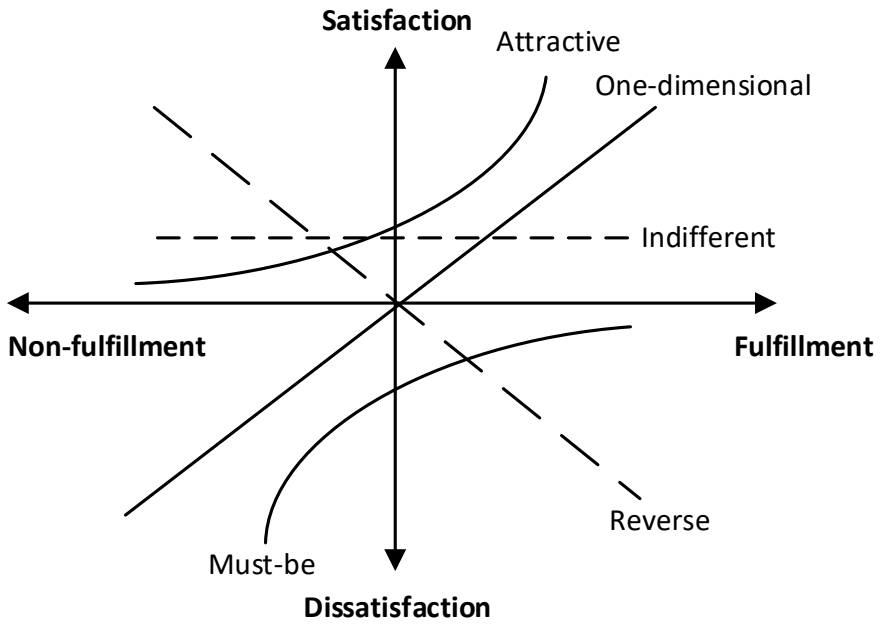



**Figure 4. Graphical representation of the Kano categories (Berger et al., 1993; Pflügner, Maier, et al., 2021)**

The first step in designing a Kano questionnaire is to identify the features of the product (in our case IS) (Matzler & Hinterhuber, 1998) through an exploratory pilot study and own considerations about the product's functionalities, the presumed consumer's (in our case user's) desires and expectations, problems, and "hidden" needs (Hölzing, 2008). Then, a functional and a dysfunctional question is developed about each identified feature. The functional question refers to a situation in which the feature is fulfilled: "What would you say if the application met [feature], how would you feel?" The dysfunctional question refers to a situation in which the feature is not fulfilled: "What would you say if the application did not meet [feature], how would you feel?" The participants choose among the answer options: "I like it that way", "It must be that way", "I am neutral", "I can live with it that way", and "I dislike it that way". The features are then classified into the Kano categories by combining the answers to these two questions (Berger et al., 1993). In

addition to the functional and dysfunctional questions, the relative importance (self-stated importance; SSI) of each feature establishes priorities for IS development (Matzler & Hinterhuber, 1998). The SSI of each feature is evaluated on a five-point importance rating scale, ranging from 1 (= not important) to 5 (= very important).

Kano questionnaires can be implemented through online questionnaires or oral interviews, among others. The advantages of carrying out the questionnaire online, e.g., on a survey platform, are the relatively low costs and high objectivity. In case there are assumed comprehension problems, standardized oral interviews are suitable (Matzler & Hinterhuber, 1998).

In Paper V, we analyzed data collected from 90 respondents to an online Kano questionnaire of the features of online stress management applications.

### 3.3.3 Data analysis: Kano analysis

The data collected through a Kano questionnaire is analyzed using Kano analysis to assign each identified IS feature to a Kano category. Participants' answers to the functional and dysfunctional questions are combined and categorized using the Kano evaluation table (Table 1). Then the frequencies of the categories are calculated for each feature (Matzler & Hinterhuber, 1998). Q indicates a questionable result, meaning that there is a contradiction in the responses to the two questions.

**Table 1. Kano evaluation table**

| | | Dysfunctional question | | | | |
|---|---|---|---|---|---|---|
| | | like | must-be | neutral | live with | dislike |
| Functional question | like | Q | A | A | A | O |
| | must-be | R | I | I | I | M |
| | neutral | R | I | I | I | M |
| | live with | R | I | I | I | M |
| | dislike | R | R | R | R | Q |

*Note*: A = attractive; I = indifferent; M = must-be; O = one-dimensional; Q = questionable; R = reverse

In addition to the frequencies, two measures help further categorize features and evaluate the categorization: category strength (Cat) and total strength (Tot). The Cat measure indicates the strength of assignment of a feature to a category. The metric is calculated as the difference between the percentage of the most frequent category for this feature and the percentage of the second most frequent category: Cat = most frequent category - second most frequent category. A Cat of at least 6 % expresses a meaningful categorization in the sense that there is a statistically significant difference between the most frequent and second most frequent category at a confidence level of 90 % (Hölzing, 2008).

The Tot measure indicates the percentage of participants for whom the fulfillment of this feature is relevant, i.e., an attractive, one-dimensional or must-be feature: Tot = A + O + M. A Tot of 60 % or higher indicates that at least 60 % of the participants consider this feature relevant. If the Cat is below 6 %, i.e., no meaningful categorization can be made, but the Tot is above 60 %, indicating that the feature is relevant for the majority of participants, a reevaluation of the categorization by evaluation rules is necessary (Lee & Newcomb, 1997).

The evaluation rule M>O>A>I is one way to categorize features that are not clearly assignable. The evaluation rule implies that a feature with two equally frequent categories should be assigned to the category that is greater on the evaluation rule scale. The rationale is that M and O features cause dissatisfaction if not fulfilled and are therefore the most important and should be considered first, followed by attractive and indifferent features (Matzler & Hinterhuber, 1998). Another

evaluation rule is: M+A+O > I+Q+R, then Max (M, A, O) (Berger et al., 1993). According to this rule, if the proportion of participants who view the feature as must-be, attractive or one-dimensional is greater than the proportion who view the feature as irrelevant, questionable or reverse, the feature should be classified as M, A, or O depending on the highest frequency. In case of the opposite, the features should be classified as I, Q or R: M+A+O < I+Q+R, then Max (I, Q, R).

Lastly, the significance of the category assignment can be calculated by the Fong test (Hölzing, 2008), whereby *a* reflects the number of the most frequent category, *b* reflects the number of the second most frequent category, and *n* is the number of participants:

$$|a - b| < 1.65 * \sqrt{\frac{(a + b) * (2 * n - a - b)}{2 * n}}$$

A feature is statistically significantly assigned if the inequation above is not fulfilled. If the formula is fulfilled, it cannot be excluded that the feature was randomly assigned to the corresponding category (Fong, 1996).

After assigning each feature to a category, the self-stated importance is calculated to reveal differences even within a respective category. The self-stated importance is the average value of all participants' answers to the SSI question for a specific feature on the scale from 1 (= not important) to 5 (= very important). This metric reveals which features are more important than others of the same category (Berger et al., 1993).

In Paper V, the quantitative data collected with a Kano questionnaire was analyzed by a Kano analysis.

### 3.3.4 Data analysis: Partial Least Squares Structural Equation Modeling (PLS-SEM)

PLS-SEM has been applied widely across a variety of disciplines, including information systems, management, and marketing (Hair et al., 2019). PLS-SEM facilitates the analysis of complex models with multiple constructs, indicators, and paths among the constructs. For this analysis, PLS-SEM does not require specific distributional properties and significant sample size (Ringle et al., 2012). Moreover, PLS-SEM is appropriate for testing the predictions from a theoretical model and exploring theoretical extensions (Hair et al., 2019).

PLS-SEM is appropriate when there are latent variables, i.e., variables than cannot be observed or measured directly, but rather need to be estimated using observable indicators. For instance, the latent variable of job burnout is measured by indicators such as "I feel emotionally drained by my work" (Maslach & Jackson, 1986; Srivastava et al., 2015). Based on these indicators, PLS-SEM estimates values for the latent variables. A special form of latent variables are second-order constructs. While first-order constructs consist of a latent variable and its indicators, the second-order construct is a multidimensional latent variable. The multiple subdimensions are indicators of the latent variable (second-order construct) and each subdimension in turn is measured by its own indicators (Wright et al., 2012). Technostressors are treated as a second-order construct consisting of the five subdimensions of techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty in existing technostress research (Srivastava et al., 2015; Tarafdar, Pullins, & Ragu-Nathan, 2015).

PLS-SEM results are evaluated by examining the measurement model and assessing the structural model. The measurement model refers to the relationships among the indicators and its respective latent variables and is the basis for examining the reliability and validity of the data. The

indicators can either reflect the latent variable, specified as a reflective measurement model, or form the latent variable, specified as a formative measurement model (Jarvis et al., 2003). This dissertation applies reflective measurement models, thus the focus is on the description of the evaluation of the measurement model of reflective constructs. The structural model refers to the relationships between the latent variables and is the grounding for examining the hypothesized relationships of the research model.

The examination of the measurement model for reflective constructs includes metrics for indicator reliability, internal consistency, convergent validity, and discriminant validity. First, the assessment of the indicator loadings is used to assure indicator reliability, which should be above 0.707 (Carmines & Zeller, 2008). Composite reliability is used as an indicator of internal consistency reliability, with values above 0.70 considered as satisfactory to good. In addition, this step includes the assessment of the convergent and discriminant validity. For convergent validity, the average variance extracted (AVE) is calculated. A value above 0.50 indicates convergent validity, since the construct explains at least 50 percent of the variance of its items. Metrics for the discriminant validity are the Fornell-Larcker criterion (Fornell & Larcker, 1981) and the heterotrait-monotrait (HTMT) ratio (Henseler et al., 2014). In line with the Fornell-Larcker criterion, the shared variance of all constructs in the research model should not exceed their AVEs (Hair et al., 2019). The HTMT ratio should be lower than 0.85 to confirm discriminant validity, and the bootstrapping approach should reveal that the HTMT ratio is significantly different from 1. Lastly, multicollinearity among the constructs in the research model can distort the results, which can be assessed by the variance inflation factor (VIF). A VIF below 3 indicates that multicollinearity is not an issue in the data (Rogerson, 2001).

When these recommendations are met, the structural model is assessed by calculating the determination coefficient ($R^2$), the predictive relevance ($Q^2$), the significance levels of the path coefficients, and the effects sizes $f^2$ and $q^2$. $R^2$ is a measure of the explanatory power of the model. Acceptable values highly depend on - and should be interpreted in – the context of the study. A measure for the predictive relevance of the structural model for a specific construct is the metric $Q^2$. A value above zero indicates predictive relevance of the structural model for this construct. $f^2$ is a measure for the effect size, with values higher than 0.02, 0.15, and 0.35 reflecting small, medium, and large effect sizes, respectively (Hair, 2017). However, for moderation effects, the thresholds of 0.005, 0.01, and 0.025 are more realistic standards for medium, small, and large effect sizes (Kenny, 2016). Similarly to $f^2$, the effect size of $q^2$ indicates a small, medium, or large predictive relevance if the value is higher than 0.02, 0.15, and 0.35 (Hair, 2017).

In Paper IV, the quantitative data was analyzed by PLS-SEM, using the software SmartPLS 3.

### 3.3.5 Data analysis: fuzzy set Qualitative Comparative Analysis (fsQCA)

fsQCA is grounded in configurational theory, which views phenomena of interest as a combination of interdependent elements, i.e., conditions, that must be investigated simultaneously and understood as a whole (El Sawy et al., 2010). This is the case when the causal relationships inherent in the phenomena are complex and characterized by conjunctural causation, asymmetry, and equifinality. *Conjunctural causation* implies that outcomes are not caused by one condition but by the interdependence of multiple conditions. Combinations of these multiple interdependent conditions constitute a configuration. *Asymmetry* means that in some configurations a high intensity but in others a low intensity of a condition may be causally related to an outcome. *Equifinality* refers to the notion that there are multiple paths, i.e., configurations of multiple interdependent conditions, that lead to an outcome rather than a single path (Misangyi et al., 2017). fsQCA can account for these three aspects of causal complexity and enables to analyze research models where the conditions are theorized to influence the outcome of interest together in the form of configurations rather than individually (Schneider & Wagemann, 2012). fsQCA analyzes what

different combinations of these conditions, i.e., configurations, together lead to an outcome and considers asymmetric relationships by accounting for both the high and low intensity of a condition. QCA tests for sufficient configurations, which means that in each observation where this configuration exists, the outcome of interest exists as well (Ragin, 2014). In other words, all observations of a sufficient configuration display the outcome. fsQCA is especially appropriate when there is not sufficient theory to specify a priori sufficient configurations and provides opportunities for inductive theorizing (Park et al., 2020).

For testing the reliability and validity of the data, the same steps can be taken as in the evaluation of the measurement model in PLS-SEM (see section 3.3.4). fsQCA is grounded in set theory and relies on fuzzy set values that range from 0 to 1 for the conditions and outcome(s) of interest. The fuzzy set value expresses the extent to which this condition or outcome has a membership in a set, ranging from fully-out of set (value 0) to fully-in set (value 1) (Mattke et al., 2022). In other words, the fuzzy set values express the continuum from a low level of a condition or outcome (value 0; called fully-out of set) to a high level of a condition or outcome (value 1; called fully-in set). For instance, a fuzzy set value of 0.7 expresses a rather high level of the condition or outcome, but not as high as the fuzzy set value of 1. Thus, for fsQCA, the standard Likert scale values collected by the online questionnaire need to be transformed into these fuzzy set values, which is called calibration. While there are different approaches for calibration, IS research commonly relies on the direct calibration using three anchors from the Likert scale. Research recommends using the minimum value of the Likert scale for the fully-out of set anchor, the median value of the Likert scale as the point of maximum ambiguity, and the maximum value as the anchor for fully-in set (Mattke et al., 2022; Schneider & Wagemann, 2012).

For the analysis of sufficient conditions, the calibrated data with the fuzzy set values are incorporated in a truth table (Ragin, 2014). The truth table lists all possible configurations of the conditions, representing the conditions with the values 0 (all fuzzy set values below 0.5; indicating a low level) or 1 (all fuzzy set values above 0.5; indicating a high level). For each possible configuration, the number of observations is indicated. To reduce the truth table containing all possible configurations to only sufficient configurations, three thresholds are used: frequency threshold, raw consistency score, and PRI consistency (Mattke et al., 2022). The frequency threshold implies that only configurations with a certain number of observations are considered. The frequency threshold is chosen based on the sample size and the amount of observations that remain in the analysis (Greckhamer et al., 2018). The raw consistency score, which is calculated for each specific configuration, refers to the proportion of observations which show the outcome and should be at least 0.75 (Ragin, 2006) or even better 0.85 (Ragin, 2009). The PRI consistency expresses the degree to which the configuration is sufficient for a high level of the outcome, but not for the low level of the outcome. This metric is relevant, given that we cannot predict the outcome from configurations that are sufficient for both a high and low level of the outcome. Thus, the PRI consistency should be at least 0.75 (Greckhamer et al., 2018). Configurations of the truth table that pass these three thresholds are considered as sufficient configurations.

Papers I and II analyze the data collected via online questionnaires using fsQCA.

### 3.4 COMBINING QUALITATIVE AND QUANTITATIVE RESEARCH: CASE STUDY RESEARCH

Case study research is especially helpful for investigating contemporary phenomena in its real-life context addressing research questions of "how" or "why" (Yin, 2014). Case studies typically combine multiple primary and secondary data types such as interviews, questionnaires, observations, and archives (Eisenhardt, 1989). From these multiple sources and empirical evidence, case study research is appropriate when developing theories inductively and gaining new in-depth insights (Eisenhardt, 2021). This triangulation combining the different types of data gained by different methods provides a fuller picture of the phenomenon and increases the robustness of the results (Kaplan & Duchon, 1988; Myers, 2020). Case studies can have different case study designs with each design having its specific strengths. There is the differentiation whether case studies include one or multiple cases. Moreover, they can be holistic, meaning that the study focuses on one unit of analysis within each case or embedded, including multiple units of analysis within each case (Yin, 2014). Within this dissertation, single embedded case studies play an important role because the research focuses on an outstanding case and the research objective is to understand the how and why across multiple points in time. Moreover, the embedded design allows to compare different perceptions and interpretations of the phenomenon across the units of analysis (Yin, 2014).

Paper VI of this dissertation reports on the results of a single embedded case study and analyzes data collected via qualitative interviews and quantitative online questionnaires.

### 3.5 SUMMARY

In summary, papers constituting this dissertation include a literature review and qualitative and quantitative research analyzing data collected via a variety of data collection techniques and taking multiple data analysis approaches. The evaluation of this data addresses both research objectives and provides answers to the five research questions of this dissertation.

## 4 MAIN RESEARCH RESULTS

The eight papers of this dissertation focus on technostress formation and mitigation, addressing five research questions. Each of the eight papers addresses one or more of the research questions. Table 2 provides an overview of the research questions that each of the eight papers address as well as an overview of the main results.

**Table 2. Summary of the research questions and main research results**

| | **RO 1: Understand how technostressors and technostrain are formed** | | **RO 2: Understand how technostressors and thereby technostrain are mitigated** | | |
|---|---|---|---|---|---|
| | **RQ 1: How do personality traits predispose users to perceiving technostressors?** | **RQ 2: How do combinations of technostressors lead to technostrain?** | **RQ 3: How can users actively mitigate technostressors and thereby technostrain?** | **RQ 4: What mitigation strategies in the work environment effectively mitigate technostressors and thereby technostrain?** | **RQ 5: What are the limitations and potential negative consequences of various technostress mitigation strategies directed at specific technostressors?** |
| **Paper I** | Combinations of high and low Big Five personality traits constitute multiple profiles that predispose users to perceiving technostressors. | | | | |
| **Paper II** | | Interdependencies: complementarity, contingency, substitution<br><br>Configurations consisting of high technostressors lead to *low* technostrain.<br><br>High job burnout and low job performance result from different configurations. | | | Even when some technostressors are mitigated, a subset of the technostressors may still lead to technostrain. |
| **Paper III** | | | Users can engage in coping strategies or enhance their abilities and strengthen their malleable personality traits. | Organizations can implement organizational strategies, technological strategies by adjusting the characteristics of the IS or address the social environment by installing peer advice ties. | |
| **Paper IV** | Low mindfulness is related to higher perception of technostressors. | | Mindfulness can actively be trained and is related to lower perception of technostressors. | | |
| **Paper V** | | | Satisfaction with an intervention for stress and technostress mitigation is relevant for its adoption, and the features of an intervention vary in their relevance for user satisfaction. | | |
| **Paper VI** | | | | Organizations can adjust the email program to reduce the email traffic, homogenize the IS, introduce training sessions and contact persons, provide assistance with problems also by chatbots, and introduce office days. | Technostress mitigation strategies are differently effective for different technostressors.<br><br>For different users groups, different mitigation strategies are most effective. |
| **Paper VII** | | | | Organizations can ensure a separation of private and business devices, restrict the email traffic, introduce an emergency channel, communicate expectations, provide good practices for internal communication, introduce a "pull not push" culture, foster the communication with the manager, and introduce "off-screen" communication opportunities. | Each identified/applied strategy comes with negative consequences such as increasing other technostressors or affecting other people. These consequences depend upon the level of the users, i.e., managers or non-managerial employees. |
| **Paper VIII** | | | Managers can take an active role by engaging in digital health-oriented leadership. | Managers can engage in digital health-oriented leadership to mitigate team members' technostress. | |

## 4.1 PAPER I: PERSONALITY PROFILES THAT PUT USERS AT RISK OF PERCEIVING TECHNOSTRESS: A QUALITATIVE COMPARATIVE ANALYSIS WITH THE BIG FIVE PERSONALITY TRAITS[1]

To effectively address technostressors and prevent further negative consequences, it is relevant to first enrich our understanding of technostress formation (research objective 1) by revealing who is at risk of perceiving technostressors and should be the beneficiary group of technostress mitigation. Research has highlighted the relevance of user characteristics in the technostress context, such as individual differences influencing the extent to which technostressors lead to technostrain (Srivastava et al., 2015). Following the differential exposure-reactivity model (Bolger & Zuckerman, 1995), we argue that user characteristics such as the Big Five personality traits (McCrae & Costa, 2008) affect the perception of technostressors through differential exposure. Transferred to technostress, differential exposure means that personality traits influence the occurrence of technostressors and users might evaluate the same IS characteristics differently depending on their Big Five personality traits. Due to differential exposure, the perception of technostressors might differ among users. The Big Five personality traits openness to experience, neuroticism, agreeableness, conscientiousness, and extraversion are at the core of individual differences (McCrae & Costa, 2008) and constitute personality profiles, i.e., an individual set of personality traits that are relevant simultaneously (Furr, 2010). Paper I investigates which personality profiles of Big Five personality traits predispose users to perceiving technostressors (Figure 5).

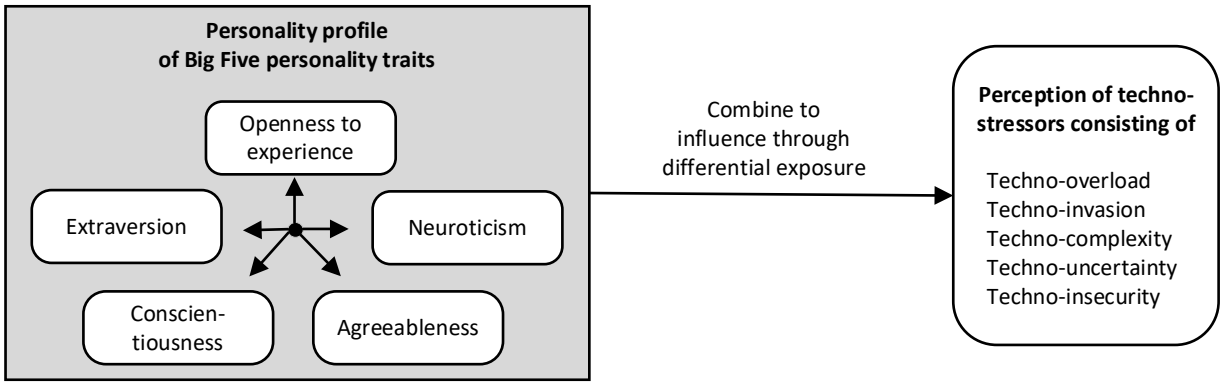


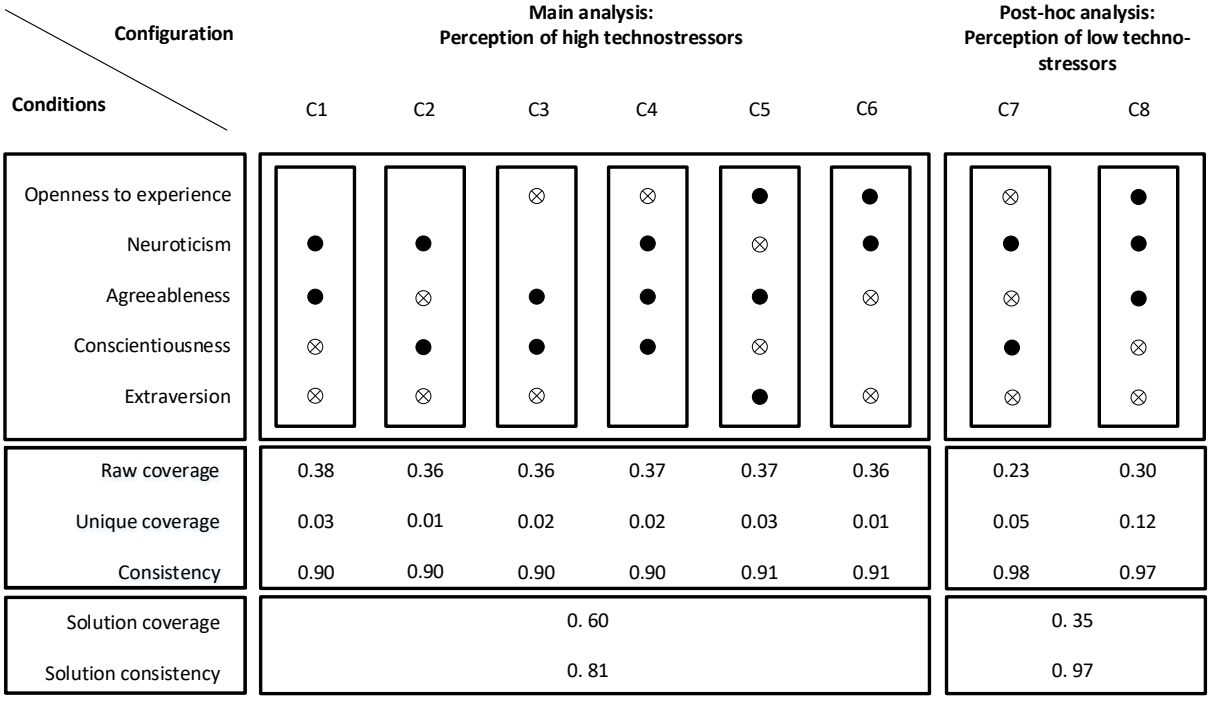

**Figure 5. The influence of personality profiles on the perception of technostressors**

We collected data via a quantitative online questionnaire using Amazon Mechanical Turk (mTurk), which is a well-established approach in IS research (Maier et al., 2019). The final sample consists of 221 participants who work with IS regularly as part of their work, with 29.1 % women and 60.9 % men and an average age of 32.5 years (SD = 9.1). We take a configurational approach and use fsQCA (Ragin, 2014) to analyze our data because fsQCA allows us to study the Big Five personality traits in profiles instead of individually and accounts for complex relationships between the distinct Big Five personality traits.

The fsQCA results reveal six personality profiles of Big Five personality traits, called configurations in fsQCA language, that predispose users to perceiving technostressors (Figure 6, C1-C6). Users with these personality profiles are predisposed to perceiving technostressors (RQ 1) and users characterized by C7 or C8 are predisposed to perceiving low technostressors. For instance, C1 depicts a personality profile where openness to experience can be either high or low

[1] Pflügner, K., Maier, C., Mattke, J., & Weitzel, T. (2021). Personality profiles that put users at risk of perceiving technostress: A qualitative comparative analysis with the Big Five personality traits. *Business & Information Systems Engineering, 63*(4), 389–402. https://doi.org/10.1007/s12599-020-00668-7. An earlier version of this paper was presented at the *14th International Conference on Wirtschaftsinformatik* (Pflügner, Mattke, & Maier, 2019).

and encompasses high neuroticism and agreeableness as well as low conscientiousness and extraversion. Thus, a user characterized by this personality profile tends to experience negative emotions easily, is more likely to want to please others, and has difficulties controlling his or her impulses, but does not seek social attention.




*Note*: Black circles (●) indicate a high level of a personality trait, white crossed-out circles (⊗) a low level of a personality trait, and blank spaces indicate a '*don't care*' situation. In this case, the trait plays a subordinate role and may be either high or low. C means configuration.

**Figure 6. Personality profiles predisposing to high and low technostressors**

With this research, we contribute to research on individual differences in technostress research (Maier et al., 2019; Srivastava et al., 2015) that personality traits need to be interpreted relatively to the other personality traits and investigating personality traits in profiles extends the insights of studying personality traits in isolation. Our results show that the influence of a personality trait depends on the other personality traits, because no personality trait is always high or always low in each of the extracted profiles. In fact, a high level of a personality trait in one personality profile and a low level of that same personality trait in another personality profile, in combination with other personality traits, can be a risk factor that predisposes an individual to perceiving technostressors.

Personality profile assessments increasingly common in organizations (Harrell, 2017) enhance employees' self-awareness and managers' awareness about individuals' risk of perceiving technostressors. This information can inform technostress mitigation by targeting employees whose personality profile makes them especially predisposed to perceiving technostressors. The group of individuals who are at risk of suffering from technostressors is diverse and technostress mitigation should not focus on individuals with any one personality profile, but needs to consider diverse users with multiple personality profiles. This differentiation is also relevant because our follow-up investigation reveals that users within each of the identified personality profiles ask for different mitigation strategies compared to the other personality profiles. However, users who perceive technostressors need not experience negative consequences of technostressors, as highlighted in Paper II.

## 4.2 PAPER II: DECONSTRUCTING TECHNOSTRESS: A CONFIGURATIONAL APPROACH TO EXPLAINING JOB BURNOUT AND JOB PERFORMANCE[2]

Deviating from the general notion that the higher the technostressors, the higher the resulting technostrain (Srivastava et al., 2015; Tarafdar, Pullins, & Ragu-Nathan, 2015), the second paper of the dissertation extends our understanding of technostress formation (research objective 1) by revealing the complexity in the relationship between technostressors and technostrain. Recent technostress literature provides first indications of this complexity, showing that *high and low* technostressors can lead to technostrain (Chandra et al., 2019; Maier et al., 2019; Stich et al., 2019). The general stress literature (Karasek, 1979) as well as general systems theory (Bertalanffy, 1975) lead us to argue that there are interdependencies among technostressors and these interdependencies shape whether and to which extent technostressors lead to technostrain. We derive and theorize from general systems theory and related research (Furnari et al., 2021) that there are three types of interdependencies among technostressors leading to technostrain, termed complementarity, contingency, and substitution. These interdependent technostressors combine and make up configurations of high and low intensity technostressors that lead to technostrain. Paper II investigates which configurations of interdependent technostressors lead to technostrain with a focus on high job burnout and low job performance (Figure 7).

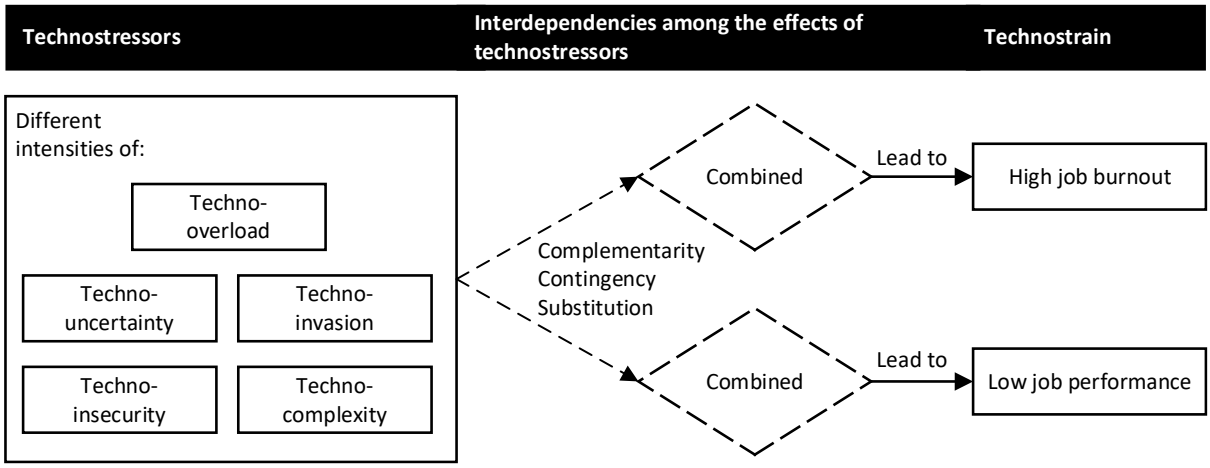



**Figure 7. Interdependencies among technostressors leading to technostrain**

We collected data via a quantitative online questionnaire within an international automotive supplier in two waves, capturing technostressors in the first wave and technostrain in the second wave six weeks later. Top management executives distributed the questionnaire to their employees in different business units who use IS at almost all of the points of their daily work processes. A total of 166 employees completed two waves including 45.5 % women and 54.5 % men with an average age of 34.7 years (SD = 10.9). We take a configurational approach and used fsQCA (Mithas et al., 2022; Ragin, 2014) to analyze our data. The configurational approach is appropriate given that we assume technostressors combine to lead to technostrain and manifest in configurations that include complementarity, contingency, and/or substitution effects. Configurations are combinations of interdependent technostressors that can be of high and low intensity.

The evaluation of our data with fsQCA reveals four configurations of technostressors leading to high job burnout (C1-C4, Figure 8) and one configuration leading to low job performance (C5) (RQ 2). The results show that job burnout occurs when all technostressors are of high intensity (C1) or when all are of high intensity except techno-uncertainty (C2), or techno-complexity (C3),

[2] Pflügner, K., Maier, C., Thatcher, J. B., Mattke, J., & Weitzel, T. (forthcoming). Deconstructing technostress: A configurational approach to explaining job burnout and job performance. *MIS Quarterly*. https://doi.org/10.25300/MISQ/2023/16978. An earlier version of this paper was presented at *DIGIT 2019* (Pflügner, Mattke, & Weitzel, 2019).

or techno-invasion (C4), each of which may be of low intensity (RQ 5). Low job performance arises when all technostressors are of high intensity (C5, Figure 8). A two-step fsQCA as post hoc analysis highlights that high job burnout can mediate the configurations of technostressors that lead to low job performance.

| Configuration / Condition | High job burnout | | | | Low job performance |
|---|---|---|---|---|---|
| | C1 | C2 | C3 | C4 | C5 |
| Techno-overload | ● | ● | ● | ● | ● |
| Techno-invasion | ● | ● | ● | ○ | ● |
| Techno-complexity | ● | ● | ○ | ● | ● |
| Techno-insecurity | ● | ● | ● | ● | ● |
| Techno-uncertainty | ● | ○ | ● | ● | ● |
| Raw/unique/ solution coverage | 0.33 | 0.18 | 0.24 | 0.23 | 0.34 |
| Consistency/solution consistency | 0.91 | 0.94 | 0.92 | 0.94 | 0.88 |
| Solution coverage (minimized solution) | 0.44 | | | | 0.34 |
| Solution consistency (minimized solution) | 0.88 | | | | 0.88 |

*Notes:* ● = high intensity, ○ = low intensity, C = configuration

**Figure 8. Configurations of technostressors leading to high technostrain**

The results of a post-hoc analysis on configurations of technostressors leading to low technostrain, i.e., low job burnout or high job performance, reveal one configuration for low job burnout and five configurations for high job burnout. Low job burnout occurs when all technostressors are of low intensity. High job burnout can occur even when up to four technostressors are of high intensity (Figure 9).

| Configuration / Condition | Low job burnout | High job performance | | | | |
|---|---|---|---|---|---|---|
| | C1_low | C2_low | C3_low | C4_low | C5_low | C6_low |
| Techno-overload | ○ | ○ | ● | ○ | ● | ● |
| Techno-invasion | ○ | ○ | ○ | ● | ○ | ● |
| Techno-complexity | ○ | ○ | ○ | ○ | ● | ○ |
| Techno-insecurity | ○ | ○ | ○ | ○ | ● | ● |
| Techno-uncertainty | ○ | ● | ● | ● | ● | ● |
| Raw/unique/solution coverage | 0.40 | 0.36 | 0.26 | 0.22 | 0.18 | 0.18 |
| Consistency/solution consistency | 0.85 | 0.86 | 0.88 | 0.90 | 0.92 | 0.91 |
| Solution coverage (minimized solution) | 0.40 | 0.68 | | | | |
| Solution consistency (minimized solution) | 0.85 | 0.86 | | | | |

*Notes:* ● = high intensity, ○ = low intensity, C = configuration

**Figure 9. Configurations of technostressors leading to low technostrain**

Our main analysis extended by the post-hoc analyses support that there are three types of interdependencies among technostressors (RQ 2) (Table 3). *Complementarity* implies that technostressors mutually enhance their effects on technostrain. This type of interdependency leads to instances where users experience high job burnout even if they are confronted with not all but only a subset of high-intensity technostressors. *Contingency* arises when the effect of technostressors on technostrain is only felt in the presence of another technostressor of high intensity. Thus, due to contingency there are instances where users can tolerate some high-intensity technostressors, where no technostrain in the form of low job performance results. Finally, *substitution* implies that the high intensities of technostressors can offset the low intensity of another technostressor. As a result, different situations, i.e., configurations of high and low technostressors, can lead users to experience technostrain and one user may respond to a situation in a different way than another user.

**Table 3. Three types of interdependencies grounded in fsQCA results**

| Interdependency | Description | Formula* |
|---|---|---|
| **Complementarity** | Complementarity implies that technostressors mutually enhance their effects on technostrain. | Based on Fiss et al. (2013)<br>Technostressor A and technostressor B are complementary if:<br>$V(A•B) - V(\sim A•B) > V(A•\sim B) - V(\sim A•\sim B)$ |
| **Contingency** | Contingency arises when the effect of technostressors on technostrain is only felt in the presence of another technostressor of high intensity. | Self-developed<br>Technostressors A, C, D, and E are contingent upon the intensity of technostressor B if:<br>$Outcome(A•B•C•D•E) \neq Outcome(A•\sim B•C•D•E)$ |
| **Substitution** | Substitution implies that the high intensities of technostressors offset the low intensity of another technostressor. | Adjusted from Fiss et al. (2013)<br>Technostressors are substitutable if:<br>$V(A•\sim B•C•D•E) \geq V(A•B•C•D•E)$ |

*Notes:* A, B, C, D, E = high-intensity technostressors; ~A, ~B, ~C, ~D, ~E = low-intensity technostressors; V = consistency; Outcome = high or low technostrain. * The formulas are exemplary: they are valid for configurations of high- and low-intensity technostressors other than the ones in the exemplary formulas.

We extend existing research findings that high-intensity technostressors (Galluch et al., 2015; Tarafdar, Pullins, & Ragu-Nathan, 2015) lead to technostrain by showing that configurations comprised of both high- and low-intensity technostressors can lead to technostrain. Deviating from overdetermination (Furnari et al., 2021), we show that a subset of high-intensity technostressors can have *complementary effects* and are thereby sufficient to lead to high job burnout. Beyond that, we reveal that because of *substitution*, different configurations, including those that contain low-intensity technostressors, have an equivalent impact on high job burnout.

Our post-hoc investigation of low technostrain led us to reconsider the notion of high-intensity technostressors and revealed that their adverse effects are *contingent* upon the intensity of other technostressors. High-intensity technostressors may be well-tolerated and do not necessarily lead to high technostrain but in combination lead to *high* job performance as long as specific other technostressors are of low intensity.

Comparing the two forms of technostrain, our results reveal that job burnout and low job performance can result from divergent mechanisms. Job burnout can be caused by fewer high-intensity technostressors and the two-step fsQCA shows that job burnout can occur as a first state before employees then show low job performance. Thus, managers should not think themselves safe when team members perform high.

The results highlight that the negative consequences implied in technostress can even arise when users face only part of the technostressors at a high intensity and that different configurations of technostressors can all lead to adverse consequences. Thus, it is relevant to mitigate the technostressors and thereby technostrain.

## 4.3 PAPER III: TECHNOSTRESS MANAGEMENT AT THE WORKPLACE: A SYSTEMATIC LITERATURE REVIEW[3]

Basing on the insights into technostress formation in the Papers I and II, the remaining papers of this cumulative dissertation aim at enhancing our understanding of technostress mitigation (research objective 2). As a start, Paper III reviews existing literature on technostress mitigation to provide an overview of empirical insights into technostress mitigation strategies and identify future research avenues for further research on technostress mitigation.

Following existing guidelines (vom Brocke et al., 2009; Webster & Watson, 2002), the review scope includes peer-reviewed empirical research studies published in English between January 2007 and July 2017 in the leading journals of psychology, organizational behavior, and IS literature. The journals were selected based on the AIS basket-of-eight journals, the Financial Times ranking lists, and journals previously searched for in review papers (Tarafdar et al., 2019). We included papers that covered technostress mitigation strategies in the work context and excluded papers, e.g., because they studied other forms of stress not due to IS or non-malleable factors of technostress. From the 86 initial hits, 14 papers were relevant. In addition, 8 papers were added based on a backward and forward search, resulting in 22 relevant papers included in the literature review. For data analysis, a concept matrix was used (Webster & Watson, 2002) that extracted the methodological approach and design, mitigation details as well as technostressors and technostrain aspects that were studied in each paper.

The analysis of existing literature reveals that there are four different groundings for technostress mitigation strategies: the users themselves, the technological environment, the organizational environment, and the social environment. Table 4 illustrates the findings of the literature review on technostress mitigation strategies.

**Table 4. Findings on technostress mitigation strategies identified in the literature review (Pflügner, 2022)**

| | Mitigation strategy |
|---|---|
| **User** | Computer experience (Tams et al., 2018)<br>Computer self-efficacy (Tams et al., 2018)<br>Cognitive behavior skills training (Soucek & Moser, 2010)<br>Personal innovativeness in IT (Maier et al., 2019)<br>IT mindfulness (Maier et al., 2019)<br>Promotion focus (Hwang & Cha, 2018)<br>Deleting emails (Addas & Pinsonneault, 2018)<br>Adaptive coping strategies (Gaudioso et al., 2017)<br>Distress venting (Pirkkalainen et al., 2019)<br>Distancing from IS (Pirkkalainen et al., 2019)<br>Positive reinterpretation (Pirkkalainen et al., 2019)<br>IS control (Pirkkalainen et al., 2019)<br>Resource control (Galluch et al., 2015)<br>Method control (Galluch et al., 2015) |
| **Technological environment** | Usefulness (Ayyagari et al., 2011)<br>Reliability (Ayyagari et al., 2011)<br>Anonymity (Ayyagari et al., 2011)<br>Timing control (Galluch et al., 2015) |

[3] Pflügner, K. (2022). Technostress management at the workplace: A systematic literature review. *Proceedings of the 17th International Conference on Wirtschaftsinformatik*.

| | |
|---|---|
| **Organizational environment** | Technical support provision (Fuglseth & Sørebø, 2014; Ragu-Nathan et al., 2008; Tarafdar, Pullins, & Ragu-Nathan, 2015)<br>Literacy facilitation (Fuglseth & Sørebø, 2014; Ragu-Nathan et al., 2008; Tarafdar, Pullins, & Ragu-Nathan, 2015)<br>Involvement facilitation (Fuglseth & Sørebø, 2014; Ragu-Nathan et al., 2008; Tarafdar, Pullins, & Ragu-Nathan, 2015; Tarafdar et al., 2010)<br>IS support (Day et al., 2012; Sykes, 2015)<br>Boundary control (Cho et al., 2020)<br>Organizational support in work-home boundary management (Benlian, 2020) |
| **Social environment** | Peer advice ties (Sykes, 2015) |

*Strategies grounded in the user* include distress venting (Pirkkalainen et al., 2019) and cognitive behavior skills training (Soucek & Moser, 2010), besides others (RQ 3). *Strategies grounded in the environment* include IS reliability (Ayyagari et al., 2011), technical support provision (Tarafdar, Pullins, & Ragu-Nathan, 2015), and peer advice ties (Sykes, 2015), besides others (RQ 4). However, the investigations are mainly cross-sectional rather than interventional, and insights into strategies grounded in the technological and social environment rather than organizational environment are scarce.

Next to the overview on technostress mitigation strategies, the analysis reveals initial insights into the limitations and negative consequences of technostress mitigation (RQ 5). First, some technostress management strategies do not mitigate all, but rather only specific technostressors (Day et al., 2012). Second, the technostress management strategies can affect technostressors or the technostressors' effect on technostrain in a different way. For instance, one and the same strategy can decrease a specific technostressor, but increase another one (Galluch et al., 2015). This finding provides first indications that technostress mitigation strategies might also lead to negative consequences and combinations of multiple strategies might prevent the negative consequences (RQ 5).

Starting with the overview on existing findings, the analysis builds the grounding for identifying future research avenues. Overall, the analysis identifies five avenues for future research (Table 5), which are addressed in the remaining papers in Chapter II of this dissertation (Table 12).

**Table 5. Future research avenues (RA) identified in the literature review (Pflügner, 2022)**

| Future research avenue (RA) |
|---|
| **RA 1:** Interventions for technostress mitigation |
| **RA 2:** Technostress management strategies grounded in the technological environment |
| **RA 3:** Technostress management strategies grounded in the social environment |
| **RA 4:** Technostress management strategies specific for certain technostressors |
| **RA 5:** Combination of technostress management strategies |

Paper III reveals that users as well as the environment can engage in strategies to mitigate technostressors and thereby mitigate technostrain. Thus, some of the papers on technostress mitigation of this dissertation focus on mitigation strategies that the users can take (Papers IV and V), and the remaining papers focus on strategies that can be implemented in the technical, organizational and social environment (Papers VI, VII, and VIII), addressing future research avenues in technostress mitigation identified in Paper III.

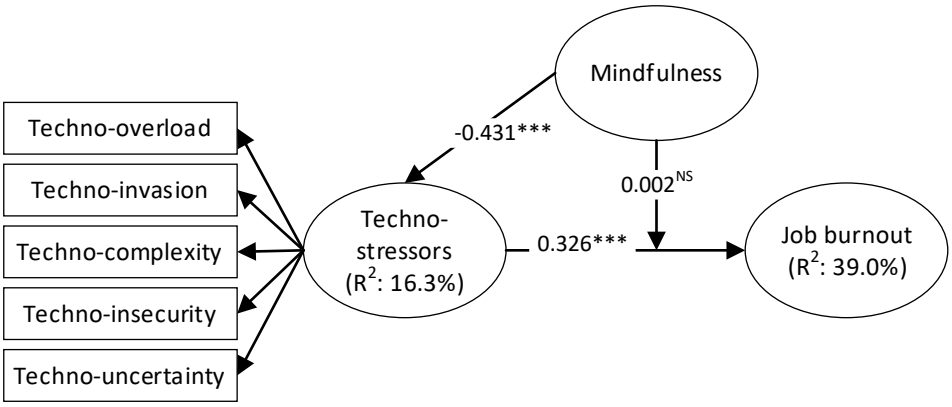
## 4.4 PAPER IV: THE DIRECT AND INDIRECT INFLUENCE OF MINDFULNESS ON TECHNO-STRESSORS AND JOB BURNOUT: A QUANTITATIVE STUDY OF WHITE-COLLAR WORKERS[4]

Paper IV focuses on mitigation strategies that the users can take, investigating specifically the role of mindfulness as a technostress mitigation strategy. Given that mindfulness is a malleable personality trait that can be trained by users themselves (Lomas et al., 2017), mindfulness might provide a way for at-risk users (Paper I) to actively mitigate their perceptions of technostressors and thereby mitigate technostrain. Drawing from the theoretical model of mindfulness (Shapiro et al., 2006), we argue that mindfulness influences the extent to which individuals are confronted with technostressors. Mindful individuals have higher self-regulation, they recognize the values that are important to themselves, respond to conditions in their environment in an adaptive and flexible way, and are willing to expose themselves to their experiences and emotions (Shapiro et al., 2006). Due to these mechanisms, they might for example less easily get distracted by IS-related notifications or may view a "failure" in dealing with IS as separate from themselves or learning opportunity rather than as a threat. Paper IV investigates whether mindfulness influences the degree of perceived technostressors and whether mindfulness influences the extent to which technostressors lead to technostrain in the form of job burnout.

We collected data via a quantitative online questionnaire distributed among the authors' professional contacts and snowball sampling to employees in Germany who use IS regularly at their work. The final sample consists of 134 participants, including 59.0 % women and 41.0 % men with an average age of 43.2 years (SD = 12.6), working in diverse sectors, business units, and hierarchical levels. The quantitative data gathered was analyzed with Structural Equation Modeling using SmartPLS 3 to test the direct and moderating hypotheses in one research model.

The results are summarized in Figure 10 and reveal a significant effect of mindfulness on technostressors ($\beta = -0.431$, $p < 0.001$). The higher the mindfulness, the lower the perceived technostressors of users. There is no significant moderation effect ($p > 0.05$), i.e., mindfulness does not lower the effect of technostressors on job burnout. However, the post-hoc mediation analysis reveals an indirect mediation effect, following the three steps suggested in literature (Baron & Kenny, 1986). Mindfulness has a significant negative effect on job burnout ($\beta = -0.506$, $p < 0.001$) and a significant negative effect on technostressors ($\beta = -0.440$, $p < 0.001$). Technostressors (the mediator) has a significant positive effect on job burnout ($\beta = 0.351$, $p < 0.001$) when controlling for mindfulness. Supported by additional bootstrapping, where zero is not within the confidence interval, we deduce that technostressors mediate the influence of mindfulness on job burnout. In other words, mindfulness leads to lower job burnout through lower technostressors.

[4] Pflügner, K., Maier, C., & Weitzel, T. (2021). The direct and indirect influence of mindfulness on techno-stressors and job burnout: A quantitative study of white-collar workers. *Computers in Human Behavior*, *115*, Article 106566. https://doi.org/10.1016/j.chb.2020.106566. An earlier version of this paper was presented at the *25th Americas Conference on Information Systems* (Pflügner & Maier, 2019).




*Notes:* Rectangles are dimensions, ellipses are constructs; NS: p > 0.05, *: p < 0.05; **p: < 0.01; ***p: < 0.001.

**Figure 10. Results on the role of mindfulness for technostress**

Given the insignificant moderation effect, there is no indication that mindfulness leads users to react to perceived technostressors in a more adaptive way. Nevertheless, mindfulness enables users to perceive less technostressors (RQ 3). In line with the transactional model of stress (Lazarus & Folkman, 1984), the perception of technostressors is not only influenced by IS characteristics (Ayyagari et al., 2011) but also user characteristics and mindfulness is a relevant user characteristic that provides a starting point for technostress mitigation grounded in the user. In contrast to factors that are grounded in the organizational (Tarafdar, Pullins, & Ragu-Nathan, 2015) or technological environment (Ayyagari et al., 2011) or user characteristics that are stable (Paper I), the practicing of mindfulness enables users to take an active role in mitigating technostressors and thereby technostrain. Next to mindfulness-based workplace interventions offered by the management (Lomas et al., 2017), users can themselves engage in structured stress management interventions (Kabat-Zinn, 1982). These include information, instructions, and practices to enhance a users' mindfulness and were found to be effective in mindfulness training and improving employee well-being (Hülsheger et al., 2013; Lomas et al., 2017).

## 4.5 PAPER V: ONLINE STRESS MANAGEMENT INTERVENTIONS: THE ROLE OF APPLICATION FEATURES[5]

Besides traditional stress management interventions, there exist online stress management applications to strengthen mindfulness and mitigate chronic stress as well as technostress as a specific sub-form of chronic stress (Heber et al., 2017; Jayewardene et al., 2017). In such web-based online stress management applications, users can complete predefined units of training developed by experts on their own without accompanying therapy (Ebert et al., 2016; Heber et al., 2017). However, only satisfied users will actually use the application (DeLone & McLean, 2003; Petter et al., 2012). Online stress management applications have a variety of features. A potential user judges these features and this judgement is a decisive factor whether they will be satisfied and use the application or not (Vaezi et al., 2016). Based on the idea of the Kano model (Kano et al., 1984), the multiple features of the application might not be equally relevant for the satisfaction with the application and the relationship might not be linear. The Kano model distinguishes five different categories of features, called must-be, attractive, one-dimensional, irrelevant, and reverse features, with each category having a different relationship with the satisfaction of potential users (section 3.3.2). Paper V investigates which role the features of online stress management application play for the satisfaction of potential users with this application.

[5] Pflügner, K., Maier, C., Hielscher, M., & Weitzel, T. (2021). Online stress management interventions: The role of application features. *Proceedings of the 42nd International Conference on Information Systems*.

We collected our data following the Kano method (Berger et al., 1993; Matzler & Hinterhuber, 1998) which is derived from the Kano model. As a first step, we identified the features of online stress management applications by interviewing two experts from a healthcare startup and two potential users, and reviewing publicly available online stress management applications. We analyzed the data following descriptive and interpretive coding (Myers, 2013) using MaxQDA 2020. The identification led to a set of 44 features of online stress management applications (Table 6).

We constructed a Kano questionnaire to assign these 44 features to the five Kano categories. The final sample consisted of 90 participants completing the questionnaire, 54.4 % of them female 45.6 % male with an average age of 32.0 years. A total of 48.0 % of the participants were stressed or very stressed and 68 % of the participants who had not used an online stress management applications before could potentially imagine using one in the future.

The categorization with Kano analysis reveals 13 *must-be features*. When these 13 features are not fulfilled, potential users are dissatisfied. However, their fulfillment does not bring about satisfaction with the online stress management application. The opposite is the case for the 16 *attractive features*. Potential users do not expect these features, but when they are fulfilled, potential users are satisfied. For the 16 *one-dimensional features*, the fulfillment of these features pays off, given that the higher the fulfillment of these features, the higher the user satisfaction. Ten *features are irrelevant* and do not influence whether users are satisfied with the online stress management application or not. Finally, there is one *reverse feature*, which leads to dissatisfaction of potential users if this feature is fulfilled. The self-stated importance (SSI) reveals a hierarchy within each of these categories, meaning that features with higher SSI values are more important to potential users than features with lower SSI within the same category (Table 6).

**Table 6. Categorization of identified application features**

| No. | Application feature | Category | SSI |
|---|---|---|---|
| | **Selection criteria** | | |
| 1 | Availability of the privacy policy of the online application | M | 4.13 |
| 2 | Reference to the privacy policy of the online application | M | 3.84 |
| 3 | Availability of the imprint / contact details of the online application | M | 4.04 |
| 4 | Visibility of the application developer | M | 4.17 |
| 5 | Certification of the application as a prevention program | A | 3.59 |
| 6 | Effectiveness study of the application | A | 4.09 |
| 7 | Explicit recommendation of the application by health insurance | A | 3.14 |
| 8 | Experience reports / reviews of former users of the application | A | 3.51 |
| | **Costs** | | |
| 9 | Free use of the application | O | 3.77 |
| 10 | Coverage of the fees for the application by health insurance | A | 3.68 |
| 11 | Availability of discount codes on the website of the application | I | 2.59 |
| | **Framework conditions** | | |
| 12 | Absence of advertising in the application | O | 3.98 |
| 13 | Use of the application without registration / login | A | 3.22 |
| 14 | Possibility of offline use of the application | A | 3.40 |
| 15 | Availability of associated mobile application | A | 3.66 |
| 16 | Possibility of offline use of the mobile application | A | 3.38 |
| 17 | Use of the online application immediately after registration | I | 3.36 |
| | **Content** | | |
| 18 | Scaling of the contents of the application into weekly modules | I | 3.21 |
| 19 | Virtual introduction to the application | A | 3.70 |
| 20 | Support for technical questions regarding the application | M | 4.03 |
| 21 | Contact possibility for questions regarding the content of the application | M | 4.09 |
| 22 | Contact possibility to trained personnel of the application | A | 3.91 |
| 23 | Extension of the application usage with telephone coaching | A | 3.33 |
| 24 | Accompanying use of the application for therapy | A | 3.64 |
| | **Gamification / personalization** | | |

| No. | Application feature | Category | SSI |
|---|---|---|---|
| 25 | Exchange with other users of the application | I | 2.90 |
| 26 | Connection with social media accounts | R | 2.28 |
| 27 | Accompaniment of the application by a virtual figure (e.g., mascot) | I | 2.38 |
| 28 | Monitoring function (progress display) | A | 3.61 |
| 29 | Reward / point system for completed tasks | I | 3.04 |
| 30 | Different language selections | I | 3.54 |
| 31 | Selection of thematic focus within the application | O | 4.11 |
| 32 | Regulation of the speed for completing the tasks in the application | O | 4.00 |
| 33 | Reminder function to complete the tasks | I | 3.38 |
| 34 | Regulation of the frequency of notifications | A | 3.89 |
| 35 | Personalized username | I | 2.90 |
| 36 | Creation of a personalized avatar | I | 2.31 |
| 37 | Technical reliability of the online application | M | 4.72 |
| | **User-friendliness** | | |
| 38 | Clearly understandable tasks | M | 4.72 |
| 39 | Intuitive use of the application | M | 4.58 |
| 40 | Understandable language of the application | M | 4.51 |
| 41 | Clear presentation of the content of the application | M | 4.58 |
| 42 | Logical structure of the application | M | 4.63 |
| 43 | Overview of the various functions of the application | M | 4.41 |
| 44 | Attractive design of the application | A | 3.61 |

*Note:* M = must-be; A = attractive; O = one-dimensional; I = indifferent; R = reverse

Our results show that features can be assigned to different Kano categories and can have a different effect on the satisfaction of potential users with online stress management applications that in turn influences its adoption (RQ 3). We identify the need for further investigation of satisfaction at the feature level because the relationship between a feature and potential user satisfaction varies by the feature that is investigated. Moreover, we see differences in terms of which Kano categories the application features are assigned to in healthcare contexts other than chronic stress contexts (Gimpel et al., 2021). It is relevant to study the different features for a specific healthcare application because, in our context, features that might potentially induce stress and thereby interfere with the application's aim are assessed differently by potential users.

Potential users of online stress management applications are not necessarily the more satisfied the more the features are fulfilled and the relationship between feature fulfillment and satisfaction can be linear or asymmetric. Our results provide developers of online stress management applications a better understanding of potential users' needs and help them set priorities across features. We recommend that developers fulfill all must-be features, e.g., that the application is user-friendly, that users can access privacy assurance practices, and that users can ask for technological and content-related support. In addition, in order to compete with competitors, we recommend that developers focus on one-dimensional and attractive features, fulfilling especially those features with the highest SSI to the highest possible degree. Especially under competitive conditions, fulfilling attractive features is an opportunity for developers to stand out among competitors (Matzler and Hinterhuber 1998). Potential users are more likely to be satisfied with and therefore use online stress management applications to take an active role if must-be features are fulfilled, reverse features are not present, and the users see some of the one-dimensional and attractive features fulfilled (RQ 3).

## 4.6 PAPER VI: HOW BUSINESS AND IT LEADERS CAN REDUCE TECHNOSTRESS AMONG EMPLOYEES[6]

The responsibility for technostress mitigation does not rest solely with users themselves, but rather also with the organization that provides the work environment to employees. Grounded in the person-environment fit theory (Edwards et al., 1998), technostress mitigation can target the users with their specific abilities and needs as well as the environment with its specific demands and supplies (Pflügner, 2022). Paper VI investigates what organizations can do to mitigate employee technostress but also the limitations of these organizational technostress mitigation strategies.

For that, we conducted a case study in a medium-sized agency for integrated healthcare communication and marketing headquartered in Germany and operating globally, which we refer to as TheCompany to ensure anonymity. TheCompany's employees had been burdened by technostress before it successfully implemented technostress mitigation strategies in 2019. We studied the implemented strategies, limitations to their effectiveness for specific technostressors, and negative consequences that TheCompany experienced before, during or after the implementation of the technostress mitigation strategies. To learn about the implemented strategies, we conducted semi-structured interviews with experts involved in the development, implementation, and evaluation of the strategies, as well as users affected by them. The experts (N = 16) were from different departments of TheCompany, including the Chief Executive Officer, as well as the heads and selected employees from Marketing and Sales, Information Technology (IT), Human Resources (HR) as well as Medical and Technical Consulting. Among them, there were 25.0 % women and 75.0 % men with an average age of 38.8 years (SD = 6.1). In addition, we analyzed quantitative data from employee surveys that TheCompany conducted before and after the implementation of the strategies.

Our interviews reveal *six technostress mitigation strategies* that address specific technostressors: reducing email traffic, homogenization of IS, training sessions, introducing contact persons, assistance with problems, and office days (RQ 4). TheCompany *reduced their email traffic* and resulting off-topic interruptions by introducing an email ticket system. This system accumulates all emails that are sent within an hour and sends them collectively every hour. However, within the email ticket system, employees can also open a new conversation for a certain topic every hour. Within this open conversation, emails can be sent and answered immediately. Emails regarding another topic without an open ticket are only sent every hour. For the *homogenization of IS*, TheCompany provides standardized IS on which both the business and IT departments have agreed upon. This strategy aims at limiting the complexity by reducing the diversity of IS and preventing hardware or software incompatibilities. *Training sessions* at TheCompany were implemented for all new software introduced. For remaining issues after the training sessions and the support on the job, *contact persons* are introduced. Contact persons are internal employees at TheCompany who, in addition to performing their job, receive credit for training themselves in their area of expertise and provide low-threshold IS support to other employees. *Assistance with problems* refers to establishing a culture of mutual support among the colleagues as well as assistance by IS in the form of chatbots for easily accessible IS support on the job. Finally, TheCompany decided to introduce *office days*, which are specific days on which employees are expected to work from the office, where communication can take place without potential IS hassles.

The quantitative employee surveys at TheCompany reveal that each of these six strategies had a *different effectiveness for mitigating different technostressors* (Table 7) illustrating the limitations to how effective the strategies are (RQ 5). For example, reducing email traffic is the most effective strategy

[6] Valta, M., Maier, C., Pflügner, K., & Weitzel, T. How business and IT managers can reduce technostress among team members. An earlier version of this paper was presented at the *54th Hawaii International Conference on System Sciences* (Valta et al., 2021).

for mitigating techno-invasion, but contact persons are most effective for techno-overload. The different strategies also had *different effectiveness depending on the business department*. Overall, the strategies were the most effective in the Marketing and Sales department and least effective in the IT department, while some strategies were more effective in the IT department than in other departments.

**Table 7. Results on the effectiveness of technostress mitigation strategies for specific technostressors**

| | Techno-overload | Techno-invasion | Techno-complexity | Techno-insecurity | Techno-uncertainty | Techno-unreliability | IT-based monitoring | Cyber-bullying | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Reducing email traffic** | 5.68 | 5.56 | 3.82 | 4.12 | 3.82 | 4.06 | 3.94 | 4.12 | 4.39 |
| **Homogenization** | 5.62 | 4.48 | 6.16 | 5.62 | 5.50 | 5.08 | 4.24 | 4.36 | 5.13 |
| **Training sessions** | 5.92 | 4.36 | 6.16 | 5.92 | 5.50 | 5.68 | 4.48 | 5.08 | 5.39 |
| **Contact persons** | 6.16 | 4.66 | 6.10 | 5.74 | 5.68 | 5.56 | 4.54 | 5.20 | 5.46 |
| **Assistance with problems** | 6.08 | 4.48 | 5.80 | 5.98 | 5.56 | 5.62 | 4.60 | 5.74 | 5.48 |
| **Office days** | 4.66 | 4.18 | 4.30 | 4.00 | 4.24 | 4.18 | 4.18 | 4.42 | 4.27 |

*Notes:* 1.00 – 2.50 **not effective at all**; 2.51 – 4.00 **not effective**; 4.01 – 5.50 **effective**; 5.51 – 7.00 **very effective**

Moreover, the investigation revealed indications that some strategies initially resulted in negative side effects (RQ 5). For instance, the company initially implemented an email system that transmitted all emails only once an hour and did not include the option to open a ticket to which employees can answer directly. The strategy reduced technostressors among individuals receiving the email (techno-overload), but impaired the job performance (technostrain) among individuals sending the email. TheCompany adjusted the strategy and implemented the email ticket system, and deduced that an evaluation of the strategies was needed to reveal potential negative consequences in mitigating technostressors.

The results have implications for business and IT leaders working in organizations designing strategies to mitigate technostressors and technostrain. As a starting point, business and IT leaders should identify which business departments are confronted with which technostressors, since technostressors can be differently prevalent in different business departments and technostressors require specific technostress mitigation strategies. An as-is analysis using employee interviews, observations, and survey can help reveal which technostressors employees perceive and therefore need to be reduced. After strategies that are most effective for the identified technostressors are selected and implemented, business and IT leaders should evaluate the effectiveness of each of the implemented strategies in mitigating technostressors and technostrain over time. This evaluation might lead to situations where business and IT leaders need to adjust the implemented strategies to counteract negative side effects.

## 4.7 PAPER VII: UNINTENDED CONSEQUENCES OF TECHNOSTRESS MITIGATION: AN EMPLOYEE PERSPECTIVE ON THE EFFECTIVENESS OF MITIGATION MEASURES[7]

Building on insights into the potential negative consequences of technostress mitigation strategies and the knowledge that mitigating different technostressors requires different strategies (Paper VI), we systematically investigate the potential unintended negative consequences of technostress mitigation strategies targeting certain technostressors. Among the different technostressors that employees are confronted (Fischer et al., 2021; Ragu-Nathan et al., 2008), techno-overload and techno-invasion often receive practical attention. The European Foundation for the Improvement of Living and Working Conditions highlights the prevalence of permanent connectivity (Eurofound, 2021), which relates to the technostressors techno-overload and techno-invasion. Paper VII focuses on technostress mitigation strategies specific for techno-overload and techno-invasion and investigates both their positive effects, but also their potential negative consequences.

We conducted semi-structured qualitative interviews of 30 workers, including 23 specialists, 5 managers, and 2 Chief Information Officers (CIOs), all of them working in the IT departments of two medium-sized organizations in the production industry headquartered in Germany. Both organizations indicated that technostress was an issue in their organization and they had implemented strategies to mitigate technostress during the year prior to our study. The sample consisted of 46.6 % women and 53.3 % men with an average age of 35.3 years (SD = 8.3). We analyzed the qualitative data following the coding scheme presented by Myers (2020), including descriptive and interpretive coding.

The analysis of the qualitative results reveal technostress mitigation strategies beyond organizational strategies that include technological and social strategies. We reveal four strategies that target techno-overload (Table 8) and four strategies that target techno-invasion (Table 9) (RQ 4). For *techno-overload*, good practices for internal communication such as the introduction of enterprise social networks to reduce email traffic are a technological technostress mitigation strategy. Moreover, the implementation of good internal wikis, FAQ pages or chatbots enable a "pull not push culture" that addresses techno-overload. In that way, employees can "pull" the information from digital sources when needed, without interrupting other colleagues by asking for the information and without "pushing" the wrong or too much information at an inappropriate point in time. An example of a social technostress mitigation strategy to mitigate techno-overload is to improve communications between managers and team members to help the employee prioritize or delegate IS-related tasks. Additionally, providing off-screen communication settings, for instance in team areas or outside meetings, are also strategies for mitigating techno-overload.

An example of a technological strategy for mitigating *techno-invasion* is the separation of private and business devices to prevent those business devices being used after work in the private context. The restriction of email traffic for mitigating techno-invasion implies that automatized and manual measures restrict the delivery of emails outside of dedicated working hours. Moreover, the introduction of an emergency channel mitigates techno-invasion. Responsible employees are only contacted via this emergency channel in urgent cases, which provides them with the opportunity to not check or respond to messages on other channels outside of working hours. A social strategy for mitigating techno-invasion and ensuring valuable breaks is a clear communication of expectations regarding the reachability via IS between managers and team members as well as among the team members themselves. A strategy applied to mitigate both technostressors involves

[7] Reis, L., Maier, C., Pflügner, K., & Weitzel, T (forthcoming). Unintended consequences of technostress mitigation: An employee perspective on the effectiveness of mitigation strategies. *The Data Base for Advances in Information Systems*. An earlier version of this paper was presented at the *20th ACM SIGMIS Conference on Computers and People Research* (Pflügner et al., 2020)

communications between colleagues and managers, highlighting that communication with the social environment is central to technostress mitigation.

In terms of the positive effects and potential negative consequences, our results reveal that each of these strategies has limitations and potential negative consequences (RQ 5) and that the perception of these effects differed depending on whether the interviewee was a manager or (non-managerial) specialist. These effects are described in more detail in Table 8 and Table 9.

**Table 8. Mitigation strategies for techno-overload**

| Strategy | Effects | Assessment by role | |
|---|---|---|---|
| | | Specialists | Managers |
| **Good practices for internal communication** | Positive | • Employees receive fewer requests<br>• Fewer interruptions<br>• Fosters informal communication and culture of information pull | • Employees receive less unneeded information<br>• Fewer interruptions<br>• Fosters informal communication and culture of information pull |
| | Negative | • Fosters multi-channeling<br>• Need for guidelines on when to use which tool | • Fosters multi-channeling<br>• Need for awareness that an instant message does not mean an instant response |
| **Introduction of "pull not push" culture** | Positive | • Employees receive less unneeded information<br>• Fewer interruptions by standard requests<br>• Strengthens organizational IS infrastructure | • Employees receive less unneeded information<br>• Fewer interruptions by standard requests<br>• Strengthens organizational IS infrastructure<br>• Strengthens work autonomy<br>• Better support through higher reliability<br>• Based on wikis, first-level support can help with elaborated tasks |
| | Negative | • Extra work and extra screen time<br>• No guaranteed usage | • High dependency on employees' willingness to contribute<br>• High dependency on IS infrastructure |
| **Communication with manager** | Positive | • Better prioritization of requests<br>• Reduction of workload | • Early mitigation possible |
| | Negative | • Highly dependent on specific manager and trust towards that person<br>• Fear of being perceived as less competent and less resilient than others | • Reduction is not always possible<br>• Higher workload for managers and too much involvement in employees' private affairs<br>• No substitute for professional help |
| **Introduction of "off-screen" communication opportunities** | Positive | • Reduction of IS use and screen time<br>• Working break<br>• Exercise and fresh air | • Working break<br>• Higher creativity<br>• Potential for social support |
| | Negative | • Extra coordination, preparation, and the post-processing effort<br>• Only particular meetings suitable for off-screen | • Dependency on team structure and relationships |

**Table 9. Mitigation strategies for techno-invasion**

| Strategy | Effects | Assessment by role | |
|---|---|---|---|
| | | Specialists | Managers |
| **Separation of private and business devices** | Positive | • Clear end of the workday<br>• Reduction of blurred boundaries<br>• No accidental involvement in business-related communication | • Clear end of the workday<br>• Reduction of blurred boundaries |
| | Negative | • Stressful to use multiple devices<br>• Loss of flexibility<br>• No free choice of the end device | • Loss of flexibility<br>• Deceleration of work processes<br>• Loss of decision autonomy |
| **Restriction of email traffic** | Positive | • Clear end of the workday<br>• Reduction of blurred boundaries | • Clear end of the workday<br>• Reduction of blurred boundaries |
| | Negative | • Postponing of overload<br>• Loss of flexibility | • Loss of flexibility<br>• Deceleration of work processes<br>• Loss of decision autonomy |
| **Valuable break/free time culture: introduction of an emergency channel** | Positive | • No feeling guilty for not staying up to date constantly at home<br>• Fosters disconnection from work<br>• Push of urgent messages, no need for constant pull | • Clear attribution of responsibilities<br>• Fosters disconnection from work<br>• Shared understanding of the value of free time |
| | Negative | • Still a need to constantly check the channel<br>• Channel not in an isolated tool<br>• Fear of misuse | • Abuse of free time burdens others with more work<br>• Need for establish core working hours |
| **Valuable break/free time culture: clear communication of expectations** | Positive | • No feeling guilty for not staying up to date constantly at home<br>• Fosters disconnection from work | • Fosters disconnection from work<br>• Shared understanding of the value of free time |
| | Negative | • Need to reach mutual agreement with all employees | • Abuse burdens others |

Among others, potential negative consequences to strategies to mitigate techno-invasion include increased techno-overload when email traffic restrictions postpone email delivery. Some of the positive and negative effects that managers report overlap with the effects that the specialists (team members) report, but some effects also differ between the two groups. For instance, both managers and specialists report the loss of flexibility as a potential negative consequence of email traffic restrictions, but only managers report the effects of the strategies on the broader team, such as how the abuse of the emergency channel affects other team members and leads to crossover effects among employees.

We contribute to existing technostress research by going beyond technological strategies and considering the socio-technical nature of IS (Chatterjee et al., 2021). We demonstrate the importance of taking a multidimensional approach to technostress mitigation, considering technological, cultural, and social aspects of technostress mitigation. Common among all strategies is the relevance of communication, such as an IS infrastructure or social norms that foster constructive communication. Moreover, our employee perspective reveals that technostress mitigation can come at a price, whereas the assessment of technostress mitigation strategies sometimes differs and sometimes overlaps among interviewees in different roles. Based on our interviews, we find support for crossover effects (Carlson et al., 2019) in technostress mitigation meaning that a strategy intended to mitigate technostressors can indeed have negative consequences for other employees. Above that, technostress mitigation strategies can replace the perception of one technostressor by the perception of another technostressor.

These insights help organizations better understand the implications and potential downsides of technostress mitigation for employees. The implementation of technostress mitigation strategies is not a short-term project with guaranteed success but requires long-term commitment by management moving beyond the introduction of new IS or regulations.

## 4.8 PAPER VIII: DIGITAL HEALTH-ORIENTED LEADERSHIP: MAINTAINING AND IMPROVING EMPLOYEE WELL-BEING[8]

Paper VIII builds on insights gained from Paper VII that managers (who we synonymously refer to as leaders) play a major role in many identified technostress mitigation strategies, such as communicating with managers for mitigating techno-overload. The general health literature informs us that managers can engage in a leadership style that focuses on health-specific issues among the employees (Franke et al., 2014). Basing on these insights, Paper VIII conceptualizes a leadership style specific for the technostress context, analyzing data collected in semi-structured interviews with leaders and team members.

We conducted 37 interviews, 31 of those with team members and 6 with leaders to conceptualize and investigate leadership styles that encourage healthy IS use behaviors. Among the interviewees, 43.2 % were women and 56.8 % were men with an average age of 34.7 years (SD = 10.1). The interviewees were working in diverse fields, such as engineering, human resources, marketing, and sales, most of them in large organizations but some also in medium-sized, small, and micro organizations. The data analysis combined deductive and inductive coding based on existing guidelines (Myers, 2020), applying descriptive and interpretive coding using MAXQDA 2020. The data analysis informed the definition and conceptualization of a leadership style supporting the digital health and thereby mitigating the technostressors and resulting technostrain of employees, which we coin *digital health-oriented leadership*. Digital health in the workplace refers to the healthy use of IS in order to maintain and improve the well-being of employees (Montagni et al., 2018; Smits et al., 2022). Building on existing literature (Franke et al., 2014) and our interviews, we define *digital health-oriented leadership* as a digital health-specific leadership style that models and supports the healthy use of IS in order to maintain and improve employee well-being.

Based on our interviews, digital health-oriented leadership has three dimensions. *Awareness* implies that leaders are aware of potential threats of improper IS use to digital health, *value* means that leaders acknowledge the importance of digital health and healthy IS use behavior, and *behavior* implies that leaders engage in behaviors that promote digital health (Table 10).

**Table 10. Definitions of digital health-oriented leadership and its three dimensions**

| Construct / dimension | Definition (derived from Franke et al., 2014) |
|---|---|
| **Digital health-oriented leadership** | A digital health-specific leadership style that models and supports the healthy use of IS in order to maintain and improve employee well-being |
| **Awareness** of digital health | Leaders' attention, sensitivity, and reflection related to digital health |
| **Value** of digital health | Leaders' interest in digital health and the extent to which they acknowledge its importance to the well-being of employees |
| **Behavior** directed at digital health | Leaders' personal behaviors and actions to support digital health |

Each of these three dimensions can be directed toward team members and leaders themselves, and the dimension behavior can additionally be directed toward IS. The dimension *awareness* refers to leaders' awareness of their own digital health, but also of the digital health among team members and possible use-related threats to digital health, such as technostressors and technostrain. The dimension *value* refers to leaders acknowledging the importance of their own digital health as well

[8] Pflügner, K., Maier, C., & Waßmiller, J. Digital health-oriented leadership: Maintaining and improving employee well-being.

as that of team members. *Behaviors* supporting digital health includes behaviors and actions directed toward team members, the IS, and the leaders themselves (Figure 11).

| Digital health-oriented leadership | | | | | | |
|---|---|---|---|---|---|---|
| **Awareness** | | **Value** | | **Behavior** | | |
| Team members | Self | Team members | Self | Team members | IS | Self |

**Figure 11. Conceptualization of digital-health oriented leadership with its three dimensions**

These three dimensions can be interrelated. For instance, when leaders are aware of technostressors and technostrain as digital health threats and attach importance to maintaining their own digital health and that of their team members by mitigating technostressors, they are more likely to engage in behaviors that support digital health healthy IS use. Thus, *digital health-oriented leadership* goes beyond specific behaviors, including underlying cognition and motivation that need not be visible, but that constitute the basis for maintaining digital health and mitigating technostressors and resulting technostrain.

Our research contributes to technostress research by providing a context-specific concept and highlighting the relevance of leaders for technostress mitigation and digital health promotion among team members. Our empirical results suggest that leaders can directly influence team members' technostressors and resulting technostrain levels, such as by providing them with IS support. Above that, leaders' awareness, value, and behavior can indirectly improve team members' digital health and therefore technostressors and technostrain through crossover effects. In other words, leaders' awareness, values, and behaviors can cross over to team members and improve the team members' own awareness for digital health threats, the importance they attach to their digital health and their digital health behavior choices. This conceptualization permits leaders assess their leadership style in terms of promoting digital health and draw on the identified leadership dimensions to help mitigate their own and their team members' technostressors and technostrain.

# 5 CONTRIBUTIONS AND IMPLICATIONS

The results of the eight papers of this cumulative dissertation contribute to both technostress theory and practice in the work context.

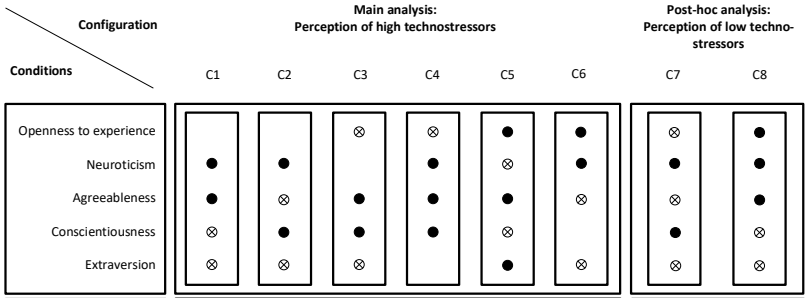
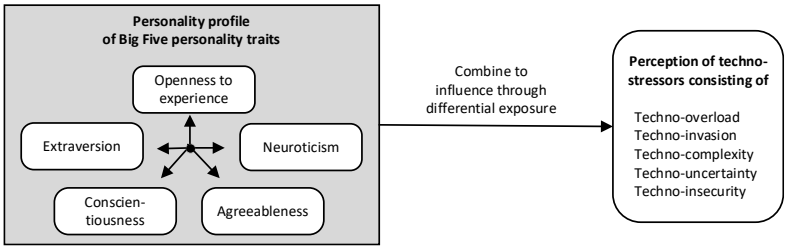
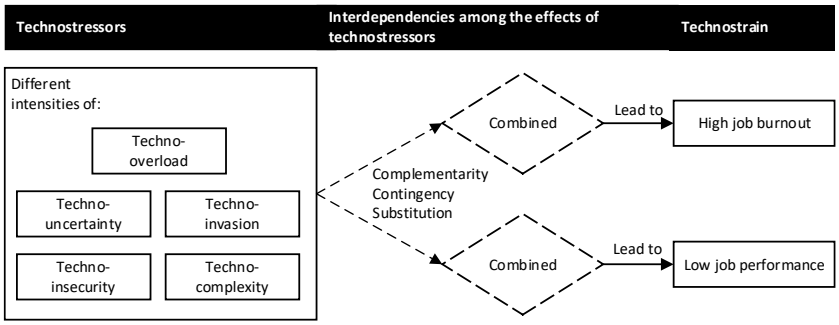
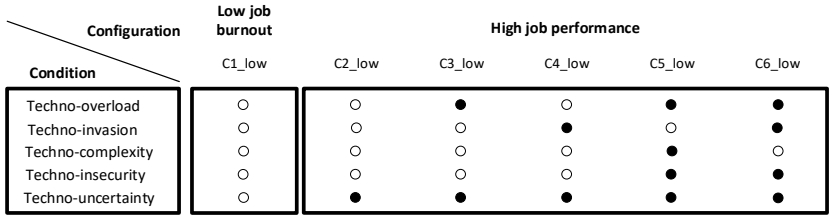
## 5.1 CONTRIBUTIONS TO THEORY

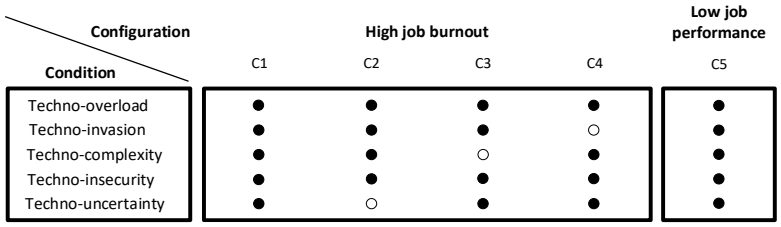
This research constituting this cumulative dissertation focuses on technostress formation (research objective 1) and technostress mitigation (research objective 2). The following summarizes the contributions of the eight papers along these two research objectives.

### 5.1.1 Technostress formation

Research objective 1 of this dissertation is to *understand how technostressors and technostrain are formed*, corresponding to RQ 1 (How do personality traits predispose users to perceiving technostressors?) and RQ 2 (How do combinations of technostressors lead to technostrain?). The Papers I and II address these two RQs and contribute to literature on the formation of technostress in four ways (Table 11).

**Table 11. Summary of the results and contributions regarding the formation of technostress**

| RQ | Results | Contributions |
|---|---|---|
| RQ 1 | Multiple profiles consisting of high and low Big Five personality traits predispose users to perceiving technostressors. (Paper I)<br>  | In addition to IS characteristics, user characteristics influence the perception of technostressors. (Paper I) |
| RQ 1<br>RQ 2 | Combinations of personality traits comprising personality profiles predispose users to perceiving technostressors. (Paper I)<br>  <br>Technostressors interdependently lead to technostrain. Technostressors can be complementary, contingent upon each other or substitute each other in leading to technostrain. (Paper II)<br>  | Systems perspective enhances our understanding of technostress formation. (Papers I and II) |
| RQ 2 | Configurations consisting of high technostressors lead to low technostrain.<br>  | High technostressors are not necessarily bad. (Paper II) |

| RQ | Results | Contributions |
|---|---|---|
| | High job burnout and low job performance result from different configurations of high and low technostressors. (Paper II)<br>  <br> | The relationship between technostressors and technostrain is complex and differs among the forms of technostrain. (Paper II) |

#### *5.1.1.1 User characteristics influence the perception of technostressors*

Existing research has highlighted that IS characteristics such as the pace of change of IS can lead users to perceive technostressors (Ayyagari et al., 2011). The results of Paper I extend these insights by adding that characteristics of the users influence the perception of technostressors. We contribute that technostress should be studied from a sociotechnical perspective (Chatterjee et al., 2021), indicating that it is not the IS per se that leads to technostressors and thereby technostrain, but both, the IS and the users themselves. Technostress is not determined by the IS. Rather, the same IS can result in high technostressor perception in one user but low technostressor perception in another user depending on how their personality profiles predispose them to perceiving technostressors.

#### *5.1.1.2 A systems perspective enhances our understanding of technostress formation*

In Paper I, we consider combinations of the Big Five personality traits as components of personality profiles, acknowledging interdependencies among personality traits. In Paper II, we understand how various configurations of technostressors lead to technostrain. Thus, we investigate technostress formation from a systems perspective that accounts for interdependencies among the influencing factors. Theoreticians distinguish among variance, process, and systems theoretical perspectives (Burton-Jones et al., 2015) resulting in different types of causality (Mithas et al., 2022). While the variance perspective focuses on covariation of influencing and outcome factors and the process perspective focuses on sequences of events, the systems perspective focuses on the whole system and interdependencies among the influencing factors (Burton-Jones et al., 2015). The papers constituting this dissertation contribute by providing a systems perspective as an alternative perspective to variance and process perspectives and theorizing and identifying three types of interdependencies, namely complementarity, contingency, and substitution (Paper II). The Papers I and II provide a methodological approach, i.e., fsQCA as a configurational approach, to follow a systems perspective and two-step QCA (Paper II) as a means to combine different theoretical perspectives such as a systems and a process perspective.

#### *5.1.1.3 High technostressors are not necessarily bad*

There are recent indications that challenge technostressors can have positive effects on employee well-being and work performance (Benlian, 2020; Maier et al., 2021; Tarafdar et al., 2019). We extent these insights by contributing that so-called hindrance technostressors generally associated with negative consequences (Tarafdar et al., 2019), do not necessarily lead to negative consequences. This dissertation and Paper II focus on hindrance technostressors, revealing that, in certain combinations, high technostressors can be related to positive consequences, including high job performance. Thus, rather than considering technostressors as bad or good per se, we draw attention to interdependencies among the technostressors by showing how hindrance technostressors can – in combinations – be either good or bad. These interdependencies, i.e.,

complementarity, contingency, and substitution may lead to different appraisals of the technostressor configurations, shaping whether they lead to high or low technostrain. We extent the investigations of technostressors either as a conglomerate (Tarafdar, Pullins, & Ragu-Nathan, 2015) or separate technostressors in isolation (Galluch et al., 2015) by highlighting that technostressors can have divergent influence on technostrain. A configurational approach, which we apply in Paper II, enables studying combinations of multiple technostressors while revealing the level of separate technostressors in leading to technostrain.

#### *5.1.1.4 The relationship between technostressors and technostrain is complex and differs among the forms of technostrain*

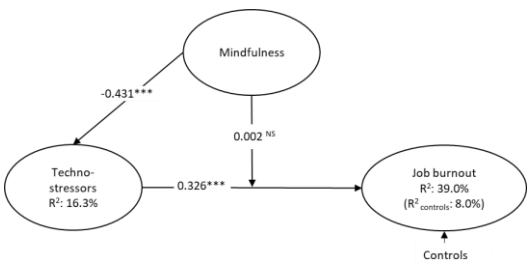
Extant technostress research shows that technostressors can lead to technostrain, which are negative psychological, behavioral, and physiological consequences. We contribute that these different forms of technostrain are not elicited in the same way (Paper II). Psychological consequences such as job burnout can be elicited by different configurations of technostressors and fewer high-intensity technostressors compared to behavioral consequences such as low job performance. Thus, insights into one form of technostrain cannot be directly generalized to other forms of technostrain.

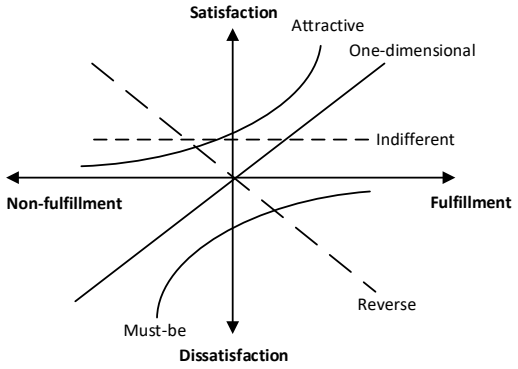
The fact that different forms of technostrain are elicited by different configurations of technostressors (Paper II) also indicates that the underlying mechanisms why technostressors lead to technostrain might vary across different forms of technostrain. For instance, while job burnout may results from technostressors depleting resources and employees' energy, low job performance may result from technostressors impairing employees' motivation and work engagement (Bakker & Demerouti, 2007).

### 5.1.2 Technostress mitigation

Research objective 2 of this dissertation is to *understand how technostressors and thereby technostrain are mitigated*, corresponding to RQ 3 (How can users actively mitigate technostressors and thereby technostrain?), RQ 4 (What mitigation strategies in the work environment effectively mitigate technostressors and thereby technostrain), and RQ 5 (What are the limitations and potential negative consequences of various technostress mitigation strategies directed at specific technostressors?). After identifying five future research avenues (RAs) (Paper III), the remaining papers (Papers IV to VIII) in Chapter II address these three RQs, respond to the five RAs, and contribute to literature on the mitigation of technostress in five ways (Table 12).

**Table 12. Summary of the results and contributions regarding the mitigation of technostress mapped to the future research avenues identified in Paper III**

| RQs | RAs (Paper III) | Results | Contributions |
|---|---|---|---|
| RQ 3 | RA 1: Interventions for technostress mitigation | Mindfulness is a personality trait that can actively be trained and is related to perceiving lower technostressors. (Paper IV)   | Users can take an active role in technostress mitigation by training mindfulness in the form of interventions. (Paper IV) |

<table>
<tr><th>RQs</th><th>RAs (Paper III)</th><th>Results</th><th>Contributions</th></tr>
<tr><td></td><td></td><td>Satisfaction with an intervention for stress and technostress mitigation is relevant for its adoption. The features of an intervention vary in terms of their relevance for user satisfaction (Paper V).<br> 
</td><td>Users will only take an active role if they are satisfied with the intervention. (Paper V)</td></tr>
<tr><td>RQ 4</td><td>RA 2: Technostress mitigation strategies grounded in the technological environment</td><td>Papers VI and VII reveal strategies for adjusting IS so that it induces less technostressors.<ul><li>Adjust the email program to reduce the email traffic (Papers VI and VII)</li><li>Homogenize the IS (Paper VI)</li><li>Ensure separation between private and business devices (Paper VII)</li></ul>Papers V, VI, and VII show that technostress mitigation strategies can be transmitted via IS.<ul><li>Introduce IS interventions for technostress mitigation (Paper V)</li><li>Provide assistance with IS problems through chatbots (Papers VI and VII).</li></ul></td><td>IS can be both, the subject (Papers VI and VII) and the object (Papers V, VI, and VII) of technostress mitigation.</td></tr>
<tr><td>RQ 4</td><td>RA 3: Technostress mitigation strategies grounded in the social environment</td><td>Papers VI, VII, VIII reveal the central role of managers and colleagues in mitigating technostress.<ul><li>Introduce contact persons (Paper VI)</li><li>Provide assistance with IS problems by colleagues (Paper VI)</li><li>Introduce office days (Paper VI)</li><li>Communicate expectations (Paper VII)</li><li>Fostering communication with managers (Paper VII)</li><li>Introduce “off-screen” communication opportunities (Paper VII)</li></ul>Managers can engage in digital health-oriented leadership to mitigate own and team members’ technostress. (Paper VIII)<table><tr><th colspan="7">Digital health-oriented leadership</th></tr><tr><th colspan="2">Awareness</th><th colspan="2">Value</th><th colspan="3">Behavior</th></tr><tr><td>Team mem-bers</td><td>Self</td><td>Team mem-bers</td><td>Self</td><td>Team mem-bers</td><td>IS</td><td>Self</td></tr></table></td><td>Communication with managers and colleagues is central to technostress mitigation. (Papers VI and VII)<br><br>Conceptualization of digital health-oriented leadership as a leadership style that can mitigate team members’ and managers’ technostress. (Paper VIII)</td></tr>
</table>

<table>
<tr><th>RQs</th><th>RAs (Paper III)</th><th>Results</th><th>Contributions</th></tr>
<tr><td>RQ 5</td><td>RA 4: Technostress mitigation strategies specific for certain techno-stressors<br><br>RA 5: Combination of technostress mitigation strategies</td><td>Technostress mitigation strategies are differently effective for different technostressors. (Paper VI)<br><br>
<table>
<tr><th></th><th>Techno-overload</th><th>Techno-invasion</th><th>Techno-complexity</th><th>Techno-insecurity</th><th>Techno-uncertainty</th><th>Techno-unreliability</th><th>IT-based monitoring</th><th>Cyber-bullying</th><th>Average</th></tr>
<tr><td>Reducing email traffic</td><td>5.68</td><td>5.56</td><td>3.82</td><td>4.12</td><td>3.82</td><td>4.06</td><td>3.94</td><td>4.12</td><td>4.39</td></tr>
<tr><td>Homogenization</td><td>5.62</td><td>4.48</td><td>6.16</td><td>5.62</td><td>5.50</td><td>5.08</td><td>4.24</td><td>4.36</td><td>5.13</td></tr>
<tr><td>Training sessions</td><td>5.92</td><td>4.36</td><td>6.16</td><td>5.92</td><td>5.50</td><td>5.68</td><td>4.48</td><td>5.08</td><td>5.39</td></tr>
<tr><td>Contact persons</td><td>6.16</td><td>4.66</td><td>6.10</td><td>5.74</td><td>5.68</td><td>5.56</td><td>4.54</td><td>5.20</td><td>5.46</td></tr>
<tr><td>Assistance with problems</td><td>6.08</td><td>4.48</td><td>5.80</td><td>5.98</td><td>5.56</td><td>5.62</td><td>4.60</td><td>5.74</td><td>5.48</td></tr>
<tr><td>Office days</td><td>4.66</td><td>4.18</td><td>4.30</td><td>4.00</td><td>4.24</td><td>4.18</td><td>4.18</td><td>4.42</td><td>4.27</td></tr>
</table>
Notes: 1.00 – 2.50 not effective at all; 2.51 – 4.00 not effective; 4.01 – 5.50 effective; 5.51 – 7.00 very effective<br><br>For different users groups, different mitigation strategies are most effective. (Papers I and VI)<br><br>Each identified/applied strategy has potential negative consequences such as increasing other technostressors or affecting other people. These consequences depend upon the level of the users, i.e., managers or non-managerial employees. (Paper VII)</td><td>Technostress mitigation strategies have limitations. Multiple strategies can be combined (Papers I and VII) to account for potential negative consequences on other technostressors and individuals.</td></tr>
</table>

#### *5.1.2.1 Users can take an active role in mitigating technostress by training mindfulness, but only if they are satisfied with the intervention*

Existing literature has revealed that organizational strategies such as IS support provision and involvement facilitation can mitigate technostressors and thereby mitigate technostrain (Tarafdar, Pullins, & Ragu-Nathan, 2015). This dissertation extends these strategies grounded in the organizational environment by providing strategies of the users themselves (Paper IV). Paper IV reveals that mindfulness is related to lower technostressors among users. Given that mindfulness is a malleable personality trait that can be trained (Lomas et al., 2017), user can engage in mindfulness interventions to reduce the technostressors they perceive, corresponding to the research avenue of interventions for technostress mitigation (RA 1). However, users only engage in this active role in technostress mitigation if they are satisfied with the intervention (Paper V). Thus, the design of the intervention, such as the features of an online stress management intervention, is central to user satisfaction and thereby to the adoption and use of such interventions (Paper V).

#### *5.1.2.2 IS can be both the subject and the object of technostress mitigation*

Paper III identifies by a systematic literature review that there is a paucity of research into how the technological environment can be altered to mitigate technostressors and technostrain (RA 2). Papers V, VI, and VII respond to this opportunity of technostress mitigation in the technological environment, extending the literature on how IS leads to an increase in technostressors (Ayyagari et al., 2011). The Papers VI and VII identify multiple strategies how IS can be designed or adjusted to mitigate technostressors, such as by implementing an email ticket system (Paper VI), homogenizing IS (Paper VI), or separating private and business devices (VII). For example, when an IS, such as the email program overloading employees, is adjusted, such as by only transmitting emails immediately if a ticket is open (Paper VI), employees perceive less technostressors. In this case, the IS is the central subject evoking perceived technostressors, and also the target of technostress mitigation strategies, adjusted so that employees perceive less technostressors.

According, IS *is the subject of technostress mitigation*, extending existing research that has examined organizational strategies to mitigate technostressors (Tarafdar, Pullins, & Ragu-Nathan, 2015) by providing technostress mitigation strategies grounded in the IS.

Papers V, VI, and VII also reveal that technostress mitigation goes beyond adjusting existing IS to mitigate perceived technostressors and thereby technostrain, showing how technostress mitigation grounded in the technological environment also positions *IS as the object of technostress mitigation*. In other words, to mitigate technostressors caused by one IS, the organization can implement another IS. For instance, an online stress management intervention is not evoking technostressors, but can be implemented as part of a technostress mitigation strategy, which is transmitted to and learned by employees (Paper V). Similarly, organizations can implement a new IS, such as a chatbot, to provide employees IS support assistance whenever they need it (Papers VI and VII). Thus, IS can be the both the subject and object of technostress mitigation, and technostress mitigation strategies grounded in the technological environment can even imply implementing more or new IS.

#### *5.1.2.3 Communication with managers and colleagues is central to technostress mitigation*

Our systematic literature review presented in Paper III reveals gaps in research into what strategies grounded in the social environment can mitigate technostressors and thereby mitigate technostrain (RA 3). We know that the social environment can increase the technostressors' effect on technostrain (Brown et al., 2014; Harris et al., 2015) and there are first indications that informal strategies involving changes in the social environment can be even more powerful than organizational strategies in technostress mitigation (Sykes, 2015). Thus, strategies grounded in the social environment deserve further research attention, especially the role and relevance of communication in technostress mitigation.

IS is often used as a communication tool at the workplace social environment, e.g., communication between managers and team members, among colleagues, or between employees and customers. Some of the strategies identified in this dissertation aim to change the *volume of communication*, such as reducing unnecessary email traffic (Papers VI and VII) or improving or increasing communications between managers and team members (Paper VII). Other technostress mitigation strategies aim to change the *timing of communication*, such as supporting a "pull not push culture" so that users use IS to pull information when they need it, rather than having information pushed at them whether they need it or not (Paper VII), or separating business and private devices to restrict business-related communications to working hours (Paper VII). Finally, technostress mitigation strategies can also aim to change the *modus or IS used to communicate*, such as providing more opportunities for off-screen communication (Paper VII), establishing office days (Paper VI), and communicating critical messages outside working hours via an IS emergency channel (Paper VII). Thus, technostress mitigation should not focus solely on users perceiving technostressors in isolation, but rather also on their IS-supported communication in the workplace social environment.

#### *5.1.2.4 Leadership styles promoting digital health can mitigate managers' and team members' technostressors and technostrain*

Building on extant literature (Harris et al., 2015), Papers VI and VII show how leaders play a pivotal role in technostress mitigation. Building on these insights and general workplace stress literature (Franke et al., 2014), we conceptualize *digital health-oriented leadership* (Paper VIII) as a leadership style that explicitly models and supports healthy IS use in order to maintain and improve employee well-being as part of a technostress mitigation strategy grounded in the social environment (RA 3). Our research contributes that technostress mitigation should move beyond

individual behaviors, e.g., coping strategies (Pirkkalainen et al., 2019), to consider the important role of awareness of threats to digital health such as technostressors and the importance managers attach to digital health. We illustrate the interplay between the dimensions of awareness, value, and behavior in technostress mitigation. For instance, value – meaning that managers place importance on the own and their team members' digital health – is a necessary step toward managerial behaviors to mitigate technostress (Paper VIII). We extend existing research by identifying crossover effects between managers and team members, such as when a manager's underlying awareness, value, and behavior leads to team members engaging in technostress mitigation themselves. Specifically, when a team member perceives by the manager's expressions that a manager values his or her own digital health and that of the team, the team member is more likely to engage in healthy IS use behaviors to promote the own digital health and mitigate technostress (Paper VIII). Our conceptualization of *digital health-oriented leadership* paves the way for further research into the opportunities and limitations of managers' engagement in technostress mitigation.

#### *5.1.2.5 Technostress mitigation strategies have limitations and can be combined to account for potential negative consequences on other technostressors and individuals*

We provide a technostressor-specific perspective, thereby extending existing research studying technostress mitigation strategies for technostressors in general (Tarafdar, Pullins, & Ragu-Nathan, 2015). Our research on the effectiveness of technostress mitigation strategies specific to different technostressors, addressing RA 4, reveals that the strategies have limitations in that they are differently effectiveness in mitigating different technostressors (Paper VI) and in that specific technostressors require different technostress mitigation strategies (Paper VII). These insights imply that technostress mitigation should start by precisely identifying perceived technostressors and then selecting the most effective technostress mitigation strategy or combination of strategies.

Moreover, we contribute that technostress mitigation strategies may not only be differently effective depending on the technostressors (Paper VI), but may also have negative consequence, such as increasing one technostressor (such as techno-overload) while decreasing another (such as techno-invasion) (Paper VII). Next to potential negative consequences on other technostressors, technostress mitigation strategies can also have unintended negative consequences on other employees such as increasing the burden on a certain group of employees while benefiting others (Paper VII). Managers must therefore consider the potential negative consequences of technostress mitigation strategies. One possible remedy for negative consequences is to combine multiple technostress management strategies, such that one strategy overcomes the negative consequences of another strategy. While combining technostress mitigation strategies has received sparse attention in previous technostress research (RA 5), we show that users with different personality profiles require different technostress mitigation strategies (Paper I). Combining technostress mitigation strategies may also account for the preferences of employees with different personality profiles (Paper I). These insights into the potential negative consequences of technostress mitigation strategies and the role of individual differences reflected by personality profiles show that a more differentiated view on technostress mitigation strategies is necessary.

## 5.2 IMPLICATIONS FOR PRACTICE

The insights into workplace technostress formation and mitigation presented in the eight papers constituting this cumulative dissertation have practical implications for employees, managers, and health professionals.

### 5.2.1 Do not think things are fine just because employees are performing well

Paper II reveals that job burnout can result from fewer technostressors than low job performance. Technostressors can lead employees to experience technostrain in the form of job burnout well before they exhibit low job performance. In fact, even top performers can experience technostrain in the form of job burnout due to technostressors and high job performance may not be an indicator that technostressors and technostrain are not an issue among the employees (Paper II). We show that individual differences among employees, such as their personality profiles, can influence predisposition to technostressor perception and therefore technostrain levels (Paper I). Managers and health professionals should be aware of the role of such individual differences and recognize that a scattergun approach to technostress mitigation is likely to be ineffective. Rather, technostress mitigation should target employees currently perceiving technostressors or whose personality profiles predispose them to perceiving them.

### 5.2.2 Technostress mitigation needs to be considered as a process that starts with identifying the problem and carefully assessing groups at risk of perceiving technostressors

Based on the findings of the research presented in the papers constituting this dissertation, we advocate for viewing technostress mitigation as a six-step process (Paper VI) (Figure 12). *First*, managers and health professionals need to accurately identify that the problem, such as high job burnout rates, is due to technostressors, potentially even if it comes with high job performance (Paper II). *Second*, employees perceiving technostressors need to be identified, bearing in mind that individuals with certain personality profiles (Paper I) are more at risk of perceiving technostressors and experiencing technostrain than individuals with other personality profiles, and that individuals in different roles and departments can also be affected differently (Paper VI). This step assures that technostress mitigation is target-oriented and focuses on the risk group. *Third*, the specific technostressors being perceived by employees need to be identified accurately. *Fourth,* the most appropriate technostress mitigation strategy or combination of strategies to address the identified technostressors needs to be selected and implemented (Papers VI and VII). *Fifth*, the efficacy and effectiveness of implemented technostress mitigation strategies need to be evaluated and unintended negative consequences identified (Paper VII). *Sixth*, as needed, the technostress mitigation strategies need to be adjusted or combined with further technostress mitigation strategies to overcome negative consequences. This six-step process should be iterative to ensure that workplace technostressors and technostrain have been mitigated.

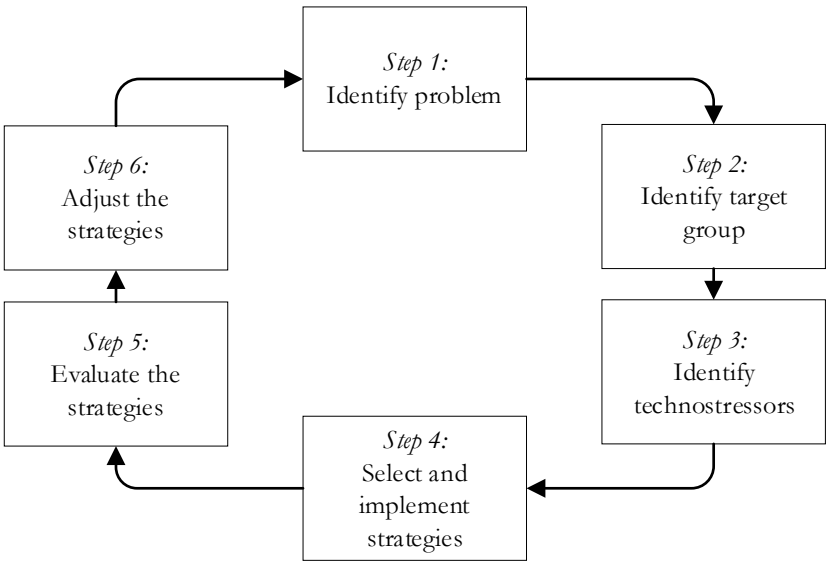



**Figure 12. The process of technostress mitigation**

### 5.2.3 Managers, health professionals, and employees can draw from a variety of technostress mitigation strategies grounded in users or the environment

The papers constituting this dissertation provide an overview of existing technostress mitigation strategies (Paper III) and identify different starting points for technostress mitigation grounded in users or the organizational, technological, and social environment. Managers, health professionals, and users themselves can draw on individual strategies and combine different strategies grounded in both starting points, recognizing that the interplay between IS users and their work environment is relevant for technostress mitigation (Edwards et al., 1998; Stich et al., 2019).

Our findings also extend existing research into technostress mitigation by revealing further technostress mitigation strategies. For example, we show how users can take an active role in technostress mitigation by training mindfulness (Paper IV and V) and how managers and health professionals should consider the central role of the social environment in technostress mitigation, especially communications among stakeholders including colleagues, customers, and managers (Papers VI and VII). We also show how managers' awareness, values, and behaviors can influence technostress perception among team members (Paper VIII).

### 5.2.4 The managerial role is pivotal and involves caring about team members' well-being, as well as caring for one's own well-being

To mitigate their own and the team members' technostress, managers can adopt a leadership style that models and supports healthy IS use, which we call *digital health-oriented leadership* (Paper VIII). Managers must not only model and support leadership behaviors that mitigate their team members' technostress, but also be aware of indicators of technostress among their team members and give importance to their team members' digital health. Demonstrating such awareness, value, and behavior positively influences team members' technostress and keeps them healthy and productive. Managers should be aware and make use of the role model that they are for their team members. However, managers also perceive technostressors and experience technostrain themselves (Pflügner, Baumann, & Maier, 2021), and perceive certain technostressors that non-managerial employees do not (Paper VII). Thus, digital health-oriented leadership has two sides, caring about their team members, as well as caring for oneself. Managers should put themselves first and must be aware of indicators of technostress in themselves, recognize the importance of and take actions for their own healthy IS use.

## 5.3 LIMITATIONS

The research presented in each paper constituting this dissertation is limited in several specific and individual ways, which is discussed at the conclusion of each paper. Overall, however, this dissertation also has certain limitations. We begin by identifying mitigation strategies and evaluating their effectiveness mitigating certain technostressors. As we point out, users with different personality profiles ask for different technostress mitigation strategies (Paper I), indicating a need for individualized technostress mitigation. This indicates that the effectiveness of technostress mitigation strategies varies depending on the user's individual personality profiles, abilities, or needs (Edwards et al., 1998). Certain technostress mitigation strategies might mitigate technostressors and technostrain more effectively among some users compared to others, depending on these individual differences.

Some of the papers in this dissertation (Papers VI and VII) focus on IS professionals and IS managers, while other papers consider a variety of professions in various departments. However, it has been shown that IS professionals differ from non-IS professionals in terms of their user and work characteristics, which can influence the formation and mitigation of technostress (Maier, Laumer, & Eckhardt, 2015). Our results also indicate that the effectiveness of technostress mitigation strategies is different in the IT department compared to other departments of the organization (Paper VI). Therefore, consistently distinguishing between IS professionals and non-IS professionals might reveal more nuanced differences in the formation of technostress and the effectiveness of technostress mitigation strategies. For example, non-IS professionals might experience further negative consequences in addition to those identified in Paper VII, and differences between the leaderships tasks of IS managers and those of non-IS managers may shape our understanding of *digital health-oriented leadership* (Paper VIII).

The research presented in the papers constituting this dissertation focus on hindrance technostressors, consistent with existing research (Maier et al., 2019; Pirkkalainen et al., 2019). In addition to hindrance technostressors, recent literature theorizes challenge technostressors associated with positive consequences (Califf et al., 2020; Maier et al., 2021). Given the conceptual difference, the identification of personality profiles that predispose users to perceiving challenge technostressors and the effectiveness of the strategies identified by the papers of this dissertation in strengthening the positive effects of challenge technostressors requires separate investigation.

The majority of papers in this dissertation analyze cross-sectional data sampled in one or two waves. Cross-sectional studies are efficient and appropriate in revealing associations among factors such as those in focus in the papers of this dissertation (Maier et al., 2023). However, cross-sectional data falls short on testing hypotheses with temporal relationships. Thus, the insights into temporal effects based on the empirical data is limited (Maier et al., 2023) and the conclusions about temporal order are based on theoretical arguments and existing longitudinal empirical research.

Finally, the papers of this dissertation analyze self-reported data. Self-reported data is subjective and depends on participants' own knowledge and insights. Objective measures of technostrain such as changes in stress hormones or skin conductance (Galluch et al., 2015; Weinert et al., 2020) may reveal further configurations of technostressors leading to technostrain and provide further insights into potential positive effects and negative consequences of technostress mitigation strategies.

## 5.4 FUTURE RESEARCH

The dissertation at hand paves the way for future research on technostress formation and mitigation. Moreover, future research in related IS contexts can build upon the system perspective involving interdependencies among the constructs of interest introduced in the papers of this dissertation.

### 5.4.1 Mechanisms of why technostressors lead to different forms of technostrain

Existing technostress research shows that technostressors lead to technostrain such as job burnout and low job performance (Maier et al., 2019). Paper II extends these insights by revealing that technostressors interdependently lead to technostrain and that different configurations of technostressors lead to job burnout compared to low job performance. These insights indicate that how technostressors lead to technostrain is different for different forms of technostrain. This might be due to different mechanisms relevant to different forms of technostrain (Bakker & Demerouti, 2007). For instance, while technostressors might lead to job burnout through depleting resources and energy, technostressors might lead to low job performance through decreasing the employees' motivation at work. Grounded in theoretical considerations from related literature (Bakker & Demerouti, 2007; Chen & Karahanna, 2018), future research might investigate the research question *what mechanisms influence how certain (configurations of) technostressors lead to certain forms of technostrain*. A potential research model could include the mechanisms as mediators between (configurations of) technostressors and various forms of technostrain and be tested on quantitative data collected via an online questionnaire. Understanding these mechanisms would improve practitioners' ability to predict when and why employees experience which form of technostrain, as well as practitioners' ability to identify and implement technostress mitigation strategies that consider these mechanisms.

### 5.4.2 Individualization in technostress mitigation

According to our findings, the formation of technostress is individual. In addition to IS characteristics (Ayyagari et al., 2011), user characteristics also influence whether employees perceive technostressors (Paper I). Our findings also indicate that individual user characteristics, such as personality profiles, influence the effectiveness of technostress mitigation strategies. Specifically, we show how users with different personality profiles that predispose them to perceiving technostressors identify different technostress mitigation strategies as helpful (Paper I). For instance, employees with a personality profile including low conscientiousness, i.e., they have difficulties controlling their impulses, consider a reduction of distractions as helpful for mitigating technostressors. Employees who are open to new experiences consider IS trainings to improve their IS skills as helpful for mitigating technostressors (Paper I). Future research delving deeper into the research question *how do individual differences influence the effectiveness of technostress mitigation strategies* would enhance our understanding of the extent to which and how technostress mitigation needs to be individualized. A quantitative online questionnaire could be used to assess employees' personality profiles and how effective they perceive different technostress mitigation strategies. By analyzing this quantitative data, differences in the effectiveness of various strategies and combinations of strategies among users with various personality profiles, such as those identified in Paper I, could be revealed. Technostress mitigation strategies such as social support could also be simulated in a laboratory experiment (Weinert et al., 2020), enabling objective data such as skin conductance to be collected as a measure of technostrain (Weinert et al., 2020), potentially measuring technostrain levels over time as an indicator of the effectiveness of the mitigation strategy.

### 5.4.3 Combination of technostress mitigation strategies

Technostress mitigation research focuses on a variety of technostress mitigation strategies grounded in the user as well as the technological, organizational, and social environment (Paper III). Given that most of the technostress mitigation strategies have potential negative consequences (Paper VII) and employees with different personality profiles ask for different technostress mitigation strategies (Paper I), combinations of technostress mitigation strategies are likely more effective than single strategies. Future research on technostress mitigation could reveal the relative efficacy of various combinations of technostress mitigation strategies in overcoming negative consequences of single component technostress mitigation strategies and in accounting for users with different personality profiles. Moreover, an investigation of combinations of technostress mitigation strategies could reveal interdependencies among technostress mitigation strategies, e.g., which technostress mitigation strategies become obsolete in the presence of other strategies. To address the research question *what combinations of technostress mitigation strategies most effectively reduce technostress and the negative consequences their component strategies,* a longitudinal field study in an organization facing an IS implementation (Eisenhardt & Graebner, 2007; Sykes, 2015) could be conducted. After the implementation of specific technostress mitigation strategies in the course of the IS implementation, an evaluation of the strategies (Figure 12) may reveal unintended negative consequences, such as an increase in other technostressors. Additional technostress mitigation strategies could be implemented and evaluated whether and to which extent this combination of strategies has incremental effects.

### 5.4.4 Limitations and boundaries of technostress mitigation grounded in managers

Papers VI, VII, and VIII of this dissertation highlight the role of managers in technostress mitigation. Among others, managers can engage in *digital health-oriented leadership* to model and support healthy IS use and mitigate their team members' and also their own technostress (Paper VIII). Given that managers also perceive technostressors and suffer under technostrain (Pflügner, Baumann, & Maier, 2021) and the influential role of managers in technostress mitigation comes with responsibilities, future research could investigate the limitations of *digital health-oriented leadership*. For instance, abilities or traits of mangers (Compeau et al., 2022; Köppe & Schütz, 2019), situational circumstances (Sykes, 2020) or team member traits or expectations (Kaluza et al., 2021) might facilitate or hinder that managers engage in digital health-oriented leadership. A research question such as *what facilitates and hinders managers in digital health-oriented leadership* could be addressed by a mixed-methods study (Venkatesh et al., 2016) to reveal context-specific facilitating and hindering factors. Data collected in qualitative interviews with managers about their ability to model and support healthy IS use could be used to develop a quantitative online questionnaire. Such insights would support managers' efforts to model and support healthy IS use behaviors such as inherent in digital health-oriented leadership and help understand the limitations and barriers they face in that endeavor.

### 5.4.5 Multilevel effects of technostress formation and mitigation

This dissertation focuses on the formation and mitigation of technostress in the workplace. Traditional workplace constellations involve team members, managers, and company-wide colleagues. In Paper VIII, we consider the multilevel effects of how awareness, value, and behavior at the leadership level influence technostressors and technostrain at the team member level. Future research could investigate further multilevel effects, such as how technostressors at the individual level affect technostressors and technostrain at the team level. Technostress mitigation strategies directed at an individual employee could also influence other colleagues. For instance, if an individual seeks support from colleagues or contact persons (Paper VI) can lower technostressors, but the colleagues or contact persons may perceive higher technostressors. To inform us about multilevel effects in technostress mitigation, future research could address *what are the positive and negative effects of technostress mitigation strategies on individuals at different levels* by investigating

technostressors and technostrain at the individual and at the team level or at the team member and manager level.

### 5.4.6 Investigation of interdependencies in other research contexts

In Paper II, we identify three types of interdependencies in the context of technostress. These insights may be applicable not only to technostressors, but also transferable to interdependencies among other influencing factors beyond technostress formation and mitigation research. By demonstrating how fsQCA can be used to investigate and reveal such interdependencies, this dissertation paves the way for future research into complementarity, contingency, and substitution in related research contexts such as IS adoption. For instance, some influencing factors of IS acceptance might mutually enhance their positive effects on IS adoption or one factor might only have a positive effect in the presence of another influencing factor. An investigation of *how multiple influencing factors combine to lead to the outcome of interest* could be investigated by a configurational approach (Mattke et al., 2022; Ragin, 2014).

# 6 CONCLUSION

Technostress pervades the workplaces in todays' highly technological society, leading to adverse consequences for employee health and organizational functioning. Inspired by a desire to preserve a healthy and productive work environment, we investigate how technostressors and technostrain are formed (research objective 1) and can be mitigated (research objective 2). Overall, the eight papers of this cumulative dissertation reveal that the formation and mitigation of technostress is complex and influenced by individual differences, interdependencies, and unintended negative consequences. Employees differ in their perception of technostressors due to their *personality profiles*. When employees perceive technostressors, these technostressors *interdependently* lead to technostrain, with possibly compounding detrimental effects. In implementing strategies for technostress mitigation, potential negative consequences such as increases in other technostressors or crossover effects of adverse consequences among individuals must be considered. A systemic understanding of the interdependencies among technostressors leading to technostrain and the potential negative consequences of technostress mitigation enables managers and individuals to choose and implement more effective, target-oriented technostress mitigation strategies.

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# APPENDIX

**Table 13. Relevant research into technostress formation published in AIS Basket of Eight journals**

| Authors | Major finding | Techno-stressors | Technostrain |
|---|---|---|---|
| **Ayyagari et al., 2011** | IS characteristics predict the perception of technostressors, and the perception of technostressors (especially work overload and role ambiguity) predict the experience of technostrain. | Multiple technostressors (e.g. work-home conflict) | Psychological (exhaustion) |
| **Benlian, 2020** | Technostressors can be divided into IS-driven challenge stressors that trigger positive affect, and IS-driven hindrance stressors that trigger negative affect. The triggered positive as well as negative affect spills over to partnership satisfaction, and the spillover is influenced by work-home role integration and perceived organizational support in work-home boundary management. | Challenge technostressors, hindrance technostressors | Psychological (reduced partnership satisfaction) |
| **Califf et al., 2020** | Multiple challenge technostressors are related with positive psychological responses, while multiple hindrance technostressors with negative psychological responses. These responses influence job satisfaction, attrition, and thereby also turnover intention. | Challenge technostressors, hindrance technostressors | Psychological (job satisfaction, attrition), behavioral (turnover intention) |

| | | | |
|---|---|---|---|
| **Chen & Karahanna, 2018** | IS-mediated interruptions in leisure time affect work and non-work outcomes negatively and positively. This takes place through three mediating mechanisms, namely interruption overload, psychological transition, and task closure. | IS-mediated interruptions | Psychological (non-work to work conflict), behavioral (non-work performance) |
| **D'Arcy et al., 2014** | Security-related stress provokes coping in the form of moral disengagement from violations from IS policy, which increases the susceptibility to these violations. | Security-related overload, complexity, uncertainty | - |
| **Galluch et al., 2015** | Technostressors and their perception lead to psychological and physiological technostrain. These processes are influenced by control that users have, e.g. control over the timing of technostressors or control over the method that is used for accomplishing a task. | Overload, conflict | Psychological (exhaustion), physiological (stress hormones), |
| **Maier, Laumer, & Eckhardt, 2015** | Technostressors lead to techno-exhaustion. Techno-exhaustion increases work-exhaustion and thereby indirectly results in low job satisfaction, turnover intention, and low organizational commitment. | Techno-induced work-home conflict, invasion of privacy, work overload, role ambiguity, job insecurity | Psychological (techno-exhaustion, work-exhaustion, job satisfaction, organizational commitment), behavioral (turnover intention) |
| **Maier et al., 2019** | Personality traits from different hierarchical levels lead users to perceive technostressors. The personality trait of the lowest level (IT mindfulness) has the strongest impact on technostressors. Moreover, the findings highlight that the influence of technostressors on user performance is inverted u-curved. High as well as low technostressors lead user to perform low. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty | Psychological (job burnout), behavioral (low job performance) |
| **Maier et al., 2021** | Hindrance technostressors hinder the routine use of IS through hindrance IS use appraisal. However, this is only the case if there are no challenge technostressors. Morover, challenge technostressors are beneficial and even necessary for the innovative use of IS. | Challenge technostressors, hindrance technostressors | Behavioral (routine use, innovative use) |
| **Maier et al., 2022** | The study identifies eight technostressors that are prevalent during the trial period of IS. These trial-period technostressors reduce user satisfaction and increase the intention to reject the IS. | Trial-period technostressors (e.g., perceived difficulty to use) | Psychological (user satisfaction), behavioral (intention to reject) |
| **Pirkkalainen et al., 2019** | Proactive and reactive coping behaviors influence the effects of technostressors and IS-enabled productivity. Proactive coping behavior includes positive reinterpretation and IS control, reactive coping includes distress venting and distancing from IS. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty | Behavioral (reduced IS-enabled productivity) |
| **Ragu-Nathan et al., 2008** | Five different factors create technostressors. The technostressors lead to psychological technostrain. Technostress inhibitors (e.g., support provision) lead to decreased technostrain. Demographic factors and computer confidence influence technostress. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty | Psychological (low job satisfaction, low commitment) |
| **Salo et al., 2022** | The study theorizes how technostress forms over time and mitigation takes place in the private context – in contrast to the work context. Given the private context, where IS is used voluntarily, affordances and affordance actualization costs are relevant for technostress formation and mitigation. | - | - |

| | | | |
|---|---|---|---|
| **Salo et al., 2019** | Distinct sets of social network sites (SNS) technostressors and characteristics generate four types of technostrain that are related to the well-being of users: concentation problems, sleep problems, identity problems, and social relation problems. | Social network sites technostressors (e.g., life comparison discrepancy) | Psychological (concentration problems, sleep problems, identity problems, social relation problems) |
| **Srivastava et al., 2015** | Personality influences how technostressors affect job burnout and job engagement. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty | Psychological (job burnout) |
| **Tams et al., 2014** | Combining both, psychological/self-reported and physiological measures of technostress leads to better explanation and prediction of task performance. | Interruptions due to IS | Psychological (perceived stress), physiological (incidence in stress hormones) |
| **Tams et al., 2020** | Interruption overload negatively influences the work-related usage of mobile IS via increasing work-life conflict. The strength of this relationship depends upon the schedule, method, and criteria control that the employee has. The higher the dimensions of control, the weaker the relationship. | Interruptions due to IS | Behavioral (low IS usage) |
| **Tams et al., 2018** | Interruptions lead to mental workload, which leads to perceived stress and impaired task performance. The effects are moderated by age, which is attributable to age-related differences in inhibitory effectiveness, computer experience, and computer self-efficacy. | Interruptions due to IS | Psychological (mental workload, perceived stress), behavioral (low performance) |
| **Tarafdar et al., 2020** | Distraction through the use of the SNS and distraction through activities outside the use of the SNS are two coping behaviors that users engage in when confronted with social network sites (SNS) technostressors. The coping behavior of distraction through the use of the SNS explains and mediates the relationship between SNS technostressors and SNS addiction. | Social network sites technostressors (e.g., social overload) | SNS addiction |
| **Tarafdar et al., 2007** | Technostressors lead to low performance. Moreover, technostressors lead to role stress, which additionally impairs performance. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty | Psychological (role stress), behavioral (low performance) |
| **Tarafdar et al., 2010** | Organizational factors like involvement facilitation and support decrease the perception of technostressors and technostrain. Technostressors lead to reduced user satisfaction and performance. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty | Psychological (low end user satisfaction), behavioral (low performance) |
| **Tarafdar, Pullins, & Ragu-Nathan, 2015** | Technostressors lead to low performance and low innovation. Technostress inhibitors (e.g., support provision) lead to decreased techno-stressors and technostrain. Furthermore, technology competence and technology self-efficacy reduce technostrain. | Techno-overload, techno-invasion, techno-complexity, techno-insecurity | Behavioral (low performance, low innovation) |

**Table 14. Relevant research into technostress mitigation published in AIS Basket of Eight journals**

| Authors | Strategy | Addressed technostressor | Conceptualization of technostressors |
|---|---|---|---|
| **Addas & Pinsonneault, 2018** | Deleting emails | Interruptions | Specific |
| **Benlian, 2020** | Organizational support in work-home boundary management | Challenge technostressors, hindrance technostressors | Conglomerate |
| **Galluch et al., 2015** | Resource control,<br>method control,<br>timing control | Techno-overload,<br>techno-conflict | Specific |
| **Maier et al., 2019** | Personal innovativeness in IT,<br>IT mindfulness | Techno-overload,<br>techno-invasion,<br>techno-complexity,<br>techno-insecurity,<br>techno-uncertainty | Conglomerate |
| **Pirkkalainen et al., 2019** | Distress venting,<br>distancing from IS,<br>positive reinterpretation,<br>IS control | Techno-overload,<br>techno-invasion,<br>techno-complexity,<br>techno-insecurity | Conglomerate |
| **Ragu-Nathan et al., 2008** | Technical support provision,<br>literacy facilitation,<br>involvement facilitation | Techno-overload,<br>techno-invasion,<br>techno-complexity,<br>techno-insecurity,<br>techno-uncertainty | Conglomerate |
| **Salo et al., 2022** | Theorization how technostress mitigation takes place in the private context – in contrast to the work context. | - | - |
| **Sykes, 2015** | IS support,<br>peer advice ties | -<br>(mitigation of technostrain) | - |
| **Tams et al., 2018** | Computer experience,<br>computer self-efficacy | Interruptions | Specific |
| **Tarafdar, Pullins, & Ragu-Nathan, 2015** | Technical support provision,<br>literacy facilitation,<br>involvement facilitation | Techno-overload,<br>techno-invasion,<br>techno-complexity,<br>techno-insecurity | Conglomerate |
| **Tarafdar et al., 2010** | Involvement facilitation | Techno-overload,<br>techno-invasion,<br>techno-complexity,<br>techno-insecurity,<br>techno-uncertainty | Conglomerate |

# 1.

## Chapter I

# Technostress formation

Paper I

# PERSONALITY PROFILES THAT PUT USERS AT RISK OF PERCEIVING TECHNOSTRESS

## A QUALITATIVE COMPARATIVE ANALYSIS WITH THE BIG FIVE PERSONALITY TRAITS

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Business & Information Systems Engineering (63:4), pp. 389-402.

https://doi.org/10.1007/s12599-020-00668-7

Paper II

# DECONSTRUCTING TECHNOSTRESS

## A CONFIGURATIONAL APPROACH TO EXPLAINING JOB BURNOUT AND JOB PERFORMANCE

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MIS Quarterly (forthcoming)

https://doi.org/10.25300/MISQ/2023/16978

# 2.

## Chapter II

# Technostress mitigation

Paper III

# TECHNOSTRESS MANAGEMENT AT THE WORKPLACE

## A SYSTEMATIC LITERATURE REVIEW

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Proceedings of the 17th International Conference on Wirtschaftsinformatik (WI), Nürnberg, Germany

https://aisel.aisnet.org/wi2022/adoption_diffusion/adoption_diffusion/2

Paper IV

# THE DIRECT AND INDIRECT INFLUENCE OF MINDFULNESS ON TECHNO-STRESSORS AND JOB BURNOUT

## A QUANTITATIVE STUDY OF WHITE-COLLAR WORKERS

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Paper V

# ONLINE STRESS MANAGEMENT INTERVENTIONS

## THE ROLE OF APPLICATION FEATURES

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Paper VI

# HOW BUSINESS AND IT LEADERS CAN REDUCE TECHNOSTRESS AMONG EMPLOYEES

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# HOW BUSINESS AND IT LEADERS CAN REDUCE TECHNOSTRESS AMONG EMPLOYEES


## Abstract

Technostress is a significant challenge for employees using information and communication technologies that puts the health of employees and the success of companies at risk. Research has suggested interventions, such as reducing e-mail traffic, to minimize technostress. Yet, it remains unclear to business and IT leaders responsible for reducing technostress what specific interventions work, how to best implement them, and what are possible unintended consequences.

We report how a medium-sized company could effectively reduce technostress among its employees. The company realized that technostress led to individual-level problems, such as decreased performance and sick days, and company-level problems, such as financial losses and increasing project failures. The company set up a technostress reduction team consisting of business and IT leaders to identify technostressors and implemented and evaluated six specific measures six months later. The program helped to reduce employees' sick days, increased their overall well-being, and improved the company's project success rates and customer perception. We derive specific practical recommendations for business and IT leaders and a six-step framework for reducing company technostress. We identify close cooperation between business and IT leaders as a critical success factor in identifying technostressors, selecting and implementing appropriate measures, and monitoring and adjusting those measures.


**Keywords:** Technostress, IT leaders, Business leaders, Case study, Measures, Technostress reduction, Technostress mitigation.

## 1 TECHNOSTRESS IS A SIGNIFICANT CHALLENGE FOR COMPANIES' SUCCESS

A recent study (Microsoft, 2018) surveys more than 20,000 employees from small and medium-sized companies and concludes that the extensive usage of information and communication technologies (ICTs) causes adverse consequences and thus challenges companies' success. The scientific literature agrees and suggests that the reason for this is not ICT use per se, but employees' experience of technostress, i.e., stress that individuals experience due to their usage of ICTs (Ragu-Nathan et al., 2008). It reflects the process of how technostressors, i.e., the causes of technostress, such as an overload due to text messages and e-mails (Barley et al., 2011), lead to adverse consequences (Ayyagari et al., 2011), such as health impairment among employees due to job burnout (Ayyagari et al., 2011; Maier et al., 2019) and financial losses for companies from absenteeism and lower productivity (Tarafdar, D'Arcy, et al., 2015). While scientists and

practitioners try to find ways to reduce technostress, it is still unclear what measures are adequate for what technostressors, how to implement them, and how to avoid unintended consequences (Tarafdar, Pullins, & Ragu-Nathan, 2015). Based on the experiences of a medium-sized company that could successfully mitigate technostress challenges over time, we provide practical recommendations to business and IT leaders on identifying appropriate measures and effectively implementing them.

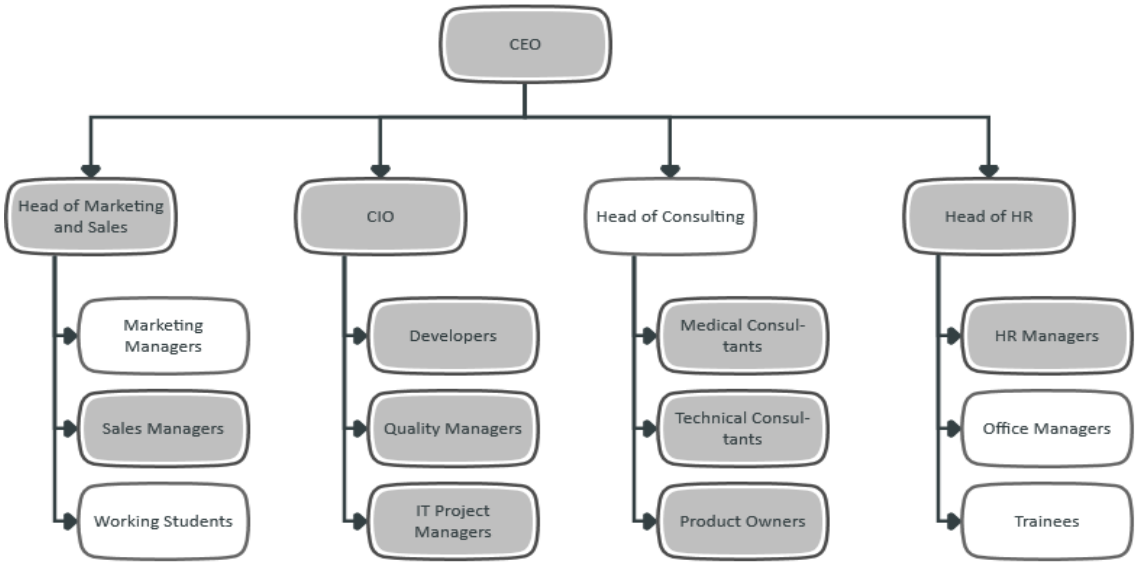
*TheCompany*[1] had noticed several individual-level and company-level problems, identified those as consequences of technostress, and decided to make the systematic reduction of technostress one of their main goals. As technostress negatively influences the business performance of companies and is caused by the usage of ICTs, it is the responsibility of business and IT leaders to reduce technostress. Within *TheCompany*, business leaders, such as the CEO and heads of departments, were responsible for consistently ensuring that key processes and core business were operating during the technostress reduction process. IT leaders, such as Chief Information Officers (CIOs) or IT Project Managers, were responsible for the potential strategic implications of IT, such as the rules of competition and advantage, and everyday operations (Porter & Millar, 1985). *TheCompany*'s business and IT leaders found measures with varying effectiveness and made some relevant experiences throughout implementing them and evaluating their short- and long-term success[2].

Below, we briefly introduce *TheCompany*, its initial problems that motivated *TheCompany* to take on technostress, and the technostressors identified. Next, we describe their approach to reducing technostress and implementing six measures. *TheCompany* faced some obstacles during the implementation, and not all interventions worked as expected. From these lessons learned, we derive practical recommendations for business and IT leaders, including a six-step process of technostress reduction. The recommendations and the six-step process offer a guide for identifying technostress as a problem within a company, identifying the affected business units and underlying technostressors, and selecting appropriate measures for the specific situation within the company. In addition, they support business and IT leaders in effectively implementing and adjusting these measures to reduce technostress in the long term. One critical insight is that close cooperation between business and IT leaders is necessary for successful localization and identification of the technostressors, selection and implementation of appropriate measures, and ongoing monitoring and adjustment of those measures.

# 2 DESCRIPTION OF *THECOMPANY*

*TheCompany* is a medium-sized agency for integrated healthcare communication and marketing, cooperating with various globally operating companies. It is headquartered in Germany. *TheCompany* employs approximately 200 people divided into marketing and sales, IT, medical and technical consultants, and HR. It is structured along the organigram shown in Figure 1.

[1] The company of this case study preferred to be anonymous. However, we have permission to describe this case anonymously, so we will call the investigated company "*TheCompany*" in this study and will only use the job positions rather than the names of our interviewees.
[2] The research methodology is described in more detail in the Appendix.




*Note:* We interviewed experts from the positions shaded in grey.

**Figure 1. *TheCompany*'s organizational chart**

## 2.1 TIMELINE OF THE CASE STUDY

The period of the case study is from November 2019 to May 2021. Within this period, *TheCompany* has gone through different stages in reducing technostress, from identifying problems to identifying technostressors to developing, implementing, evaluating, and adjusting measures. We present a chronological overview of these stages in Table 1.

**Table 1. Chronological overview of *TheCompany's* stages in reducing technostress**

| Stages in reducing technostress | Point of time |
|---|---|
| Identification of technostress and resulting individual-level and company-level problems | End of 2019 |
| Introduction of a technostress reduction team | February 2020 |
| Identification of technostressors with the help of …<br>… employee interviews<br>… observations of employees at work<br>… surveys | <br>March – April 2020<br>March – April 2020<br>May 2020 |
| "Reduction of technostress" as a top priority issue | June 2020 |
| Development of measures | June 2020 – October 2020 |
| Implementation of measures | November 2020 |
| Evaluation and adjustment of measures | From December 2020 |

### 2.1.1 Identification of technostress and introduction of a technostress reduction team

Business and IT leaders of *TheCompany* stated that towards the end of 2019 employees started reporting problems resulting from using ICTs. For example, it was noticed that an increasing number of employees were calling in sick because of stress with using ICTs at work. "*More and more employees consulted their supervisors and HR because they felt overwhelmed and exhausted with ICTs during their daily work and therefore called in sick*" (CEO). Likewise, "*three employees even were absent for long periods due to burnout*" (Head of HR), and "*many employees stated that they are not satisfied with their computer programs and tools anymore*" (CIO). These statements made *TheCompany* aware that there were **individual-level problems** in the company. Those individual-level problems led to **company-level problems** for *TheCompany*, which recorded decreasing financial income and increasing project failures. *TheCompany* realized that its "*employees made mistakes more often in the projects, customers were less satisfied with the quality of project results, and there were increasing delays in the projects*" (IT Project Manager). Due

to these issues, there were first assumptions that the problems could be related to ICTs and technostress. Therefore, *TheCompany* aimed to gain more insights into the company's technostress and its exact causes. In February 2020, *TheCompany* **introduced a technostress reduction team** consisting of the business and IT leaders of *TheCompany*. As business leaders, the technostress reduction team included the CEO of *TheCompany* and heads of departments. As IT leaders, *TheCompany* included the CIO, and also IT project managers as capabilities of IT project managers also apply to the designation of IT leaders having authority to drive bold, fast changes to reconfigure internal structures and ICTs in the company (Morton et al., 2018).

*TheCompany* chose to include business and IT leaders because they understood that technostress is a complex phenomenon that requires both technological and managerial actions. "*Since the problems arose from using ICTs and affected the entire company, we deliberately included our business managers and IT leaders in the technostress reduction team. We were aware that the changes that came with the introduction of the measures would affect many processes in the company. Therefore, business leaders had to ensure that the company would remain operational during the restructuring*" (CEO). The technostress reduction team aimed to conduct internal research and identify existing technostressors using **employee interviews**, **observations of employees at work**, and **employee surveys**. By these three sources, the technostress reduction team identified various technostressors that cause individual-level and company-level problems, confirming that the problems were indeed due to technostress. The identification of technostressors was conducted by the business leaders in the technostress reduction team. In the following, we provide details on how the business leaders identified technostressors using employee interviews, observations of employees at work, and employee surveys.

### 2.1.2 Employee interviews

Through initial **employee interviews**, the business leaders revealed various technostressors. Employees increasingly complained that they felt overwhelmed because of many work-related e-mails. "*The massive amount of e-mails constantly arriving in our inboxes on a variety of topics is hard to manage*" (IT Project Manager). This stressful stimulus has been termed techno-overload and describes situations in which ICTs force employees to work faster or longer (Ragu-Nathan et al., 2008). Employees stated that they could not switch off from work in the evening and experienced the constant need to check their phones for work-related issues. "*Employees often felt pressured to check and respond to e-mails on their work phones even after working hours*" (IT Project Manager). This stressful stimulus is called techno-invasion and describes the invasive effect of ICTs by enabling employees to be reached anytime and anywhere (Ragu-Nathan et al., 2008). Employees of all ages complained about the ever-increasing number of programs and applications. There was negative feedback from employees who felt uninformed and uninvolved when new ICTs were introduced, and management spent money on them. Employees continued to prefer using the old ICTs. "*As an employee, I often no longer knew which applications we should use for which purposes"* (Quality Manager). This stressful stimulus where continuous ICT changes and upgrades unsettle employees and create uncertainty has been discussed under techno-uncertainty (Ragu-Nathan et al., 2008). Employee interviews revealed that many employees feel monitored by ICTs. "*I felt like I have a duty that my Skype status should constantly be online. Managers also checked if some employees were not online during working hours, even though it is common practice, especially in our department, to sketch a draft on paper sometimes*" (Sales Manager). This stressful stimulus falls under IT-based monitoring, describing situations in which employees experience electronic performance monitoring (Fischer et al., 2019).

### 2.1.3 Observations of employees at work

To identify further technostressors, the business leaders observed employees at work for eight weeks during March and April 2020 at regular intervals and more intensively after every introduction of new ICTs. The **observations of employees at work** revealed that technostress was caused mainly by employees not using ICTs correctly, e.g., files were not saved in the cloud but locally on the computer, which led to employees working on different versions simultaneously. That led to employees' frustration because they had to do their work again. Employees spent much time getting ICTs to work, watching how-to videos, or researching the internet. This stressful stimulus, where employees do not have sufficient skills to work with ICTs and spend additional time and effort to understand the ICTs, is called techno-complexity (Ragu-Nathan et al., 2008).

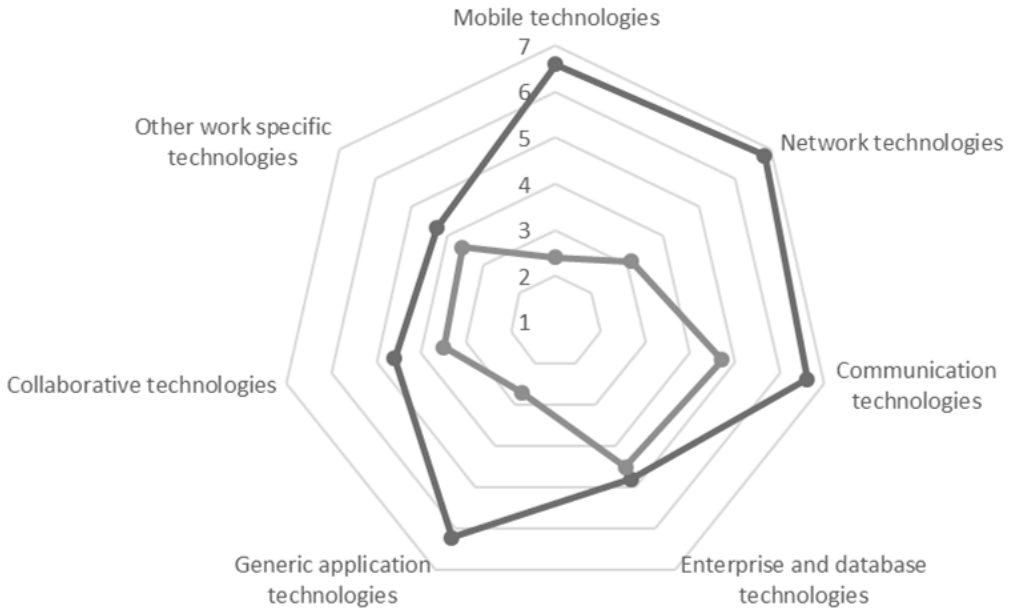
### 2.1.4 Employee surveys

After the business leaders identified these technostressors within *TheCompany*, **employee surveys** were conducted to see if the employees experienced further technostressors. Building on the insights gained through employee interviews and overserving employees at work, the business leaders developed an employee survey to assess current technostressors in the company. The employees were explicitly asked about specific situations regarding using ICTs they perceive as stressful. Employees complained about frequent system failures and that ICT malfunctions often prevented them from doing their jobs. Such stressful stimuli, where ICTs are unavailable or do not work as expected, are typical examples of techno-unreliability (Fischer et al., 2019). During the survey, it was stated that the tone of online communication had become rougher in recent years. Many employees wrote offending comments in group chats that harmed colleagues. These situations in which employees get offending comments or statements via ICTs are termed cyber-bullying (Fischer et al., 2019).

It showed that such offending comments were often based on employees' fear of "*being replaced because other employees were better at handling ICTs*" (Medical Consultant). Employees often became insecure due to constant updates and "*became afraid that other employees would outrank them in terms of effectiveness at work and use of ICTs*" (IT Project Manager). As a result, employees need to improve their working situation. This fear of employees losing their jobs due to ICTs is called techno-insecurity (Ragu-Nathan et al., 2008).

## 2.2 ICTs WITHIN *THECOMPANY* AND THEIR INFLUENCE ON TECHNOSTRESS

During the employee interviews, observations of employees at work, and employee surveys, the business leaders in the technostress reduction team could elaborate on eight technostressors that cause technostress in *TheCompany*. The eight identified technostressors arose from the usage of different ICTs. The technostress reduction team extended the employee survey to determine how the ICTs relate to the employees' experienced technostress. The added questions aim to examine which ICTs are in use, who uses them, and how central these ICTs are to the experience of technostress and the work being done. To expose which and how ICTs influence technostress within *TheCompany*, we analyzed the extended the employee surveys and categorized the ICTs used at *TheCompany* according to existing IS literature (Ayyagari et al., 2011). Our analysis reveals the intensity of use and resulting technostress levels, i.e., how stressful employees perceive ICTs, of existing ICT categories within *TheCompany* (Figure 2; for more details, see Appendix Table 4).




*Note:* inner line = technostress level; outer line = intensity of use;
1 = not intense/stressful at all, 7 = very intense/stressful

**Figure 2. *TheCompany*'s ICTs with the corresponding intensity of use and technostress levels**

*TheCompany's* ICTs can be divided into seven categories: mobile technologies, network technologies, communication technologies, enterprise and database technologies, generic application technologies, collaborative technologies, and other work-specific technologies. We provide findings on differences between these categories in terms of intensity of use and technostress resulting from usage.

**Mobile technologies** such as laptops or mobile phones, **network technologies** such as internet or VPN, and **generic application technologies** such as Microsoft PowerPoint or Microsoft Word are used intensively by most employees across all departments (blue line in Figure 2). They can be considered basic working tools within *TheCompany*. Mobile technologies consist of hardware purchased by *TheCompany*. Network technologies consist of vendor-based technologies, such as Citrix or Cisco AnyConnect. Generic application technologies consist of vendor-based software installed locally but using cloud extensions such as Microsoft Office 365 and Axure (for categorization and more details see Appendix Table 4). Despite or even due to their intensive use, mobile, network, and generic application technologies cause a low technostress level within *TheCompany* (orange line in Figure 2).

Differences exist in the other categories of ICTs regarding the intensity of use and the resulting technostress levels. **Communication technologies** like Skype or Microsoft Teams can also be seen as basic working tools within *TheCompany* and the intensity of use is high. Although these are basic working tools, the technostress caused by communication technologies is high compared to the above-mentioned categories due to the invasive effect of communication technologies. Communication technologies within *TheCompany* include purchased hardware such as smartwatches or telephones and vendor-based software installed locally but using cloud storage such as Skype or Microsoft Teams.

**Enterprise and database technologies,** such as SAP R/3 and Salesforce CRM, are used less intensively within *TheCompany*. While they are used less intensively, they generate a high technostress level among users due to their high complexity. Enterprise and database technologies

within *TheCompany* are mostly vendor-based software managed locally, such as SAP R/3 or SQL Server Management Studio. Partly, they exist of proprietary software, such as Innovator, or vendor-based software, such as ERP eEvolution, managed in the cloud.

**Collaborative technologies** such as Confluence or Miro are used frequently within *TheCompany* and cause a medium level of technostress. All collaboration technologies within *TheCompany* are vendor-based software and managed in the cloud.

**Other work-specific technologies** vary enormously between departments due to their contextual focus. For example, Marketing and Sales often use Adobe Photoshop or Google Analytics. In contrast, Human Resources has little contact with these ICTs and uses software such as Personio or Travel Expenses HRworks. Work-specific technologies are used medium overall and cause a medium technostress level. Work-specific technologies within *TheCompany* include vendor-based (e.g., Datev Portal) and proprietary software (e.g., eLearning Platform). They are managed locally (e.g., Travel Expenses HRworks) and in the cloud (e.g., Backup VEEAM). The situation within *TheCompany* goes in line with existing technostress literature and confirms a large-scale study (Camarena & Fusi, 2022) surveying 2,500 local government managers and concluding that using mobile, communication, enterprise and work-specific technologies increases technostress.

## 2.3 TECHNOSTRESSORS WITHIN *THECOMPANY*

To get an overview of *TheCompany's* situation and related challenges, Table 2 aggregates the findings on technostressors and ICTs within *TheCompany* and shows the technostressors identified, their definitions from IS literature and ICTs within *TheCompany* where the individual technostressors mainly occur.

**Table 2. Technostressors**

| Technostressor | Definition in literature | Related ICTs in *TheCompany* |
|---|---|---|
| **Techno-overload** (Ragu-Nathan et al., 2008) | *"Too much"*<br>ICTs force employees to work faster and longer | Collaborative technologies<br>Communication technologies |
| **Techno-invasion** (Ragu-Nathan et al., 2008) | *"Always connected"*<br>The invasive effect of ICTs in situations in which employees can be reached anytime and anywhere;<br>the need to be constantly connected, thus blurring work-related and personal contexts | Communication technologies<br>Mobile technologies |
| **Techno-uncertainty** (Ragu-Nathan et al., 2008) | *"Too often and unfamiliar"*<br>Continuous ICT changes and upgrades unsettle employees and create uncertainty, so they must constantly learn and educate themselves about new workflows | Enterprise and database technologies<br>Other work-specific technologies<br>Generic application technologies |
| **IT-based monitoring** (Fischer et al., 2019) | *"Too transparent"*<br>Situations in which employees experience electronic performance monitoring;<br>monitored individuals report higher levels of job-related stress and physical strains independent of their profession | Collaborative technologies<br>Communication technologies<br>Mobile technologies<br>Network technologies |
| **Techno-complexity** (Ragu-Nathan et al., 2008) | *"Too difficult"*<br>The complexity associated with ICTs leads employees to experience insufficient ICT skills forces employees to spend time and effort on learning and understanding ICTs | Enterprise and database technologies<br>Generic application technologies<br>Other work-specific technologies |

| | | |
|---|---|---|
| **Techno-unreliability** (Fischer et al., 2019) | *"Not reliable"*<br>Contexts where ICTs are not available<br>Contexts where ICTs do not work as expected or have unexpectedly long system response times | Network technologies<br>Mobile technologies |
| **Cyber-bullying** (Fischer et al., 2019) | *"Feeling attacked"*<br>Situations in which employees get offending comments or statements via ICTs | Communication technologies<br>Collaboration technologies |
| **Techno-insecurity** (Ragu-Nathan et al., 2008) | *"Too dangerous"*<br>Employees feel threatened about losing their jobs, either because of the automation of ICTs or other people who better understand ICTs | Enterprise and database technologies<br>Other work-specific technologies<br>Generic application technologies |

With employee interviews, observations, and employee surveys, the technostress reduction team was able to identify the above technostressors within *TheCompany*. With employee surveys, the technostress reduction team revealed that different categories of ICTs exist in *TheCompany* that differ in their intensity of use and technostress levels. Using this knowledge, *TheCompany* established awareness of technostress as an essential and relevant challenge for employees that the company associated with the individual- and company-level consequences. Therefore, *TheCompany* made **reducing technostress a top priority** in its corporate goals in June 2020 (see Table 1).

# 3 MEASURES INTRODUCED BY *THECOMPANY* TO REDUCE TECHNOSTRESS

After the technostress reduction team noticed that technostress was a significant issue in the company and identified the relevant technostressors within *TheCompany*, they aimed to identify suitable measures. While identifying technostressors was the responsibility of the business leaders, identifying appropriate measures required the business and IT leaders with specific objectives. The business leaders had identified the requirements from a business perspective, and the IT leaders identified possibilities for implementation and compliance. After a collaborative identification of appropriate measures, the implementation lay in the responsibility of the IT leaders. *TheCompany* **developed six measures** to address the technostressors identified.

## 3.1 REDUCING E-MAIL TRAFFIC

*TheCompany* builds on employees' complaints of being "*constantly distracted from their actual work by e-mails*" (IT Project Manager) and the insights of the technostress reduction team. The investigations reveal "*that employees were overwhelmed by constant messages and thus worked less productively and were more prone to errors*" (CEO). The IT leaders aimed to increase performance by decreasing distraction due to permanently incoming e-mails and therefore introduced an 'e-mail system'. This system accumulates all e-mails that would arrive in the employees' inboxes over an hour, does not send them, and delivers them once an hour to the employees. A test phase with a pilot team revealed that the employees' tasks were processed qualitatively better and faster, and the employees reported lower technostress. The study also showed a significant problem. "*Other departments [which had to work with the pilot team] mentioned that this made them work slowly because the pilot team responded only once an hour, and they often had to waste time waiting in which they could not do any work*" (Head of Marketing and Sales). The measure reduced the productivity of the other departments while increasing the productivity of the pilot team. The technostress reduction team realized that this measure needed some adjustment.

To counteract this crossover effect and resolve the negative side effect that employees could not respond to until the next full hour, the technostress reduction team conducted additional

collaborative sessions. During these sessions, business leaders highlighted the occurring problems with the existing 'e-mail system' and IT leaders provided input on a modified system – the 'e-mail **ticket** system'. The 'e-mail ticket system' still accumulates all e-mails of the last hour and then sends them collectively every hour. But the 'e-mail ticket system' makes it possible to open a new conversation ticket every hour, allowing a conversation independent of the hourly delivery times, e.g., when there is only a short and urgent concern. These conversations receive the ticket status 'open'. If a conversation has the status 'open', it is possible to answer directly. The possibility was introduced to prevent the undesired use of open tickets, and employees were requested to close the open ticket manually when the issue was resolved. Every employee can write e-mails in this open conversation, and there are no restrictions. If an e-mail is delivered and an employee only has a short request, this e-mail is delivered immediately because the e-mail ticket still has an open status. The 'e-mail ticket system' still accumulates all e-mails without an open ticket of the last hour and sends them collectively every hour. This way, issues on one topic can be clarified while employees are not constantly confronted with new topics and are less distracted.

To reduce the e-mail traffic, the technostress reduction team introduced a rule to not write e-mails on Sundays and holidays. Employees are requested to refrain from reading or answering e-mails after work. If there is an important issue, *TheCompany's* approach is "*talk to me and do not write me an e-mail*" (CEO), which prevents employees from constantly checking their e-mails or being afraid of missing essential ones. *TheCompany* introduced one day per week (Friday) on which no e-mails need to be answered, and employees can focus on their actual tasks. Initial employee feedback has shown a positive effect on the employees' daily work by having to wait to answer e-mails. The feedback has revealed that the employees are more focused on their tasks and are less distracted by new topics coming in via e-mail. Crossover effects are a factor, as employees cannot send e-mails on Sundays and holidays. Since such rules remove the pressure on employees to answer e-mails after work and avoid distraction through e-mails, the advantages outweigh the disadvantages within *TheCompany*.

## 3.2 HOMOGENIZATION OF ICTS

Through the results of employee observations at work and surveys, the technostress reduction team found that ICT heterogeneity stresses employees. "*Some employees save their files locally and some in the cloud, which led to employees working on different versions at the same time and frustration and there are often problems with tasks that involve several teams because different, often incompatible ICT applications are used across different teams*" (CIO). It is particularly difficult "*for tasks that build on each other, where certain files are edited successively by different teams, as interface or visualization problems occur*" (IT Project Manager). As a result, "*employees get frustrated and have to find often time-consuming solutions*" (CEO). The referred ICTs, namely mobile and generic application technologies, do not cause the highest technostress level within *TheCompany*. However, since they are used intensively (see Figure 2), they contributed to technostress problems within *TheCompany* and were considered relevant to be addressed. In line with IS literature (Rentrop & Zimmermann, 2012), the technostress reduction team wanted to increase performance and compatibility by reducing and homogenizing individual systems' diversity and avoiding shadow IT. "*This approach means, among other things, trying to provide standardized ICTs, both hardware and software, to employees throughout the company to achieve a high level of compatibility. Employees in the commercial departments all receive work laptops. These now all run with the same operating system to avoid heterogeneity. The employees also get business mobile phones, which run on Android. This homogenization of ICTs has proven to succeed over the past years. Everything is done to simplify the interfaces and eliminate software and hardware incompatibility*" (CIO). For the same reason, the Microsoft ecosystem with PowerPoint, Teams, Word, and Excel is now used consistently. The aim was for all company employees to use standardized software and hardware for one task. "*This approach prevents messages and information from being lost because employees use different communication tools*" (IT Project Manager). To implement this measure, the IT leaders listed all existing systems and ICTs and critically examined them step by step. They carefully assessed whether there is a justified reason for each ICT in the company to

continue to be used and whether other ICTs with similar functions already exist. If similar ICTs already exist, IT leaders select an ICT that meets the requirements of all departments. The IT leaders made the experience that it is necessary to commit to one ICT sparingly, as within *TheCompany*, ICTs were removed too early and had to be reinstalled afterward. It is advisable to discuss ICTs with employees from other departments - as they might have different requirements for the tool - and collectively decide on a specific ICT which meets all requirements.

Although the IT leaders carefully selected ICTs based on the requirements and discussions with all departments, there were problems and challenges initially, as many employees were forced to use a new operating system or ICTs with which they were unfamiliar. Some employees did not want to move away from the typical ICTs, such as the operating system iOS, to a new standardized one, e.g., Android, or could not work as effectively with the new standardized ICTs initially as they had before. The managers were advised to encourage employees to use standardized software such as Microsoft Office or Android to establish homogenization. *TheCompany* has learned that when ICTs are homogenized, it is critical to diminish the variety of ICTs as much as possible without affecting or complicating communication within the company. Furthermore, too much homogenization of ICTs can lead to a de-individualization of employees. Existing case studies (Dery & MacCormick, 2012) show that companies often keep ICT policies not flexible enough and limit work practices among employees. Great care must be taken, and the individual steps must be communicated to those affected. *TheCompany* aims to involve both business leaders and IT leaders in the decision-making process at an early stage and openly communicate decisions made to all employees.

## 3.3 TRAINING SESSIONS

With enterprise and database technologies and other work-specific technologies, the technostress reduction team identified the problems of the employees regarding uncertainties in "*how ICTs should be used*" (Quality Manager) and "*for what purpose they should be used*" (IT Project Manager). Companies should provide employees with best practices for the usage of ICTs. Such best practices on how to use ICTs keep employees informed and reduce their uncertainty around ICTs, thus reducing technostress (Camarena & Fusi, 2022). In *TheCompany*, IT leaders implemented training sessions to increase clarity by increasing employees' ICT skills and decreasing uncertainty when working with ICTs. The IT leaders realized that most employees had the professional expertise to solve their tasks but needed to learn how to implement their solutions due to the new ICTs. This uncertainty often led to overwhelming frustration among the employees and became noticeable in the projects through a higher error rate and frequent scheduling delays.

The investigations of the technostress reduction team revealed significant deficiencies within *TheCompany*. The IT leaders identified a time-consuming and expensive but indispensable solution from *TheCompany's* point of view. *TheCompany* provides extensive training for new introductions of ICTs that affect how employees work. These training sessions were held for an entire day and included hands-on learning of the necessary skills. This way, employees feel involved and well-informed from the beginning, increasing their motivation to use the ICT. These training sessions are available for all ICTs where *TheCompany* identified, e.g., through contact persons or employee requests, that there are difficulties when using these ICTs. These difficulties mainly occurred after new ICTs or updates were introduced. The case study has shown that it is helpful to offer a minimum of three different training levels, e.g., beginners, advanced, and experts, to avoid some employees being overstrained or bored. These insights go in line with existing case studies (Camarena & Fusi, 2022) showing that a lack of individuality in-company training sessions leads to lower participation and interest.

The training sessions at *TheCompany* were partly internal and partly external. It showed that training courses from external coaches are costly and that training conducted by colleagues often

achieves better results. Internal employees with extensive experience with the new ICT and who had worked with it in practice were asked whether they would voluntarily hold training sessions for their colleagues. *TheCompany* allowed those employees to count the time spent preparing, planning, and conducting the training sessions as working hours to provide an incentive. It has been shown that a range of employees is willing to design and conduct training sessions for colleagues on various topics during their working hours. For proprietary software such as the eLearning Platform or Smartfacts, internal employees involved in the development provide training on basic functions or updates. Presentations are used to show the new ICT's advantages or updates. *TheCompany* also started offering regular group meetings, where subject-specific and technological problems were discussed and solved. The goal of such meetings is a quick and uncomplicated solution to occurring issues, and there is also time for questions and answers on the latest topics and ICTs. For topics that were new to all employees, professional training was provided by external coaches in *TheCompany*. In the case of new or updated vendor-based software, such as SAP R/3 or Axure, *TheCompany* aims to book external trainers. In the case of ICTs that are essential for specific employees or departments in particular, these are invited on a mandatory basis. *TheCompany* emphasizes that "*all employees have the opportunity to participate in the training, even if it is, for example, a training on new Google Analytics features which might be less relevant for HR, simply to distribute knowledge within the company broadly*" (CEO). Employees should have no problems handling new ICTs after such training sessions. They should have gained sufficient knowledge regarding new ICTs to focus on the business challenges of their current job rather than the challenges of using their ICTs.

## 3.4 INTRODUCING CONTACT PERSONS

*TheCompany* found a suitable way to explain the basics and the benefits of using the new ICT, especially enterprise and database technologies, or other work-specific technologies, to the employees in introductory training sessions. Nevertheless, the technostress reduction team recognized that on-the-job complications appear with the new ICTs, as "*many problems only arise when the ICT is in actual use*" (CIO). The IT leaders aimed to reduce technostress by eliminating individual and later occurring complications that prevent employees from working and by introducing central contact persons in addition to initial training sessions. These contact persons are employees who have already worked with the newly introduced ICTs in that company and are willing to support other employees. The IT leaders do not allocate contact persons per team but according to expertise and responsibility for specific ICTs. Among others, there is a contact person responsible only for hardware-related problems such as laptops and mobile phones, and a separate contact person for SAP R/3. Contact persons have reserved certain hours in their employment contract for training in their area of expertise and for supporting and answering employee questions. The training of contact persons consists of targeted external workshops with experts for specific ICTs and internal exchanges with other contact persons. The contact persons can be approached personally and asked for help, but they also have their e-mail inbox to which employees with problems can turn. Contact persons also have their intranet page where they can post themselves as contact persons for specific areas or programs. These intranet pages allow employees to find the right contact person for specific problems quickly. Contact persons also use their intranet page to document their knowledge and share it with each other. This documentation includes frequent problems encountered by employees and how they are solved. An example within *TheCompany* is that employees feel overwhelmed with complex tools they do not frequently use, such as SAP R/3 or ERP eEvolution, because the workflows are unfamiliar. Employees often use ICTs incorrectly or not at all. Contact persons document such problems, which can become the subject of future training sessions.

Through internal research, the technostress reduction team discovered another issue that made the introduction of contact persons worthwhile. "*In the past, employees didn't dare to ask for help, because they didn't want to seem stupid in front of their colleagues. Instead, they tried to familiarize themselves with ICTs on their own, which takes a long time and would have been much faster with the help of other people" (CEO).* A

central contact person allows everyone to ask for help if there are any complications without being put in a bad light in front of their teammates and prevents other teammates, who would have had to help them, from being distracted from working. This way, "*employees simply get in touch with the contact person, clarify the issues, and immediately continue with their work*" (Medical Consultant). Contact persons enable employees to get fast and uncomplicated guidance from an expert and they do not have to deal with the complications themselves.

At the beginning of implementing contact persons, *TheCompany* frequently encountered problems where the contact persons in the various areas of expertise were available but not contacted by the employees. To encourage employees to ask the contact persons for guidance, *TheCompany* tried to keep the barrier as low as possible. Employees should not shun seeking help from the contact persons, feel supported, and not uncomfortable when asking for help. The contact persons attached a picture to their profile and provided an overview with brief introductions of all contact persons on the company intranet. It has proven successful at *TheCompany* that contact persons receive regular training and updates in their area of expertise. The contact persons receive time reserved to exchange information with each other and inform themselves independently about ICT-related changes ranging from new software updates to the implementation and integration of AI systems. They can decide autonomously within their area of expertise what is important for the company and what is not. This information and changes are then filtered and communicated to the employees.

## 3.5 ASSISTANCE WITH PROBLEMS

Through contact persons, employees receive help in case of severe difficulties with ICTs. If the employee's problem is minor, it is often the easiest to ask a colleague in the same room or team. This approach is especially relevant if the employee wants to avoid going directly to the designated contact person but would still need to spend a lot of time and energy on their own to solve the problem. *TheCompany* aimed to decrease technostress by cultivating a corporate culture in the way that employees assist each other when problems with ICTs arise. To cultivate this culture, *TheCompany* focuses on the recruiting process and aims to recruit employees who meet the requirements, e.g., a willingness to help or the ability to work in a team. To increasingly employ people with these characteristics in the company, the HR department deliberately focuses on applicants' personal and social suitability. It uses assessment centers to analyze applicants' social skills and whether they fit into the existing team. This preselection should create a more positive and productive work atmosphere in the company. "*It has been shown that it is more efficient and more effective if employees help each other according to the idea that one helps the other. By that, everyone can benefit from the knowledge of others. That has been proven successful in recent years, yielding a huge advantage to individual employees, departments, and the entire company. […] Meanwhile, the employees clarify issues completely among themselves without supervision*" (CEO). IT leaders support employees during the introduction of new ICTs and ensure that more minor complications regarding the ICTs are solved together in a team. They expect employees to help each other and offer help and thus try step by step to build up a corporate culture based on offering assistance. Since a negative side effect of assistance with problems was that employees were partly distracted from their actual work, employees need to distinguish between problems they would be better off asking a colleague for help and problems they should instead turn to a central expert, e.g., a contact person. Employees can better understand this through employee training or discussions between employees and contact persons.

In addition to assistance with problems in person, IT leaders rely on chatbots, which are built into all of *TheCompany's* proprietary software and provide employees with quick and straightforward support for problems and questions. In the modeling tool Smartfacts that combines a wide range of modeling, such as business processes, data structures, SQL schemas, and enterprise architecture, a chatbot supports employees in getting started and determine which ICT features are relevant to process the current task. IT leaders called for enabling chatbot functionality in many vendor-based

software solutions to support employees. In HR, AI chatbots assist employees with filling expense reports, opening purchase order requests, managing paid time off, and notifying employees of policy changes. *TheCompany* activated the digital assistant for ERP and CRM from Oracle to support employees in creating expense reports faster and automatically submit expenses.

### 3.6 OFFICE DAYS

The technostress reduction team noticed technostress among employees due to an increasing number of employees working from home and shifting their on-site meetings to video conferences. These long and numerous virtual meetings created zoom fatigue (Nesher Shoshan & Wehrt, 2022) among employees. Employees reported "*a reduction in concentration during and after long virtual meetings*" (IT Project Manager) as well as "*increased exhaustion*" (Technical Consultant) and "*being annoyed*" (Medical Consultant). Employees mentioned "*the lack of personal interaction*" (Technical Consultant) as well as "*organizational conditions that often require a high level of efficiency within meetings and allow little space for personal exchange and small talk"* (IT Project Manager) as causes of zoom fatigue. Technical factors such as sound and video quality, internet connection and time delays during video conferences can lead to frustration, reduced satisfaction and productivity, and increased duration of projects. *TheCompany's* findings are consistent with recent literature showing that telecommuting triggers technostress among employees and results in lower job satisfaction and job performance (Camacho & Barrios, 2022). To counteract this, the IT leaders have implemented a measure that employees are not allowed to work from home two days a week. "*The goal here is that employees are supposed to solve problems face-to-face in the company and exchange information about the project within the company. They can continue working at different locations on the other three days of the week*" (IT Project Manager). Due to the implementation of office days, *TheCompany* reduces the number of virtual meetings. "*Office days have helped us enormously to reduce zoom fatigue within the company because the employees can solve problems much easier and faster and do not have to wait long for an answer*" (Head of Marketing and Sales). During the development of this measure, the IT leaders aimed to include all employees of the different departments in the decision process on whether and on which days office days are effective. Although it is essential to enforce these agreed days strictly, "*it is necessary that the introduction of office days does not lead to worse internal communication or collaboration*" (CEO). The IT leaders allowed individual adjustments in some instances. This approach allows the measure to be as strict as possible and flexible enough that no new issues arise, such as worse internal communication or collaboration. After the IT leaders assessed the introduction of office days as having a significant impact on the company, this measure was first tested in a few smaller teams before rolling it out to entire departments. The IT leaders used this test phase to obtain early feedback from the test team through employee interviews. In addition, IT leaders identified emerging issues at an early stage which enabled them to counteract any unintended adverse side effects of the measures, such as dissatisfaction due to limited flexibility.

## 4 EVALUATION OF MEASURES TO REDUCE TECHNOSTRESS

After the IT leaders **implemented the six measures** described above, business and IT leaders repeatedly gathered feedback through individual employee conversations. In these exchanges, employees provide positive feedback, such as the "no e-mails on Sundays and holidays" rule, and criticism, such as the lack of necessary tools through homogenizing ICTs. The business and IT leaders extended their employee surveys in December 2020, one month after implementing the measures, to examine the measures on a company-wide and representative basis on their effectiveness in reducing the eight technostressors identified. Business and IT leaders worked closely together to expand the employee surveys. While business leaders focused on evaluating improvements in work performance, IT leaders aimed to identify opportunities for improvement in implementing the measures. The business and IT leaders distributed the employee surveys

among the employees, and they rated the effectiveness of each measure to reduce each specific technostressor. The effectiveness of the six measures was rated on a seven-point scale (from 1 = '*not effective at all*' to 7 = '*very effective*'). The results are displayed and summarized in Figure 3. The color depicts the effectiveness of reducing each specific technostressor from the employees' perspective. For example, the measure to implement contact persons has an effectiveness of 6.16 out of 7 to reduce techno-overload and is the most effective measure to address techno-overload.

| | **Techno-overload** | **Techno-invasion** | **Techno-complexity** | **Techno-insecurity** | **Techno-uncertainty** | **Techno-unreliability** | **IT-based monitoring** | **Cyber-bullying** | **Average** |
|---|---|---|---|---|---|---|---|---|---|
| **Reducing e-mail traffic** | 5.68 | 5.56 | 3.82 | 4.12 | 3.82 | 4.06 | 3.94 | 4.12 | 4.39 |
| **Homogenization** | 5.62 | 4.48 | 6.16 | 5.62 | 5.50 | 5.08 | 4.24 | 4.36 | 5.13 |
| **Training sessions** | 5.92 | 4.36 | 6.16 | 5.92 | 5.50 | 5.68 | 4.48 | 5.08 | 5.39 |
| **Contact persons** | 6.16 | 4.66 | 6.10 | 5.74 | 5.68 | 5.56 | 4.54 | 5.20 | 5.46 |
| **Assistance with problems** | 6.08 | 4.48 | 5.80 | 5.98 | 5.56 | 5.62 | 4.60 | 5.74 | 5.48 |
| **Office days** | 4.66 | 4.18 | 4.30 | 4.00 | 4.24 | 4.18 | 4.18 | 4.42 | 4.27 |

*Notes:* 1.00 – 2.50 **not effective at all** 4.01 – 5.50 **effective**
2.51 – 4.00 **not effective** 5.51 – 7.00 **very effective**

**Figure 3. Results of the employee survey**

As shown in Figure 3, the measures differ in their effectiveness in reducing the individual technostressors. Every measure except office days is effective in reducing at least one technostressor. For each technostressor of our study, except IT-based monitoring, at least one effective measure can be implemented to reduce the technostressor. Although the overall results are positive and the measures were considered adequate, the technostress reduction team recognized varying results. Therefore, they examined the results and identified significant differences in the effectiveness of the measures between the various departments. These differences exist for all technostressors, which shows that the department is an essential factor in choosing suitable measures to reduce technostress in the long term. Figure 4 shows the difference in the effectiveness of the measures in *TheCompany's* departments (see *TheCompany's* organigram, Figure 1) using the example of techno-complexity. It shows that *TheCompany's* measures are the most effective in the Marketing and Sales department and the least effective in the IT department. The IT department stands out both positively and negatively. Reducing e-mail traffic is comparatively effective against techno-complexity in the IT department. At the same time, homogenization of ICTs, contact persons, and office days are comparatively less effective in the IT department. The technostress reduction team discovered that not all departments are equally affected by the technostressors, and the different measures have different relevance in different departments. At *TheCompany*, for example, it has been shown that employees in the HR department have to be constantly reachable and thus have problems with techno-invasion. Reducing e-mail traffic can be helpful, whereas in other departments, it can be less valuable.

| | Marketing and sales | IT | Medical and technical consulting | HR | Average |
|---|---|---|---|---|---|
| **Reducing e-mail traffic** | 3.52 | 4.31 | 3.68 | 3.48 | 3.82 |
| **Homogenization** | 6.43 | 5.65 | 6.38 | 6.32 | 6.16 |
| **Training sessions** | 6.32 | 6.09 | 6.14 | 6.08 | 6.16 |
| **Contact persons** | 6.35 | 5.65 | 6.24 | 6.42 | 6.10 |
| **Assistance with problems** | 6.04 | 5.63 | 5.84 | 5.65 | 5.80 |
| **Office days** | 5.37 | 3.25 | 4.47 | 4.57 | 4.30 |
| **Average** | 5.36 | 4.93 | 5.21 | 5.29 | 5.17 |

*Notes:* 1.00 – 2.50 **not effective at all** 4.01 – 5.50 **effective**
2.51 – 4.00 **not effective** 5.51 – 7.00 **very effective**

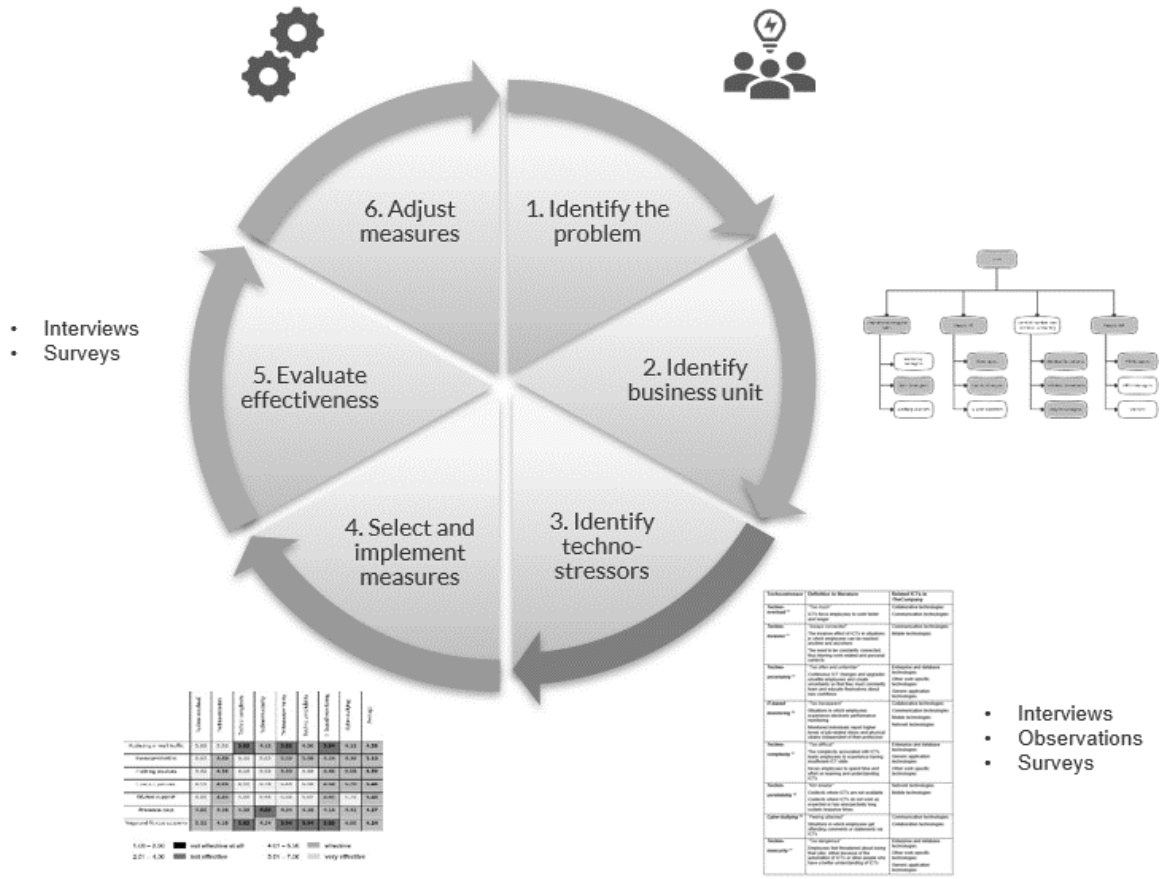
**Figure 4. Effectiveness of the six measures against techno-complexity - divided by departments**

# 5 EVALUATING THE LONG-TERM EFFECTS SIX MONTHS AFTER THE IMPLEMENTATION

In May 2021, six months after implementing the six measures, *TheCompany* is still running five of them. Due to the worldwide Covid-19 pandemic, office days became impossible and were discontinued. Through employee surveys, the technostress reduction team regularly **evaluates the measures to improve and adjust them**. As all measures have been implemented at this point and work as a conglomerate, it is no longer possible to evaluate the effects of the individual measures. The technostress reduction team adjusted the evaluation of the measures and examined how the measures together affect the technostress of employees in the company. Statistics are collected for core parameters such as sick days, and feedback is obtained on the general technostress levels of employees. In retrospect, through implementing the six measures, there are improvements in both employee health and project success at *TheCompany*. Employee sick days had decreased by 22 percent within the last six months, and the results of regular employee surveys show that employees perceive technostressors more seldom and have less adverse health-related consequences. "*The clients even notice that since we implemented the measures, the working atmosphere in projects with TheCompany and the quality of the results are better than before*" (CEO). On the one hand, *TheCompany* considers implementing the measures a success, as feedback and sickness numbers have improved since implementing the measures. On the other hand, there was also a disagreement between the employees, as some measures had varying effects. There was feedback from the IT department that homogenization of ICTs sometimes limits their employees. In contrast, employees in HR and Consulting see it as a simplification in their workplace. As a solution, the IT leaders continue to elaborate and adapt the measures to the needs of each department, such as a limited homogenization of ICTs for the IT department.

# 6 PRACTICAL RECOMMENDATIONS FOR REDUCING TECHNOSTRESS

Based on the practical insights from *TheCompany*, the challenges, and the lessons learned, we now derive six practical recommendations in the form of the six-step process of technostress reduction (Figure 5). These recommendations support business and IT leaders in reducing technostressors and their consequences.




*Note:* For the steps 1, 2, 5, and 6, business and IT leaders are responsible; for step 3, business leaders are responsible; for step 4 IT leaders are responsible

**Figure 5. The six-step process of technostress reduction**

## STEP 1: IDENTIFY THE PROBLEM

As a first step and to determine whether the six-step process of technostress reduction is a suitable approach, business and IT leaders should determine whether the problem in the company is technostress or some other form of stress-related activity. For example, e-mail overload may be a stressful stimulus due to a lack of technology-related knowledge in managing e-mails. It could also be due to a lack of clarity on decision rights, and employees send e-mails to multiple people to reach a decision, which is rather a structural and leadership problem than technology related.

## STEP 2: IDENTIFY BUSINESS UNIT

*TheCompany's* initial step in reducing technostress was to identify the causes, i.e., technostressors, and create the measures based on them. By analyzing the evaluations, the business and IT leaders observed that the different technostressors and their consequences are not equally prevalent in the different departments. The different measures led to varying effective results across

the departments. As a second step, we recommend business and IT leaders identify the business unit within the company where the employees experience technostressors and their consequences, and therefore measures should be applied. The business leaders should primarily identify the affected business unit given that these are managerial rather than technology-specific analyses. IT leaders should support business leaders in identifying the business unit through technical knowledge. For example, once a group of employees experiencing technostressors has been identified by business leaders, IT leaders can combine which ICTs (see Figure 2) are used in this group. Building on this, IT leaders can, cluster more precise business units and include employees using similar ICTs and perceiving technostressors due to their usage. A business unit can be the entire company, a department, a location, or individual workgroups identified as an area suffering from technostress. Hard facts, such as the incidence of sick days after introducing new software, and soft facts, such as complaints brought up in an employee dialogue, can be used to identify that technostress is causing problems in a certain business unit.

## STEP 3: IDENTIFY TECHNOSTRESSORS

The technostress reduction team at *TheCompany* noticed that different technostressors lead to adverse consequences among employees, and there is no single measure to address all technostressors. Different measures are more or less effective for the different technostressors. As a third step, business leaders should identify the technostressors that are currently prevalent in the business unit with the help of an as-is analysis to reveal which technostressors employees experience and therefore need to be reduced. At *TheCompany*, business leaders conducted the as-is analysis using employee interviews, observing employees, and surveys. The case of *TheCompany* shows that it is required to use different methods, e.g., only employee interviews would have identified only some technostressors. We recommend business leaders use a combination of different methods of data collecting. On the one hand, the employees' experiences are considered through surveys or employee interviews, and it can be discovered what bothers, concerns, and thus stresses the employees. On the other hand, the technostressors, which employees can not explicitly name, can be identified by observations. For employee interviews and surveys, business leaders can use key questions from technostress literature to identify the individual technostressors[3]. To act primarily against the most prevalent technostressor or combination of technostressors, but at the same time not to neglect any further technostressors that negatively influence the employees, business leaders must quantify the technostressors within the company. Again, the employees' perceptions and the implicit causes identified through observations of the employees at work are essential. Like the identification of the business unit, identifying existing technostressors within the company is a managerial analysis and should be done by business leaders.

## STEP 4: SELECT AND IMPLEMENT APPROPRIATE MEASURES

Based on the identification and quantification of the technostressors by the business leaders, the IT leaders need to select the most effective measures for the identified technostressors (Figure 3). As the measures described can also have adverse side effects, it is sometimes helpful to combine two measures to compensate adverse side effects of one measure (Pflügner et al., 2020). Determining these combinations of measures as efficiently as possible requires both the IT leaders' broad ICT knowledge and business leaders' knowledge about the various departments' requirements and constraints. After business and IT leaders have selected the appropriate measures, i.e., they know *which* measures must be implemented, IT leaders need detailed knowledge of *how* they should implement these measures and precisely what should be considered or avoided

[3] The questions for an employee survey can be taken from:
Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. *Information systems research*, *19*(4), p. 426
and Fischer, T., Reuter, M., & Riedl, R. (2021). The digital stressors scale: development and validation of a new survey instrument to measure digital stress perceptions in the workplace context. *Frontiers in psychology*, *12*, 646.

during implementation. The implementation of the identified measures should be directed by the IT leaders, as technology-related knowledge and decisions are required. Below, we provide recommendations for IT leaders on how to implement measures based on what we learned from *TheCompany*.

Our case study reveals that when introducing new ICTs or measures, e.g., the e-mail ticket system, it is crucial to involve employees directly from the beginning and increase their motivation to adopt new ICTs and measures. To increase the adoption of the measures, we recommend that IT leaders clear benefits and advantages to employees right from the start and consistently inform them about changes in ICTs and how ICTs should be used within the company, e.g., using training. It is in the interest of both the company and employees to involve employees and departments in the decision-making process of how to implement measures. As individual employees and departments have different requirements, we recommend IT leaders involve them from the beginning and take care of the different requirements when making decisions, e.g., homogenization of ICTs. Involving employees in decisions will make the changes within the company comprehensible to employees and lets them feel included.

Measures to reduce technostress often require a high investment of time and money. *TheCompany's* case has shown that it makes sense to test various measures before rolling them out across the company, such as the e-mail ticket system, homogenization, and office days. We recommend that IT leaders test measures and how they are implemented within a test team and gradually roll out the measures to the entire company. Such a test phase allows identifying whether the measure meets the company's requirements within a limited time and financial effort. We recommend using this test phase as an opportunity to get early feedback from the test team and identify emerging problems early. The measure can be adjusted or discontinued if problems appear without significant consequences.

Many measures, such as training sessions or contact persons, require contributions from employees. As an example, *TheCompany's* case has shown that in certain situations it makes sense to have training sessions conducted by internal employees familiar with new ICTs. In order to carry out these measures effectively, it is important to motivate employees to become involved. We recommend IT leaders to encourage employees' involvement, e.g., by crediting the hours spent preparing and conducting the measure as working hours or implementing incentives, such as free training or additional financial benefits.

As mentioned above, not all measures are equally effective for all companies. Companies change over time, and measures that worked well at the beginning can become less effective due to various reasons, e.g., changing ICT requirements or changing circumstances in the working environment. At *TheCompany*, presence days had to be terminated due to the worldwide Covid-19 pandemic. It has been shown that even measures with all requirements considered at the beginning can encounter problems once they are used. An example is the e-mail system, where the technostress reduction team recognized during use that the initial version partially reduced the working performance of other teams. *TheCompany* introduced an adapted e-mail ticket system, which ultimately successfully reduced technostress. We recommend that IT leaders allow subsequent adjustments to measures, regardless of whether they are already implemented. In that way, IT leaders can deal with necessary exceptions and adjust the measure to the requirements of employees and the company.

## STEP 5: EVALUATE EFFECTIVENESS

After suitable measures are selected and implemented based on the existing technostressors, business and IT leaders should evaluate the effectiveness of the selected and implemented measures against technostress over time. Although business and IT leaders both aim to reduce technostress

in the company, business leaders may be more interested in indices for the company's success. In contrast, IT leaders may focus on technological weaknesses and possibilities for improvement of the implemented measures. We recommend business leaders regularly assess subjective factors, such as employee satisfaction and perception of technostressors, and objective factors, such as burnout rate, sick days, and project success through employee surveys. Meanwhile, we recommend IT leaders use employee interviews to assess the technological pros and cons of the individual measures against technostress. We recommend evaluating the measures individually, for example, identifying weak points of each implemented measure and constantly adapting the measures to the company's environment. We recommend ensuring that all employees can openly give their opinions and feedback during these interviews without fear of possible consequences. It is most effective when all employees can give their opinion in order to be able to identify even minor problems regarding the measures and to adjust the measure as quickly as possible.

During the evaluation of employee interviews, business and IT leaders must be aware of possible adverse crossover effects from the implemented measures. These manifest themselves through contradictory statements by different employees. An example from *TheCompany* is assistance with problems. Employees who have a problem and search for a quick solution are grateful that they can turn to an assisting employee and receive immediate help. That lets employees experience a lower level of technostressors, thus rating the measure as helpful to reduce technostress. Assisting employees currently engrossed in their work are, similar to constant e-mails, distracted from their actual work, and have to deal with other topics. This crossover effect lets the assisting employees experience a higher level of technostressors and rate the measure as ineffective.

### STEP 6: ADJUST MEASURES

After assessing the effectiveness of the implemented measures, business and IT leaders should aim to improve these measures even further, actively adapt them to the technological requirements of the employees, teams, departments, or the entire company, and counteract crossover effects and unintended side effects. Given the required expertise, technological adjustments should be addressed by IT leaders, and managerial adjustments by business leaders. An example of a technological adjustment from *TheCompany* is the e-mail ticket system. Surveys quickly showed that it did not make sense to send all e-mails only every hour, as this measure slowed down communication in other departments. The IT leaders adjusted the measure, adapted the system to the company's specific requirements, and introduced the functionality of tickets to reply immediately. A managerial adjustment was the discontinuation of office days during the COVID-19 pandemic. Regardless of technological influences, business leaders decided that days on which employees had to be on-site were no longer practicable during the pandemic. Since companies, employees, and their experience of technostress are constantly changing, only with the help of monitoring and adjustment of the measures, can technostress be reduced effectively and in the long term. Even if the appropriate measures were chosen and implemented correctly, the six-step process of technostress reduction should be repeated after a certain period. It should be checked if there are still technostressors within the identified business unit, whether the perception of the technostressors has changed, and if different measures are necessary.

## 7 CONCLUDING REMARKS

Today's business environment is increasingly characterized by being constantly available and working regardless of time and place. In addition to many positive aspects, this transformation also entails challenges, such as technostress. Companies need to respond to these challenges to keep employees healthy and competitive. *TheCompany's* case described in this study shows that reducing technostress is a significant challenge for companies and requires careful thought, planning, and

conduction. Business and IT leaders must make intentional decisions regarding the localization and identification of the technostressors, selecting and implementing appropriate measures, and ongoing monitoring and adjustment of those measures. *TheCompany*'s case shows that during these steps, close cooperation between business and IT leaders is necessary (see Figure 5), as technostress reduction requires both technical and managerial decisions. With the help of the six-step process of technostress reduction and the lessons from *TheCompany's* case on how to implement the measures, this article provides business and IT leaders with guidance and recommendations for making these decisions. Following these recommendations will ensure that companies correctly implement the most effective measures depending on the situation and successfully reduce employees' technostressors and adverse consequences in the long term.

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# APPENDIX: RESEARCH METHODOLOGY

We conducted a single case study to identify measures that reduce technostressors and their consequences and develop practical recommendations for IT leaders on how to implement these measures (Tarafdar, D'Arcy, et al., 2015). *TheCompany* carried out the measures in a structured and evaluative way, which provides valuable insights into the development and implementation of measures, the challenges, and the lessons learned. First, we collected qualitative data in the form of expert interviews with employees of *TheCompany* to identify *TheCompany's* overall approach to reducing technostress. Thereby, we gained insights into the identification of individual-level and company-level problems, the introduction of a technostress reduction team, their internal conduction of employee interviews, observations of employees at work, and their internal surveys. This approach allows us to gain deeper insights into the technostressors, the development and implementation of the six measures, and the evaluation and adjustment of the measures. As more and more details emerged in the expert interviews, we second gained access to and analyzed *TheCompany*'s employee survey. *TheCompany* has used the survey before the measures were introduced to evaluate the current situation regarding the usage of ICTs within *TheCompany*. Once the measures were implemented, *TheCompany* extended the employee survey to measure the effectiveness of the six measures in reducing technostressors. In the following, we provide more details on the expert interviews and the employee survey.

## EXPERT INTERVIEWS

We conducted semi-structured expert interviews between December 2020 and May 2021. They lasted between 25 and 60 minutes and were conducted by telephone and face-to-face. The interviews were recorded, transcribed, and analyzed. To create a shared understanding, we defined relevant technostress terms at the beginning and then collected relevant demographic data. We asked the interviewees about measures currently used to reduce technostressors and their consequences in *TheCompany*. Moreover, we also examined the decisive reasons why and how these measures have been implemented. We then identified challenges and problems during the implementation phase to assess the lessons learned, possible adverse side effects of the specific measures and whether a measure successfully reduced technostress. Table 3 provides an overview of the participants in the expert interviews. All experts were involved in the development, implementation, or evaluation of the measures and, as employees, were directly affected by the measures.

**Table 3. Overview of the interviewees (N = 16)**

| # | Age | Gender | Position | Most used non-basic ICTs* |
|---|---|---|---|---|
| 1 | 46 | Male | Head of HR | Datev Portal<br>Travel Expenses HRworks<br>Personio |
| 2 | 42 | Male | IT Project Manager | JIRA<br>Confluence<br>Miro |
| 3 | 41 | Male | Head of Marketing and Sales | Adobe Photoshop<br>Google Analytics<br>JIRA |
| 4 | 38 | Male | Quality Manager | Innovator<br>Smartfacts<br>eLearning Platform |
| 5 | 40 | Male | Medical Consultant | Innovator<br>JIRA<br>Confluence |
| 6 | 39 | Male | Technical Consultant | Smartfacts<br>JIRA<br>SQL Server Management Studio |

| | | | | |
|---|---|---|---|---|
| 7 | 38 | Female | HR Manager | Personio<br>JIRA<br>Academy Portal |
| 8 | 45 | Female | CIO | Google Analytics<br>Oracle<br>Salesforce CRM |
| 9 | 25 | Male | Sales Manager | Google Analytics<br>Adobe Illustrator<br>Microsoft Access |
| 10 | 39 | Male | Developer | Oracle<br>Eclipse<br>Azure DevOpsServer (ADS) |
| 11 | 42 | Male | CEO | Salesforce CRM<br>Innovator<br>Miro |
| 12 | 51 | Male | Developer | Oracle<br>Eclipse<br>Axure |
| 13 | 29 | Male | Developer | Axure<br>Microsoft Visual Studio<br>Oracle |
| 14 | 35 | Female | IT Project Manager | SAP R/3<br>Innovator<br>JIRA |
| 15 | 33 | Female | Sales Manager | Hubspot Marketing Automation<br>Miro<br>JIRA |
| 16 | 37 | Male | Product Owner | JIRA<br>Confluence<br>Miro |

*Note:* * Basic ICTs include laptops, mobile phones, internet, intranet, VPN, telephone, Microsoft Outlook, Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Teams, Skype

## EMPLOYEE SURVEY

The employee survey initially included questions to evaluate the usage of ICTs. After implementing the six measures in November 2020, *TheCompany* extended its initial employee survey to reveal further the effectiveness of the single measures in reducing technostressors. To do so, in January 2021, *TheCompany* included questions to evaluate the effectiveness of the six measures. To analyze both the situation before the measures were implemented and the effectiveness of the implemented measures, we have gained insight into employee surveys from May 2020 (shortly before *TheCompany* defined reduction of technostress as top priority issue) and employee surveys from May 2021 (when the measures were implemented for six months). To reveal the effectiveness of the measures, *TheCompany* explained each identified measure for reducing technostress and asked the participants to assess the effectiveness of this measure to reduce technostressors in general and each of the eight technostressors in particular (using a scale from 1 = 'not effective at all' to 7 = 'very effective'; for results see Figure 3). A mean value across all answers above the mean value of the response scale indicates that the measure is considered as effective.

**Evaluation of the usage of ICTs (Employee survey: May 2020).** To analyze the usage of ICTs and how stressful employees perceive specific ICTs, *TheCompany* investigated which ICTs employees at *TheCompany* have used prior to the introduction of the measures during their daily work, how intense they were used, and how stressful the usage of these ICTs was for the employees. For this purpose, *TheCompany* asked the participants to evaluate the intensity of use and the resulting technostress levels for each ICT using a 7-point Likert scale (1 = not intense/stressful at all, 7 = very intense/stressful). We gained insight into this part of the employee survey, categorized the

ICTs mentioned by *TheCompany* employees according to IS literature[3], and calculated average values for intensity of use and technostress levels (Table 4).

**Table 4. Classification of ICTs, ICTs within *TheCompany*, intensity of use, and corresponding technostress levels (Employee survey: May 2020)**

| Classification of ICTs | ICTs within *TheCompany* *[H = Hardware, N = Network, V = Vendor-based, P = Proprietary software, L = Local, C = Cloud]* | Ø Intensity of use (Standard deviation; minimum; maximum) | Ø Technostress level (Standard deviation; minimum; maximum) |
|---|---|---|---|
| **Mobile technologies** | Laptop (macOS, Windows) *[H]*<br>Mobile phones (Apple, Android) *[H]*<br>Tablet (macOS, Windows, Android) *[H]* | 6.6<br>(0.92; 4; 7) | 2.4<br>(1.23; 1; 5) |
| **Network technologies** | Internet *[N]*<br>Intranet *[N, V, C]*<br>VPN *[N, V]*<br>Citrix *[N, V]*<br>Cisco AnyConnect *[N, V]* | 6.8<br>(0.65; 5; 7) | 3.1<br>(0.93; 1; 5) |
| **Communication technologies** | Telephone *[H]*<br>Conferencing Technology (Skype *[V, L/C]*, Microsoft Teams *[V, L/C]*, WebEx *[V, L]*, Team-Viewer *[V, L]*, myPBX *[V, L])*<br>E-mail (Microsoft Outlook *[V, L/C]*)<br>Wearable Technology (Smartwatch *[H])* | 6.6<br>(0.89; 4; 7) | 4.7<br>(1.70; 1; 7) |
| **Enterprise and database technologies** | SAP R/3 [V, L]<br>SQL Server Management Studio [V, L]<br>Oracle [V, L]<br>Microsoft Access [V, L]<br>Innovator [P, L/C]<br>ERP eEvolution [V, C]<br>Azure DevOps Server (ADS) [V, C]<br>Salesforce CRM [V, L] | 4.8<br>(1.56; 2; 7) | 4.5<br>(1.48; 2; 7) |
| **Generic application technologies** | Microsoft Powerpoint *[V, L/C]*<br>Microsoft Excel *[V, L/C]*<br>Microsoft Word *[V, L/C]*<br>Microsoft Sharepoint *[V, C/L]*<br>Microsoft One Note *[V, C/L]*<br>Axure *[V, C/L]*<br>Eclipse *[V, L]*<br>Microsoft Visual Studio *[V, L]* | 5.2<br>(0.87; 4; 7) | 2.7<br>(1.05; 1; 4) |
| **Collaborative technologies** | Excalidraw *[V, C]*<br>Miro *[V, C]*<br>Confluence *[V, C]*<br>JIRA *[V, C]* | 4.6<br>(1.25; 3; 7) | 3.5<br>(1.52; 2; 6) |
| **Other work-specific technologies** | Adobe Photoshop *[V, L]*<br>Adobe Illustrator *[V, L]*<br>Google Analytics *[V, C]*<br>Cypress *[V, C/L]*<br>Apache J-Meter *[V, C/L]*<br>Gatling.io *[V, C/L]*<br>Ranorex *[V, L]*<br>Smartfacts *[P, C/L]*<br>Amazon Web Services (AWS) *[V, C]*<br>Datev Portal *[V, C]*<br>Virtualization Management vSphere *[V, C]*<br>Backup VEEAM *[V, C]*<br>Travel Expenses HRworks *[V, L]*<br>Personio *[V, C]*<br>Hubspot Marketing Automation *[V, L]*<br>Evalanche E-mail Marketing Solution *[V, L]* | 4.3<br>(2.01; 1; 7) | 3.6<br>(1.77; 1; 7) |

| | | | |
|---|---|---|---|
| | FreeMind *[V, L]*<br>Balsamic *[V, C]*<br>Evernote *[V, C/L]*<br>Oracle VM Virtual Box *[V, L]*<br>Altova XML-Spy *[V, L]*<br>Academy Portal *[P, C]*<br>eLearning Platform *[P, C]* | | |

Our findings show that ICTs differ within each department regarding their intensity of use. In addition to the basic working tools, some ICTs are mainly used within particular departments (see Table 3). For the daily tasks in Marketing and Sales, collaborative technologies such as JIRA and Confluence, as well as work-specific technologies for content design (Adobe Photoshop, Adobe Illustrator) and market and sales analysis (Google Analytics) are crucial. In the IT department, collaborative technologies for product development (JIRA, Confluence), as well as enterprise and database technologies for data management (SQL Server Management Studio, SAP R/3) and development (Oracle, Azure DevOps Server), are necessary. Medical and technical consulting primarily uses collaborative technologies for project management (JIRA, Confluence) as well as work-specific tools for modeling (Innovator, Smartfacts) and enterprise and database technologies for data management (Innovator, Microsoft Access) for daily tasks. For HR, work-specific technologies for the company and administration of employee data and employees themselves (Personio, Travel Expenses HRworks, Academy Portal) are particularly necessary.

Paper VII

# UNINTENDED CONSEQUENCES OF TECHNOSTRESS MITIGATION

## AN EMPLOYEE PERSPECTIVE ON THE EFFECTIVENESS OF MITIGATION MEASURES

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# UNINTENDED CONSEQUENCES OF TECHNOSTRESS MITIGATION

## AN EMPLOYEE PERSPECTIVE ON EFFECTIVE MITIGATION MEASURES TO TECHNO-INVASION AND TECHNO-OVERLOAD


## Abstract

The continuous use of IT, even beyond regular office hours, is considered a cause of technostress, which impairs the health and performance of employees. To mitigate technostress, European countries have established the right to disconnect, and many organizations are struggling to identify and implement other effective measures. Based on a qualitative study with 23 IT workers, five managers, and two CIOs, this study identifies eight technological, social, and cultural measures to mitigate common techno-stressors. By focusing on the employees' perspective, the results reveal the extent to which the measures actually work, showing that well-intended countermeasures, such as email restrictions, might have unintended negative and even harmful side effects. Our analysis shows that mitigation measures seldom work in isolation and without spillover effects. We conclude that although technostress mitigation is complex and mitigation measures adopted in isolation can fail and sometimes cause additional harm, employees still appreciate the effort.


**Keywords:** Technostress, technostress reduction, interventions, techno-invasion, techno-overload, qualitative study, applicability check

## 1 INTRODUCTION

An increasing number of employees report being stressed by the continuous use of information and communication technology (ICT) (Bruijn, 2021), which is called technostress. Technostress can substantially negatively impact employee well-being, satisfaction, and performance (Maier et al., 2019; Maier et al., 2022; Maier, Laumer, Tarafdar, et al., 2021). For example, employees experiencing technostress are often overwhelmed by their work and perceive that their private life has been invaded by ICTs (Tarafdar, D'Arcy, et al., 2015). To protect employees' health (Richter, 2019), European countries have established the *right to disconnect* (Eurofound, 2021), which, basically guarantees the right of employees to disengage from work and refrain from engaging in work-related electronic communications, such as emails or other messages, during non-working hours (Eurofound, 2021). This law illustrates the need for organizations to implement further measures to mitigate technostress, such as banning or disabling after-work email traffic (Koch, 2014).

However, previous research has not established to what degree various mitigation measures actually work. In fact, there are indications that such measures might backfire and increase

technostress levels the next work day (Russell & Woods, 2020). Such findings complicate the broader controversy about whether the mitigations associated with the right to disconnect fulfill the goal of fostering employees' mental health by reducing technostress (Akanabi, 2021; Earwaker, 2021)

Therefore, in order to reduce technostress among employees, organizations must identify which mitigation measures are most effective and which possible unintended consequences must be avoided. Following suggestions in the literature to target specific techno-stressors with specific mitigation measures (Salo et al., 2017; Valta et al., 2021; Weinert et al., 2020), this research focuses on techno-invasion, such as being interrupted after working hours by work topics that creep into one's private life due to ICTs, and techno-overload, such as the feeling of being overwhelmed by ICTs such as emails or electronic messages, as the techno-stressors most related to the right to disconnect, asking:

> *Which organizational mitigation measures effectively reduce techno-invasion and techno-overload, and how do employees experience these organizational mitigation measures?*

To answer our research question, we conducted a qualitative study based on 30 semi-structured interviews with white-collar workers, specifically 23 IT professionals, five managers, and two CIOs working in the IT departments of two medium-sized organizations in the German production industry. In the year leading up to our study, both organizations introduced measures to mitigate the negative effects of techno-invasion and techno-overload among employees. We surveyed IT professionals and managers because they are particularly vulnerable to techno-invasion and techno-overload due to their constant connectivity with their work, their high workload, their high degree of responsibility for the organization's infrastructure, the continuous availability of their work IT devices, and their spatial flexibility (e.g., Maier, Laumer, & Eckhardt, 2015; Moore, 2000). Our interviews revealed that the firms initiated eight mitigation measures, four addressing techno-invasion and four addressing techno-overload, which we categorize along three mitigation dimensions: technological, cultural, and social mitigation. We assessed mitigation efficacy and unintended consequences by asking employees how they perceived and experienced the mitigation methods in our interviews with them.

Our results contribute to the literature on technostress and organizational technostress mitigation by identifying and assessing the efficacy of technological, cultural, and social mitigation measures for techno-invasion and techno-overload. We also reveal unintended looping effects between the mitigation of techno-invasion and techno-overload, such that mitigation measures designed to reduce one techno-stressor can increase the other. We also identify techno-responsibility as an IT-personnel-specific techno-stressor that is intensified when perceiving techno-invasion and techno-overload. We also contribute to practice by providing guidance on implementing organizational technostress mitigation measures effectively.

# 2 THEORETICAL BACKGROUND

In this section, we outline the theoretical concepts of technostress and techno-stressors and discuss related research on mitigation measures.

## 2.1 TECHNOSTRESS AND TECHNO-STRESSORS

*Technostress* is a term used to describe the stress caused by ICT usage (Ragu-Nathan et al., 2008), which encompasses the translation of techno-stressors into techno-strain (Ayyagari et al., 2011). Techno-stressors are stressful demands caused by using ICTs (Ragu-Nathan et al., 2008) that either challenge or hinder the user (Califf et al., 2020). Techno-strain is an adverse reaction to techno-

stressors that influences ICT users' performance, satisfaction, and well-being (Pirkkalainen et al., 2019; Srivastava et al., 2015; Tams et al., 2018). While using ICTs, employees encounter various techno-stressors (Fischer et al., 2021; Maier et al., 2022; Maier, Laumer, Eckhardt, & Weitzel, 2015; Ragu-Nathan et al., 2008). Previous literature focuses on five in particular (Pirkkalainen et al., 2019; Srivastava et al., 2015): *Techno-complexity* (feeling incapable of handling intertwined systems), *techno-insecurity* (fearing being replaced by ICTs), *techno-uncertainty* (struggling with one's ICT capabilities due to ever-changing systems), *techno-invasion* (experiencing privacy invasion by ICTs), and *techno-overload* (feeling overwhelmed by the number of requests received through ICTs) (Ragu-Nathan et al., 2008). The last two techno-stressors are closely associated with how employees communicate with each other, the issue of constant connectivity, and the right to disconnect. This study focuses on techno-invasion and techno-overload, which we describe in more detail below.

*Techno-invasion* is when work-related demands spill over into employees' private lives, even after work hours or when they are on vacation. Techno-invasion blurs the line between personal and work-related matters, leaving employees feeling permanently "connected" to work. A widespread symptom of techno-invasion is when employees think they have to stay in contact with their work and reply to emails even during non-working hours. Employees perceiving techno-invasion feel that ICTs are invading their personal lives (Ragu-Nathan et al., 2008). *Techno-overload* is when employees perceive that their work ICTs are forcing them to work faster or handle more tasks than they can or are constantly interrupting their work. An example of techno-invasion is when employees feel the need to use work ICTs to draw on different streams of real-time information from internal and external sources, mobile devices, and collaborative applications, leaving them experiencing information overload (Ragu-Nathan et al., 2008). Both of these techno-stressors have received extensive attention in IS research and are closely related to organizational communication norms and rules (Piszczek, 2017; Srivastava et al., 2015). In the following section, we summarize the findings of extant literature into various strategies and approaches for reducing or mitigating techno-stressors.

## 2.2 MITIGATION OF TECHNO-STRESSORS

Organizations benefit by reducing the level of technostress among their employees (Pirkkalainen et al., 2019). Traditionally, research into organizational technostress mitigation focuses on reducing overall techno-stressors rather than on strategies for mitigating specific techno-stressors (Valta et al., 2021). Organizationally implemented measures such as providing technical help for users through help desks (technical support provision), facilitating the sharing of technical knowledge (literacy facilitation) and training, and encouraging user involvement (involvement facilitation) have been found to reduce techno-stress levels in general (Tarafdar, Pullins, & Ragu-Nathan, 2015). Moreover, organizations can reduce the strain that employees experience due to techno-stressors by helping them better manage work-home boundaries (Benlian, 2020).

In addition to such general technostress mitigation research, more recent literature also investigates how successfully certain measures mitigate specific techno-stressors (Valta et al., 2021). For example, it has been demonstrated that organizations can help employees better deal with techno-overload in email communication by offering cognitive behavior skills training (Soucek & Moser, 2010). Implementing technical solutions for interruption control lets users decide when to respond to ICT-transmitted information and helps them control techno-overload (Galluch et al., 2015). Identifying contact persons and encouraging mutual support to solve technical problems effectively reduces techno-overload while reducing email traffic is the most effective way to reduce techno-invasion (Valta et al., 2021). These studies show that organizations can introduce measures to mitigate techno-stressors in general and can adopt strategies to reduce specific techno-stressors effectively.

However, previous research indicates that mitigation measures are not equally effective at reducing different techno-stressors, so organizations should implement mitigation measures that target specific techno-stressors (Valta et al., 2021). Based on this finding, this study thus focuses on the measures organizations can implement to mitigate techno-invasion and techno-overload specifically, by restricting or managing work-related information and communication transmitted via ICTs. For example, such measures to mitigate techno-invasion or techno-overload may include after-work email traffic restrictions, such as those introduced by Volkswagen (Koch, 2014), and communication structures regulating how employees communicate.

Based on our review of extant literature and our practical knowledge, we see three main opportunities to contribute to techno-stressor mitigation research. First, most studies focus on organizationally implemented mitigation measures targeting the ICTs themselves, such as technical solutions, ICT support, or ICT skills (Galluch et al., 2015; Tarafdar, Pullins, & Ragu-Nathan, 2015). As technostress mitigation takes place in rich social contexts, we expect mitigation dimensions other than technological might offer further opportunities to address techno-invasion and techno-overload (Pflügner, 2022). Going beyond a culture of mutual support to mitigate techno-stressors (Valta et al., 2021), we focus on mitigation measures that go beyond the technological dimension to also consider a cultural and social context dimension.

Second, most extant research takes an organizational perspective and focuses on technostress among non-IT professionals (e.g., Tarafdar, Pullins, & Ragu-Nathan, 2015). We expect to gain valuable insights by considering the perspectives of employees, especially IT professionals, who are particularly vulnerable to constant connectivity with their work, blurring boundaries and work-family conflicts due to their specific and ubiquitous work environment (Maier, Laumer, & Eckhardt, 2015; Moore, 2000). For example, IT professionals bear the often increasingly large responsibility for their organizations' digital infrastructure, as more and more employees across the organization rely on virtual workspaces and require support beyond core working hours. Further, IT professionals are scarce resources, and IT departments are often understaffed, causing higher workloads for the remaining team (Maier, Laumer, Joseph, et al., 2021).

Third, we expect that considering the employee perspective will enable us to analyze unintended and possibly harmful side effects of measures introduced to mitigate technostress. In our practical experience, employees sometimes perceive that organizational mitigation measures restrict how they organize their workday and how much flexibility they have, which can increase perceived techno-overload the next work day (Gibson, 2014). Organizations and employees would benefit by understanding the potential unintended negative effects of mitigation measures, which can negatively impact employees' mental health as much as the techno-stressors they aim to reduce. To fill these three research gaps, we conduct a qualitative study, which we describe in the next section.

# 3 METHODOLOGY

To identify organizationally implemented mitigation measures and understand how they affect employees' perceptions of techno-invasion and techno-overload, we take an exploratory approach and conduct a qualitative study based on semi-structured interviews. A qualitative study is appropriate because open questions give participants more space to consider the design of emerging challenges associated with a specific mitigation measure. The particular perspectives of the participants play a significant role in this approach (Myers, 2019), which allows us to obtain a more detailed and in-depth understanding of mitigation measures and of how employees perceive and experience those measures (Wiesche et al., 2017).

## 3.1 DATA COLLECTION

For our qualitative study, we conducted semi-structured interviews with 30 white-collar workers, specifically 23 specialists, five managers, and two CIOs working in the IT departments of two medium-sized organizations in the production industry, one in fashion and one in systems engineering. Both organizations are headquartered in Germany and have locations in and outside Europe. Both organizations are aware of the potential adverse effects of technostress on employees and implemented measures to mitigate such effects during the year prior to our study. In our sample of employees (see Table 1 for demographics), we had an equal distribution of males and females and an average work experience of 8.75 years. All employees rated their computer self-efficacy as good or very good and reported using ICTs during most of their workday. The two CIOs were males in their late forties and had at least ten years of C-level experience.

**Table 1. Demographics (N = 30)**

| **Age [years] Mean 35.26; SD 8.34** | | **Gender** | | **Professional sector** | | **Job role** | | **Work experience [years], Mean 8.75; SD 2.54** | |
|---|---|---|---|---|---|---|---|---|---|
| < 26 | 13.33% | Male | 53.33% | Fashion | 53.33% | Specialist | 76.67% | < 5 | 6.66% |
| 26-35 | 20.00% | Female | 46.67% | Systems engineering | 46.67% | Manager | 16.67% | 5-10 | 40.00% |
| 36-44 | 43.33% | Other | 0.0% | | | CIO | 6.66% | 11-15 | 36.66% |
| > 44 | 23.33% | | | | | | | > 15 | 16.66% |
| *Note:* SD = standard deviation | | | | | | | | | |

We drew on related literature (Galluch et al., 2015; Salo et al., 2020) in establishing procedures and designing our interview guideline (Myers, 2019) (see Appendix A for details) and pretested the semi-structured interview guideline with nine working students. Based on the pretest, we sharpened our focus on organizationally implemented mitigations rather than measures employees implement unilaterally.

We divided our interviews into three sections. In the first section, we asked all participants about their current work situation, whether they had demanding and stressful experiences involving ICT usage in the past, and whether they considered stress related to ICT usage a burden at work and/or outside work. We additionally asked the CIOs how they rate the overall situation in their teams and organizations. We described the five techno-stressors (techno-invasion, techno-overload, techno-insecurity, techno-complexity, and techno-uncertainty) identified in extant literature (Ragu-Nathan et al., 2008) to the participants without mentioning the concept name. This approach enabled us to understand the role technostress plays overall in their workday and other potential sources or categories of technostress related to how employees communicate with each other, the issue of constant connectivity, and the right to disconnect beyond techno-invasion and techno-overload.

In the second section, we gathered information about organizationally implemented measures to mitigate technostress. We followed an iterative approach: starting with the CIOs, we first asked each participant to identify and describe any and all measures introduced by their organization to mitigate technostress. In each subsequent interview, we mentioned the measures that had already been identified to confirm that all employees were aware of these mitigation measures. We chose this iterative approach to ensure that we had a comprehensive overview of each organization's mitigation measures.

In the third section, based on the results of the first two sections, we asked the employees how they experienced and perceived the organization's mitigation measures in terms of their efficacy in

reducing techno-invasion and techno-overload. Our intention was to identify the intended and unintended effects associated with each measure.

To ensure transparency and confidentiality, we explained our research purpose and assured participants that their interviews would be anonymous and not personally attributable in any subsequent step. We regularly confirmed that we had understood the participants' responses fully and correctly by repeating their statements back to them and strove not to influence them with our own views. On average, each interview lasted approximately 45 minutes.

## 3.2 DATA ANALYSIS

All interviews were transcribed in German, translated into English, and coded with MAXQDAplus 20 following the coding scheme presented by Myers (2019) (see Appendix B). Table 2 provides an overview of this approach. During the sampling, we first identified the basic units of the text to be analyzed. We used descriptive and interpretive coding to identify themes and measures to reduce techno-invasion and techno-overload. Then we categorized the mitigation measures' effects into intended and unintended. Two researchers analyzed the data independently and then resolved any ambiguities in the coding process. Using one interview as a sample data set, we reached inter-coder reliability of 0.90, calculated as the proportion of agreements to the total number of codes (Feng, 2014; O'Connor & Joffe, 2020). In that interview, there was agreement on 37 of the total 41 codes. After analyzing the interview data, we confirmed our interpretations with the participants to ensure interpretative validity.

**Table 2. Overview of the four-step coding approach (adapted from Myers 2019)**

| Step | Summary of the applied procedure |
|---|---|
| **First step: descriptive coding** | Transcribe and translate interviews, segment text, and assign descriptive codes deductively to identify mitigation measures and intended techno-stressor mitigation effects and unintended adverse side effects. We link mitigation measures and effects inductively. |
| **Second step: interpretive coding** | Apply interpretive coding to descriptive codes from the first step, linking mitigation and associated effects to the techno-stressors |
| **Third step: review interpretive coding** | Verify accurate coding by reviewing interpretive codes and calculating inter-coder reliability |
| **Fourth step: categorize codes** | Categorize interpretive codes into mitigation dimensions |

# 4 RESULTS

In this section, we present our results following the interview guideline structure: participants' understanding of technostress and the role it plays for them at work, mitigation measures categorized along technological, cultural, and social dimensions, and participants' assessment of the efficacy of mitigation measures.

## 4.1 THE ROLE OF TECHNOSTRESS

Our interview participants described their work environment as demanding, in part due to the constant work with ICTs. The participants do not describe experiencing techno-uncertainty or techno-insecurity while at work. Rather, they view handling the complexity of ICTs as a ubiquitous phenomenon or the new normal. The participants report perceiving techno-overload and techno-invasion as 'stressful' demands, as demonstrated by the following quotation from a specialist:

*I am honestly not worried that some ICT could take away my job, even though I am aware that technology is able to do some things that humans lack the ability to do. Of course, none of us can know everything about every system we work with, but we can learn, which is just part of the job. The same applies to the complexity issue mentioned earlier. We live in an intertwined, global, complex world, which our ICTs also reflect. It is somewhat normal and not stressful for me. Rather, I would say the way we use technology is stressful to me, such as the constant inflow of information, requests, and messages, even at home and after work. You can handle a certain amount of it, but then you just need a break from all that.*

The CIOs agree with this assessment by their employees. However, in terms of how workplace technostress affects them, both stated that even if they are stressed, they prefer not to think about it much so they can focus on the big picture and make strategic decisions, as illustrated by the following quotation from a CIO:

*I believe many employees are overwhelmed with requests and sometimes struggle to prioritize what to do first. Moreover, if they cannot finish their work, they take it home and think about what to do next or better tomorrow, which stresses them. I understand those issues. I work in the IT department of a medium-sized company where IT does not count as a core competency. We have a lot of work, a constant workload of 120 percent. That is a reality, and you have to deal with it every day. Nevertheless, I love my job. So, in order not to be stressed too much, I have learned that you cannot do everything at once, and I strictly separate my private life from work to spend quality time with my family. If you are responsible for the corporate IT infrastructure, if you begin to reflect on those things, you cannot do your job.*

Based on this insight, we identify a stressor that we call techno-responsibility, which results from bearing responsibility for the ICTs implemented in the organization and the consequences that your decisions and systems can have for employees. The following quotation from the CIO at the systems engineering organization illustrates this techno-stressor:

*The only thing I sometimes worry about is the responsibility of this job. Whenever we choose a new system or decide to automatize certain steps of a work process, we must remember that our employees have to work with it every day. The aim is to make their job easier, but I do not know [if it does]. If it burdens them additionally instead or intensifies their stress, I am the one who is responsible and who puts them in this situation in the end. So, we must decide very carefully what we will implement.*

While this CIO primarily refers to the burden of being responsible for possible negative consequences for employees' mental health in response to the managerial decision to implement an ICT, the CIO of the fashion organization also perceives the growing responsibility for the organization's infrastructure as a stressful demand for IT specialists. The CIO summarizes it as follows:

*With the increasing number of employees working remotely, the company now depends more than ever on the IT department. Consequently, IT specialists, who were responsible for the infrastructure enabling remote working tools in the past, suddenly have to handle a lot more users burdening this infrastructure and are confronted with a situation where small mistakes or malfunctions can eventually bring the whole company to a standstill. I think this new level of responsibility can be stressful, especially because those team members did not ask for it in the first place, are overwhelmed with requests and contacted after hours.*

## 4.2 IDENTIFIED MITIGATION MEASURES

After clarifying the role of technostress in the organizations, we asked the participants what measures their organization had introduced to mitigate technostress, specifically techno-overload and techno-invasion. Our analysis reveals eight mitigation measures, four addressing techno-invasion and four addressing techno-overload, which we categorize along three mitigation dimensions: technological, cultural, and social mitigation. In line with prior research (Tarafdar, Pullins, & Ragu-Nathan, 2015), we define technological mitigation measures as measures involving

ICTs and their features. Based on the interviews, we define cultural mitigation measures as those related to workplace policies and understandings manifested in the organizational culture, such as a shared understanding of the way of working and communication. Social mitigation measures require or concern interaction with others, such as introducing communication rules or fostering attentiveness towards one another. In the following section, we present the measures to mitigate techno-invasion and techno-overload.

### 4.2.1 Measures to mitigate techno-invasion

Techno-invasion refers to employees' feeling of constant connectivity to work during non-working hours and the invasion of their private life through ICTs. One predominantly technological measure to reduce such techno-invasion is restricting the usage of business end devices in private contexts to avoid blurring boundaries. This measure includes a clear *separation of personal and business devices* and the deactivation of online access to business devices during predefined times. This measure ensures that employees can and do not receive business-related emails or phone calls during non-working hours. A specialist describes the mitigation measure as follows:

> *During non-working hours, we can activate an automatic do not disturb mode on our business devices in a specified timeframe that matches our office hours. As a result, in that timeframe, calls or messages are not displayed but are somehow stored and shown the next day. We can also switch off the device if we do not need it for anything at home.*

A second and similar technological measure is an explicit *restriction of email traffic* (Stich et al., 2019). This measure includes automatized and manual measures restricting email traffic to a particular timeframe, such as by programming servers to not deliver emails outside of working hours. A manager explains this as follows:

> *Within the organization, emails are not delivered between eight o'clock in the evening and six o'clock the next day to ensure that people get their rest. These rules also apply to those working with international teams regularly. However, with this measure, we can opt out for a certain amount of time if we are working at different times for a specific project or something.*

According to both CIOs, a significant issue with techno-invasion is that employees do not disconnect because they think colleagues and especially executives expect that they must respond immediately to an incoming request. The CIOs think that employees feel irresponsible if they do not respond until the next workday. The CIO of the systems engineering organization decided to confront this reason for not disconnecting by implementing a *valuable break/free time culture* that combines two mitigation measures, one cultural and one social. The cultural mitigation measure is establishing an emergency communication channel, especially for sensitive tasks. Employees are only contacted via this channel in urgent, non-deferrable cases, such as a server breakdown. The CIO explains the mitigation measure as follows:

> *Our organization uses a short message communication tool to implement channels that gather communication around certain topics. One of these channels has been defined as the "emergency channel", meaning that this is the only channel I have to respond to immediately, like within an hour, if something comes in. Those channels have been introduced for teams responsible for sensitive tasks, like [maintaining] the server or the cooling system for machines. Conversely, this also means that everything that does not come in via this channel can be easily ignored and handled the next workday. Employees must decide whether it is an emergency that cannot wait and is worth disturbing others' valuable free time. If that is not the case, they contact their colleagues the next day and not in their valuable free time.*

The social mitigation component of the valuable break/free time culture depicts a *clear communication of expectations* between executives and employees and among employees. It bases on the tenet that no one, no executive, and no colleague expects to receive an answer during non-working hours or during breaks out of respect for the new creativity and engagement that results from having that free time or taking those breaks. Hence, having free time or taking a break is not associated with laziness or low productivity but with the renewal of physical and creative energies with medium- and long-term benefits for the individual, colleagues, and overall project or business goals. The CIO elaborates:

> *I try to create an awareness that I do not expect my employees to respond to my requests during non-working hours, and I also try to transfer that climate to the team. I want them to develop a "social awareness" across the team that valuable free time helps to foster the project and does not delay it. Free time has been negatively connoted with laziness and low productivity in the past. This connotation also affects communications within the team. As a result of that mitigation measure, I expect that having respect for others' work, achievements, and the free time and breaks they need to perform will bring more appreciation into the conversation.*

According to the CIO, in the long-term, this mitigation measure could help employees to handle their techno-overload better if they consciously decide to take little breaks to step back and reprioritize their workload and not work at home during their free time.

### 4.2.2 Measures to mitigate techno-overload

Employees perceive techno-overload when they experience increased work volume and speed due to ICT usage (Tarafdar, Pullins, & Ragu-Nathan, 2015). A technological mitigation measure is to *implement good practices for internal communication* via ICTs. One example is the implementation of interruption and spam control in communication tools, such as restricting the number of recipients of emails to reduce the number of emails forwarded or shared within the organization. Another example is the introduction of enterprise social networks, such as Yammer, or internal short message tools, such as MS Teams, to reduce email traffic and communication efforts and encourage individuals to interact informally instead. A specialist explains:

> *Besides spam filters, mute functions, and so on, the organization has introduced an instant messaging tool to reduce the number of emails we receive and to structure information better for recipients. Via the channels within the instant messaging tool, we can provide information for specific groups, and one can ask short questions with short answers without formally writing an email.*

In the same spirit, a cultural mitigation effort we identified incorporates a more efficient way to get support or information by *introducing a pull-not-push culture*. This mitigation includes efficient substitutes for contacting colleagues via emails, such as good internal wikis, FAQ pages, or chatbots handling standard internal requests. Employees can pull information when they need it and cause fewer interruptions by asking colleagues. Organizations must establish a "give and get advice" policy. Employees learn how to contribute to the joint knowledge base, train a chatbot, and help each other find information more efficiently. One CIO summarizes the cultural mitigation measure as follows:

> *The only way to reduce the amount of largely unneeded information and interruptions is to establish structures and the culture of consuming knowledge when necessary and when it fits my current task. Existing knowledge has to be gathered and processed to make this happen. I know that this is nothing employees want to do because of time, effort, and willingness issues. However, if everyone contributes, it is easier to convince employees to share their knowledge. For example, we had one employee who was pretty good with presentation tools and then held a tutorial on designing good slides. Others collected healthy eat-out options for lunchtime, so I believe everyone can contribute something.*

One social mitigation measure to reduce techno-overload is *communicating the issue to an executive* who can delegate ICT-related demands and lessen the workload for one specific employee. The executive can help to prioritize incoming requests and tasks. A manager described this as follows:

> *Normally, we prioritize and organize our workload by ourselves, but there are certain situations, especially if there is a project with many stakeholders, where there are too many requests and messages. In that case, we can speak to an executive and ask for help in prioritizing work or maybe rethink responsibilities for certain projects. I offer that to my team, but I also can talk to executives about it.*

Another social mitigation measure to reduce techno-overload is to *establish off-screen communication opportunities*. This measure includes informal communication in team areas or formal communication in meetings outside. The CIO of the fashion organization explains this mitigation as follows:

> *In my opinion, the key to reducing stress is communication. If employees feel overwhelmed by requests and interruptions by ICTs, I believe it is imperative to create off-screen communication opportunities. For example, we have an area where our employees can play foosball, talk about projects and stressful experiences, and get support from others in an informal environment, making it much easier to communicate those issues than with an executive. Further, we try to establish "walk and talks", which means we meet while going for a walk. This meeting form reduces interruptions, is healthy, and gives us a break from virtual communication tools.*

## 4.3 EMPLOYEES' ASSESSMENT OF MITIGATION MEASURES

While all the presented mitigation measures aim at reducing techno-invasion and techno-overload, interview participants varied in terms of their assessment of their reasonableness and effectiveness. After introducing participants' assessments (summarized in Table 3), we discuss the deduced effects based on data collected in the interviews (see Appendix, Table 4).

**Table 3. Overview of mitigation measures and their assessment by role**

| Techno-stressor | Mitigation dimension | Mitigation measure | Intended/ unintended effects | Assessment by role | |
|---|---|---|---|---|---|
| | | | | Specialists | Managers |
| Techno-invasion | Technological | Separation of private and business devices | Intended | • Clear end of the workday<br>• Reduction of blurred boundaries<br>• No accidental involvement in business-related communication | • Clear end of the workday<br>• Reduction of blurred boundaries |
| | | | Unintended | • Stressful to use multiple devices<br>• Loss of flexibility<br>• No free choice of the end device | • Loss of flexibility<br>• Deceleration of work processes<br>• Loss of decision autonomy |
| | | Restriction of email traffic | Intended | • Clear end of the workday<br>• Reduction of blurred boundaries | • Clear end of the workday<br>• Reduction of blurred boundaries |
| | | | Unintended | • Postponing of overload<br>• Loss of flexibility | • Loss of flexibility<br>• Deceleration of work processes<br>• Loss of decision autonomy |
| | Cultural | Valuable break/free time culture: intro-duction of an emergency channel | Intended | • No feeling guilty for not staying up to date constantly at home<br>• Fosters disconnection from work<br>• Push of urgent messages, no need for constant pull | • Clear attribution of responsibilities<br>• Fosters disconnection from work<br>• Shared understanding of the value of free time |
| | | | Unintended | • Still a need to constantly check the channel<br>• Channel not in an isolated tool<br>• Fear of misuse | • Abuse of free time burdens others with more work<br>• Need to establish core working hours |
| | Social | Valuable break/free time culture: clear communication of expectations | Intended | • No feeling guilty for not staying up to date constantly at home<br>• Fosters disconnection from work | • Fosters disconnection from work<br>• Shared understanding of the value of recreation |
| | | | Unintended | • Need to reach mutual agreement with all employees | • Abuse burdens others |

| Techno-stressor | Mitigation dimension | Mitigation measure | Intended/ unintended effects | Assessment by role | |
|---|---|---|---|---|---|
| | | | | Specialists | Managers |
| Techno-overload | Technological | Good practices for internal communication | Intended | • Employees receive fewer requests<br>• Fewer interruptions<br>• Fosters informal communication and culture of information pull | • Employees receive less unneeded information<br>• Fewer interruptions<br>• Fosters informal communication and culture of information pull |
| | | | Unintended | • Fosters multi-channeling<br>• Need for guidelines on when to use which tool | • Fosters multi-channeling<br>• Need for awareness that an instant message does not mean an instant response |
| | Cultural | Introduction of 'pull not push' culture | Intended | • Employees receive less unneeded information<br>• Fewer interruptions by standard requests<br>• Strengthens organizational IT infrastructure | • Employees receive less unneeded information<br>• Fewer interruptions by standard requests<br>• Strengthens organizational IT infrastructure<br>• Strengthens work autonomy<br>• Better support through higher reliability<br>• Based on wikis, first-level support can help with elaborated tasks |
| | | | Unintended | • Extra work and extra screen time<br>• No guaranteed usage | • High dependency on employees' willingness to contribute<br>• High dependency on IT infrastructure |
| | Social | Communication with executive | Intended | • Better prioritization of requests<br>• Reduction of workload | • Early mitigation possible |
| | | | Unintended | • Highly dependent on specific executive and trust towards that person<br>• Fear of being perceived as less competent and less resilient than others | • Reduction is not always possible<br>• Higher workload for executives and too much involvement in employees' private affairs<br>• No substitute for professional help |
| | | Introduction of 'off-screen' communication opportunities | Intended | • Reduction of ICT use and screen time<br>• Working break<br>• Exercise and fresh air | • Working break<br>• Higher creativity<br>• Potential for social support |
| | | | Unintended | • Extra coordination, preparation, and the post-processing effort<br>• Only particular meetings suitable for off-screen | • Dependency on team structure and relationships |

Our analysis reveals that employees perceive none of the identified mitigation measures as purely positive. On the one hand, the interviewed specialists and managers confirm the potential of the identified mitigation measures to reduce techno-invasion/techno-overload. On the other hand, they also see some obstacles associated with the mitigation measures, including challenges, additional tasks, and emotional burdens that may, in turn, contribute to stress. When we compare how individuals in different roles assess the measures, we see that managers focus more on the consequences for the organization and the success of work processes than specialists, who focus more on their technostress reduction. Further, while the CIOs and specialists seemed convinced and persuaded that they could work together to reduce technostress, the managers were more restrained and afraid of the misuse of the mitigation measures.

### 4.3.1 Assessments of the efficacy of techno-invasion mitigation measures

Employees acknowledge that the mitigation measures reduce interruptions during non-working hours, which can help sharpen work-life boundaries, create a clear end of the working day, and support the use of free time for leisure and non-work activities. They acknowledge that technological mandates that ensure more clearly defined working hours and a shared understanding of the value of breaks supported by the valuable break/free time culture enable them to take breaks and rest when they are not working. They report that these mitigation measures are intended to reduce techno-invasion. A specialist reports:

> *I am the type of person who is likely to stay connected with work at home. Even though I know that I do not have to do it, I normally check my email regularly because I do not want to miss anything and do not want to disappoint my manager or someone on my team. If I do not have to check on my mail account because I receive critical messages directly, and if I know that I am not falling short of expectations by taking a break, it helps me calm down and distance myself from my job.*

The employees we interviewed report having difficulties using different, less customized devices, or devices with overly regulated application restrictions and user rights. Limiting email access to certain hours severely reduces flexibility and can make it more difficult for employees to balance their work and non-work demands in a way that fits their schedules, thus reducing their decision autonomy. They report that this sometimes slows down work processes and postpones tasks to the next day, leaving them to face a flood of unread emails. One specialist reports:

> *So now they have introduced these email restrictions that no one can be disturbed in their private time. While I understand that some colleagues need that to disconnect from work, I cannot imagine that that solves any problems for me. Granted, I am not disturbed in the evening, but who helps me out when I am back in the office and swamped with emails? Honestly, starting every day by answering tons of emails is not pleasant. You feel like you will not make it through them all before the workday has even begun. In addition, I am worried that some of my colleagues go overboard on breaks, and those who take breaks responsibly end up doing all the work. I must admit that this has not happened yet, but managers must keep an eye on that.*

In essence, mitigation measures intended to reduce techno-invasion can have the unintended adverse effect of increasing the level of techno-overload if work is postponed and multiple requests come in simultaneously.

### 4.3.2 Assessments of the efficacy of techno-overload mitigation measures

The intended positive effect of measures to reduce the overall number of technology-induced requests, interruptions, and information that an employee receives is to mitigate techno-overload. Examples of such mitigation measures include strengthening the IT infrastructure by adopting or improving knowledge-sharing structures, such as wikis or chatbots, to reduce standard requests to knowledge providers and provide on-demand access to information to knowledge consumers. Introducing short message tools fosters informal communication and helps clarify which

communication channel should be used for what purposes. One manager explains how different requests are suitable for different communication channels as follows:

*I enjoy writing my colleagues direct messages via our internal social network. It is faster than writing an email because it is informal. Granted, it still interrupts your work, but the questions are more focused and the answers can be short, so I do not have to invest as much thought as with an email. However, it sometimes seems like [some people think] instant messaging implies an instant response. If colleagues do not receive a response from me instantly, they either write question marks in the chat that constantly interrupt me or write me emails on the same topic as well. Therefore, we need clear instructions on which tool to use for what and how to use the tools politely and respectfully.*

Along similar lines, a specialist stresses that the organization should provide "work-only" tools to avoid blurring boundaries that cause techno-invasion in an attempt to reduce techno-overload:

*I see many advantages in using short message tools to achieve more direct communication, but only as long as they are exclusively work-related. I must remind myself not to download those tools to remote devices to prevent interruptions after working hours.*

The intended positive effects of communicating with executives include clearer priorities, task reallocation and early intervention, such as support for consulting a mental health professional if perceived techno-overload is affecting employees' mental health. However, the effectiveness of such measures is highly dependent on the employee's relationship with the executive, whether the employee fears that the executive will perceive him or her as less competent or resilient, and how the executive handles the situation. One specialist reports:

*A few weeks ago, my executive invited us to speak to him about our work conditions during a weekly meeting with all our colleagues. He told us that he had the impression that most of us worked the whole day without even taking a break or going to the coffee corner. He suggested we could talk about why this is the case. I decided to open up and share my perception that I was suffocating in emails and requests and that I sometimes do not know where to start. It was not easy to say that, and I felt like a complete mess by confessing that I felt overwhelmed, but suddenly my colleagues shared their stories and said they felt the same. Our executive listened carefully and offered direct support in prioritizing tasks and defending our department against unnecessary requests from others. Feeling my colleagues' and my executive's understanding and having the impression we would get this done together helped me feel better and gave me the confidence to get it done. I was glad my executive reacted with much understanding since I was worried my admission could make me look weak and vulnerable in his eyes. When I think back to my last executive, a conversation like that would have been impossible because we did not share that level of trust.*

A manager adds:

*I understand the thought process behind that mitigation measure, but, besides the extra workload for us, from my point of view, a reduction or reallocation of tasks is not always possible, and as an executive, I have limited means to actually help my employees. Also, I think a certain professional distance can be helpful, so I do not want to get too deeply involved in employees' problems, as I believe such talk cannot replace professional help.*

The employees appreciate efforts to reduce screen time and encourage working outside, but, similar to with the other mitigation measures, they worry that avoiding unavoidable interruptions and requests can create other problems. A manager explains:

*I like the idea, and I try to use walk-and-talks whenever possible, but we have to be aware that we cannot hold every meeting like that and that it requires additional preparation if you cannot use slides or other tools. Also, whether a team comes together and seizes opportunities like foosball depends on the team structure and*

*relationships, so we do not know whether the mitigation measures have the intended effect or create more tasks and more stress.*

# 5 POST-HOC ANALYSIS: RESEARCH RELEVANCE AND TRANSFERABILITY TO PRACTICE

Since our study addresses what organizations can do to reduce techno-invasion and techno-overload for their employees, we are interested in whether and how practitioners can use our results. To this end, we presented and discussed our results post-hoc with the interviewed CIOs and performed an applicability check to demonstrate the study's relevance, importance, accessibility, and suitability in practice (Gill & Bhattacherjee, 2009; Te'eni et al., 2018). Additionally, we spoke with a third CIO, who has not been interviewed for this study, to get an external perspective. This third CIO also works in a medium-sized organization in the German production industry, which is currently discussing the matter of technostress and possible organizational mitigation measures but has not yet introduced them.

In terms of relevance and importance of our study, all three CIOs agree that technostress and employees' mental health are essential topics for organizations and report that there is little to no common standard way to approach these issues. In their role as decision-makers, they would appreciate recommendations on how to approach the topic. The third CIO, whose organization has not yet introduced mitigation measures, states:

*The organizational understanding of the importance of employees' mental health has grown over the past years, especially since the [start of the COVID-19] pandemic. While I believe this has always been an important topic, the willingness to approach topics like stress or burnout or burdens arising from ICT usage has now outgrown the status of 'nice to have' and is now increasingly seen as a necessity for organizations. However, we lack experience on how to approach it. Therefore, having recommendations like the ones in this study is beneficial and very important.*

Regarding the accessibility of the results, the CIOs rate the overview in Table 3 and the practical recommendations as helpful, easy to understand, transparent, and plausible.

The suitability of our results has been discussed from different perspectives, as the CIOs see four various vital takeaways from the results for their approach to mitigate technostress. The first takeaway is that employees suffer from technostress and appreciate the organizational efforts to reduce techno-invasion and techno-overload. The CIOs were surprised about the differences regarding the assessments of the mitigation measures, including how the employees' assessments contrast with their own. The CIO of the systems engineering organization states:

*While I was aware that the mitigation measures would not be perfect for every employee, I am delighted to read that most of our employees value our effort to protect them from [techno]stress. The results show very transparently and plausibly that we are in the middle of the process and not at the end. We have to think about how we can address the raised concerns and where we can adjust or expand our mitigation measures. A significant takeaway is that introducing technological measures is not enough, but rather we also need additional guidelines to make the most out of these mitigation efforts.*

The second takeaway is that while the introduced mitigation measures are a good starting point, there is still room for improvement, as demonstrated by this quotation from the CIO of the fashion organization:

*We have made a good start in reducing ICT stress for our employees, but we need to continue consolidating those mitigation measures in the future. I am also very interested in learning more about what others have done. We can learn from each other, and I will also consider bringing this valuable break/free time culture to our organization. The role I see for us as CIOs is threefold: first, to keep in touch with the employees and continue to ask for their opinion regarding the mitigation measures. Second, to build trust in ourselves as executives and in our mitigation measures. Third, to act as a prototype or role model for good communication and interaction within the team.*

The third takeaway is the importance of cultural and social mitigation measures, which have been underrated. The CIO from the production industry, whose organization has not yet introduced mitigation measures, notes:

*What I find quite impressive is that when we thought about bringing relief for our employees, we only had technological measures in mind. However, it all comes down to communication, social interaction, and culture.*

The last takeaway refers to the detected "loop" in perceiving techno-invasion and techno-overload. We showed the CIOs that specific measures to reduce one techno-stressor could foster another. Specifically, our results show that restricting email traffic after working hours and on weekends to minimize techno-invasion can cause a flood of incoming emails the next working day, causing techno-overload. Further, we found that using short message tools to reduce the number of emails and techno-overload can be perceived by employees as an invasion of their privacy, causing techno-invasion. The CIOs were unaware of these interdependencies, and all agreed that this is a relevant issue when discussing mitigation measures. The CIO of the fashion organization summarizes:

*The fact that we can cause stress by mitigating it is a big surprise for me, but I think it is plausible that some colleagues feel that way. This loop is an issue worth considering when improving implemented mitigation measures in the future. For me, this requires closer monitoring and individual feedback to understand when a mitigation starts to harm employees. With the help of their feedback, we can then decide whether we need to change, adapt or drop the mitigation measure to maximize employees' well-being.*

The CIO of the systems engineering organization suggests ways to avoid undesirable "loop" effects:

*Spontaneously, I would rather rate this loop as not fully breakable because if our employees focus on the stress potential within the mitigations instead of their advantages, there is barely anything we can do about it. However, I still believe that we could help them overcome the negative effects of the loop. For example, we could raise awareness about the huge relief of not having to check emails that arrive after working hours or on weekends, which comes at the low cost of receiving postponed emails. They will receive the emails anyway but just bundled the next workday. This issue could be a question of mindset and framing things. Additionally, we could reserve the first half an hour or first hour on Monday as a "meeting-free" slot, where employees can focus on and organize new emails and gain a sense of control to mitigate techno-overload.*

# 6 DISCUSSION

The *right to disconnect* has put mitigation measures for techno-invasion and techno-overload on the agenda of many organizations lately. While literature (Valta et al., 2021) and practice (Koch, 2014) have identified a variety of mitigation measures, there is an ongoing discussion about how effectively they reduce techno-invasion and techno-overload (Akanabi, 2021; Earwaker, 2021). Scholars have identified technostress as an example of the "dark side of IT", which continuously threatens employees' well-being (D'Arcy et al., 2014; Tarafdar, D'Arcy, et al., 2015). By interviewing

IT professionals, specifically IT specialists, managers, and CIOs, we identify mitigation measures for techno-invasion and techno-overload, categorizing them as technological, cultural, or social mitigation measures. Notably, our results show that none of the mitigation measures is free of negative effects for employees. Measures intended to mitigate one techno-stressor can have the unintended effect of fostering another, potentially failing to reduce overall technostress levels. This looping effect between techno-stressors and measures to mitigate them, combined with individual preferences regarding mitigation measures, shows that introducing successful mitigation measures requires a complex understanding of their effects on employees.

## 6.1 THEORETICAL CONTRIBUTION

With this research, we contribute to the research stream of technostress and organizational technostress mitigation measures in the following four ways (see Figure 1):

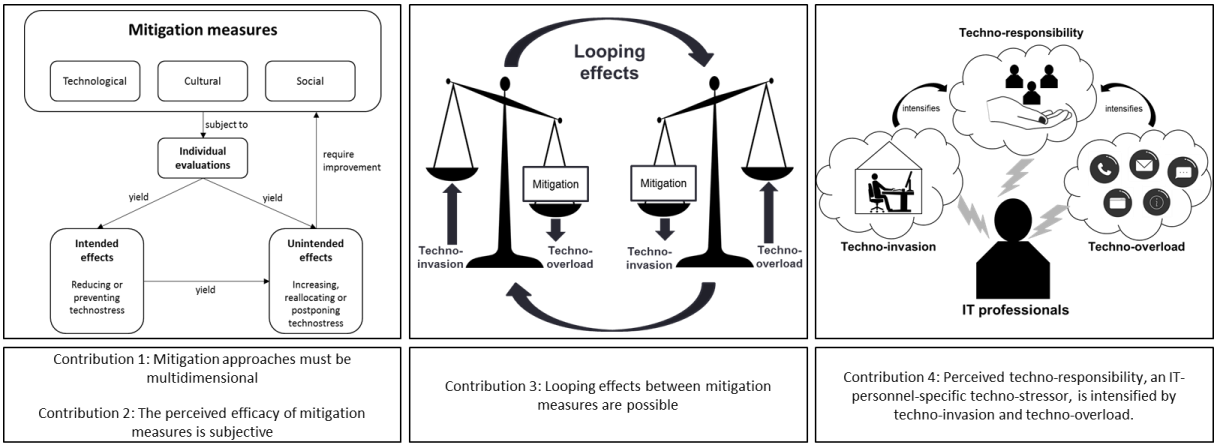


**Figure 1. Theoretical contributions**

**1) We demonstrate the importance of taking a multidimensional approach to mitigating technostress that considers the technological, cultural, and social aspects of technostress.** In our study, we identify eight measures to mitigate technostress, four to mitigate techno-invasion, and four to mitigate techno-overload. Based on our results, we categorize three of these measures as technological mitigation measures: *separation of private and business devices* and *restriction of email traffic* addressing techno-invasion and *good practices for internal communication* addressing techno-overload. In line with prior research (Tarafdar, Pullins, & Ragu-Nathan, 2015), we define technological mitigation measures as measures involving ICTs and their features. Our findings confirm the existence of previously suggested mitigation measures, such as the restriction of email traffic (e.g., Galluch et al., 2015), and show that ICTs can also mitigate ICT-induced technostress. The remaining five mitigation measures can be categorized as cultural or social mitigations, two dimensions that have not been considered in previous research. We identified two cultural mitigation measures: an emergency communications channel to mitigate techno-invasion as an expression of the valuable break/free time culture and a "pull not push" culture to mitigate techno-overload. Based on the interviews, we define cultural mitigations as measures related to workplace policies and understandings manifested in the organizational culture, such as a shared understanding of the way of working and communication. The two identified cultural mitigation measures introduce shared understandings of work regarding when to use the emergency communication channel after-hours and the practice of proactively seeking information. Further, with *valuable break/free time culture – clear communication of expectations* as a measure to mitigate techno-invasion and *communication with executives and 'off-screen' communication opportunities* as a measure to mitigate techno-overload, we identify three social mitigation measures. Our interviews indicate that social mitigation measures require or concern interactions with others, such as introducing communication rules or fostering attentiveness towards one another. The identified measures all

stress the importance of communication and illustrate the importance of an infrastructure that fosters communication, going beyond the technology to include the social level. By identifying these three dimensions, we develop an understanding of technostress mitigation beyond targeting the ICTs to include tackling the socio-technological nature of ICT usage (Bednar & Welch, 2020). We thereby contribute by demonstrating the importance of taking a multidimensional approach to mitigating technostress that targets the technological, cultural, and social aspects of technostress.

**2) We reveal the important role of subjectivity in perceived efficacy of mitigation measures.** Our results show that individuals are subjective in their assessment of how efficiently a particular measure mitigates a particular techno-stressor. Hence, while a measure may be introduced to mitigate or prevent techno-invasion or techno-overload, some employees may perceive the measure as ineffective because it increases, reallocate, or postpones technostress. By taking the employees' perspective, we complement existing research on organizational mitigation measures that mainly take the organizational view (Tarafdar, Pullins, & Ragu-Nathan, 2015), showing that reducing techno-stressors can come at a price. These insights help us better understand the implications of the mitigation measures for employees and guide organizations in considering the potential downsides of mitigation measures as they develop and implement technostress mitigation strategies. Our results point to possible job role-specific assessments of the mitigation measures, supported by partly overlapping assessments among the specialists we interviewed. This finding opens the discussion of whether techno-stressors experienced by IT-specialists in different IT job roles require unique mitigation measures. While our study makes the first step in that direction, we call for future research to continue exploring role differences in technostress mitigation research.

**3) We illustrate possible looping-effects between the measures to mitigate techno-invasion and techno-overload.** Based on our interviews, we find that measures designed to mitigate one techno-stressor can foster another. Specifically, by restricting or prohibiting email delivery after working hours and on weekends in an effort to mitigate techno-invasion, some employees perceive the resulting flood of incoming emails the next working day as techno-overload. We also found that some employees perceived the use of short message tools, intended to reduce the number of emails and thus mitigate techno-overload, as an invasion of their privacy and, therefore, as techno-invasion. On a theoretical level, these findings indicate that measures intended to mitigate technostress can cause unintended technostress and lower employees' well-being and performance. This insight contributes to research into treating transmission effects between employees (Chen & Karahanna, 2018; Ragu-Nathan et al., 2008) by adding the layer of intertwined techno-stressor mitigation effects that exchange the perceptions of one stressor for the perception of another.

**4) We identify techno-responsibility as an IT-professional-specific techno-stressor.** Extant research into technostress and mitigations for non-IT professionals (e.g., Tarafdar, Pullins, & Ragu-Nathan, 2015) and evaluating differences between the two (e.g., Maier, Laumer, & Eckhardt, 2015) shows that technostress among IT professionals is often techno-invasion or techno-overload. Our study identifies techno-responsibility as a third category relevant specifically to IT-personnel. We define techno-responsibility along two dimensions: the perceived burden of being aware of the responsibility for the ICTs implemented in the organization and of the potentially adverse consequences of ICT-related decisions and systems for employees and their working routines. Further, our findings indicate that perceived techno-overload and/or techno-invasion intensifies perceived techno-responsibility by intensifying the awareness of the responsibilities leading to techno-responsibility, triggered by incoming requests, interruptions after working hours, etc. This contributes to studies calling for further research into the interplay between techno-stressors (Pflügner et al., 2020) and transmission effects between stressors (Chen & Karahanna, 2018). Further, by identifying techno-responsibility as an IT-personnel-specific techno-stressor, our study addresses differences in perceived techno-stressors depending on the

job role and context, e.g., IT vs. non-IT professionals (Ahuja et al., 2007; Sarker et al., 2018). This insight helps us detect demands within different contexts and design suitable mitigation measures targeting role-specific techno-stressors.

## 6.2 PRACTICAL IMPLICATIONS

Our study offers practitioners valuable insights into implementing mitigation measures in organizations that support the right to disconnect by identifying eight mitigation measures and revealing how employees assess the efficacy of these mitigation measures in terms of intended and unintended effects. We deduce three significant insights for organizations:

**1) Technostress mitigation is complex and can have unintended effects.** While the *right to disconnect* implies that disconnecting from work is a desirable option for employees, organizations should be aware that reducing technostress, specifically techno-invasion and techno-overload, for their employees is a complex undertaking. Simply disconnecting technically is not enough. Introducing organizational mitigation measures requires a vital ICT infrastructure, a robust team culture, and socially skilled executives. Introducing organizational mitigation measures is not a short-term project with guaranteed success: mitigating technostress in the medium and long term requires strong organizational commitment. Our results indicate that employees' individualized working habits and preferences influence how they cope with their job's responsibility and connectivity. There is a risk that they may perceive mitigation measures as a stressful restriction of their flexibility. We advise organizations to take a complex, holistic approach rather than looking for a (non-existent) simple quick-win solution.

**2) Technological mitigation measures alone are insufficient without also considering cultural and social measures.** Our analysis indicates that simply introducing new tools or technologically implemented restrictions to reduce techno-invasion and techno-overload is insufficient. Rather, organizations must consider how employees can use such tools or technologically supported measures to reduce their technostress levels. Measures designed to mitigate technostress related to internal communications should establish and articulate and support best practices for choosing when to use various communication tools, increase social awareness among employees regarding when and how to communicate and provide guidelines on where to pull information from a wiki or database rather than asking others. Social and cultural mitigation measures should be prioritized in order to establish a shared mindset for mitigating technostress and avoiding unintended negative effects of implemented measures.

**3) Employees value the efforts to reduce technostress.** Our analysis shows that even though mitigation measures do not reduce techno-invasion and techno-overload to the same extent for every employee, they still acknowledge and value the organization's efforts to implement them. Putting employees' mental health on the organization's agenda is a sign that management cares about and appreciates the work of employees, thus increasing their job satisfaction. We encourage organizations to include employees actively in introducing technostress mitigation measures and listen to what they need to protect their employees and keep productivity and satisfaction high.

## 6.3 LIMITATIONS AND FUTURE RESEARCH

Due to the nature of our qualitative study, our results are context-specific and restricted to the specific set of employees and CIOs working in the two IT departments of organizations in the German production industry. While we acknowledge the limits to the generalizability of our study, our approach nonetheless provides an in-depth understanding of those employees' assessments and provides valuable insights into measures to mitigate techno-invasion and techno-overload among IT personnel. We encourage future research comparing our results to those in other industry, cultural and economic settings.

Furthermore, this study focuses on techno-invasion and techno-overload because they relate to the right to disconnect and are relevant for IT professionals. While we understand that extant literature has identified a number of other techno-stressors (Califf et al., 2020; Fischer et al., 2021; Ragu-Nathan et al., 2008), focusing on these two particular techno-stressors sharpened our discussion of the relevant mitigation measures. We acknowledge that techno-invasion and techno-overload may have dominated in our interviews because of the strict IT context and the high computer self-efficacy among our sample.

Our research touches on individual differences in how employees with different roles perceive and assess measures to mitigate technostress. For instance, our findings suggest that CIOs perceive, handle and manage technostress differently from other employees. Prior research shows that individual differences, such as personality traits (Maier et al., 2019) or profiles of personality traits (Pflügner et al., 2020), influence the perception of techno-stressors. Our interviews suggest that this might also apply to mitigation measures. We call for further research into how personality traits or personality profiles interact with job skills, roles, and responsibilities to influence the perceived efficacy of different measures to mitigate techno-stressors.

Moreover, we encourage future research to investigate how ICTs such as artificial intelligence (AI) can be both a source and cure for technostress. AI could also be implemented to support cultural and social mitigation measures, e.g., through using chatbots acting as support assistants answering standardized frequently asked questions. Cultural and social mitigation dimensions are expected to gain particular importance as we enter the 'feeling economy' (Huang et al., 2019).

Last, recent literature investigates the potential positive effects of technostress when techno-stressors are perceived as a challenge (Califf et al., 2020; Maier, Laumer, Tarafdar, et al., 2021). While this study focuses on the negative implications of technostress and how to reduce it for employees, future research could also investigate possible measures to mitigate negative perceptions of technostress, such as communication strategies, that foster positive techno-eustress.

# 7 CONCLUSION

This study examines measures to mitigate techno-invasion and techno-overload among IT-personnel and their assessment of the efficacy (intended and unintended effects) of such measures. We identify eight mitigation measures, four intended to mitigate techno-invasion and four intended to mitigate techno-overload. We categorized three as technological, two as cultural, and three as social mitigation measures with the intended effect of reducing techno-invasion and techno-overload and the possible unintended effects of increasing, postponing, or reallocating technostress. Our findings reveal that mitigating technostress is a complex undertaking involving the interplay between technological, social, and cultural measures and is influenced by subjective individual perception, work skills, roles, and responsibilities.

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# APPENDIX A: INTERVIEW GUIDELINE

### Introduction

Outline the purpose of the study, inform participants about data collection, analysis, and anonymization, and gather personal data of the interviewee, including age, gender, job role, work experience, workday description, and computer self-efficacy.

### The Role of Technostress

How would you describe your current work situation? Are there exceptionally high demands to handle? Do you sometimes feel stressed?

Would you describe working with ICTs as part of the problem?

How relevant do you rate the following demands to your situation:

- Do you sometimes fear losing your job due to new technology?
- Do you feel capable of working with the ICTs and applications at work? Even with new ones?
- Do you see the rising complexity of more intertwined systems as a burden?
- Do you sometimes feel overwhelmed by the volume of incoming requests?
- Can you disconnect from work during non-working hours?

### Mitigation Measures for Techno-Invasion and Techno-Overload

Has your organization done anything to reduce constant connectivity with work/the high volume of incoming requests?

Can you describe this mitigation measure and its effect? How much did it help you to relax at home/reduce incoming requests?

Have you heard of the following mitigation measures in your organization:…?

### Employees' Assessment of the Introduced Mitigation Measures

Do you perceive those mitigation measures as applicable? Did they ever lead you to experience a decrease in stress? Why/why not?

Do you see challenges arising from those mitigations?

What would you wish for that would improve the mitigations?

*Note:* The interviews were conducted in German, and the interview guideline was translated.

# APPENDIX B: CODING EXAMPLE

We followed the coding approach presented by Myers (2019) for our analysis. Table 4 shows an example of our coding approach. We used two codes to categorize the techno-stressors, three codes for the mitigation dimensions, eight codes for the mitigation measures, two codes to classify the effects, and 39 codes to label employees' assessments.

**Table 4. Coding example**

| Techno-stressor | Mitigation dimension | Mitigation measure | Intended/ unintended effects | Assessments | Coding examples (quotations) |
|---|---|---|---|---|---|
| Techno-invasion | Techno-logical | Separation of private and business devices | Intended | Clear end of the workday | Switching off the device helps me mark the end of my workday. |
| | | | Intended | Reduction of blurring boundaries | It is easier to separate private and work life with two devices. |
| | | | Intended | No accidental involvement in business-related communication | When I receive short messages on my private device, I accidentally get involved in business talks, even my private life. |
| | | | Unintended | Stress through multiple device usage | Having two devices stresses me because I have to check and switch between them. |
| | | | Unintended | Loss of flexibility | It reduces my flexibility if messages are not delivered to my business device after a certain time. |
| | | | Unintended | No free choice of the end device | I cannot choose the device or the operating system to use. I cannot decide which tools to use and need a moment to switch between devices. |
| | | | Unintended | Deceleration of work processes | If everyone takes the evening off, the leftover work is done the next day, creating more leftover and slowing down work processes. |
| | | | Unintended | Denial of decision autonomy | I feel capable of deciding whether I want to use the device in the evening and do not need someone to turn it off for me. |
| | | Restriction of email traffic | Intended | Clear end of the workday | No emails mean no work, so my day is over. |
| | | | Intended | Reduction of blurring boundaries | Knowing that the evening is not compromised by work emails, I can concentrate more on my family. |
| | | | Unintended | Postponing of overload | Not receiving the emails in the evening only stores them for the next day, where you start with a flood of emails. |
| | | | Unintended | Loss of flexibility | I love to work in the evening when my children are asleep, which is hard without email access. |
| | | | Unintended | Deceleration of work processes | Now I cannot use spare time in the evening to finish leftover work and have to postpone it to the next day, which slows down my tasks the next day. |
| | | | Unintended | Denial of decision autonomy | I would rather decide when I want to be confronted with those emails. |
| | Cultural | Valuable break/free time culture – Introduction of an emergency channel | Intended | No bad conscience for not keeping oneself up to date every minute at home | It is ok not to check my device regularly in the evening because important things are directly delivered. So, I do not have a bad conscience to relax. |
| | | | Intended | Fosters disconnection from work | Knowing there is nothing important to deal with right now helps me to wind down and concentrate on other things. |
| | | | Intended | Push of urgent messages, no need for constant pull | You do not have to be online all the time. You get informed if something is important. |
| | | | Intended | Clear attribution of responsibilities | I like that we have a clear assignment of who is responsible in that case and not that everyone is informed, even though it is not one's job to deal with that. |

| Techno-stressor | Mitigation dimension | Mitigation measure | Intended/ unintended effects | Assessments | Coding examples (quotations) |
|---|---|---|---|---|---|
| | | | Intended | Shared understanding of the value of recreation | I think having a shared awareness that breaks are important is good. |
| | | | Unintended | Still a need to check the channel constantly | Ok, but I still have to check the emergency channel every hour, so does this change anything? |
| | | | Unintended | Channel not in an isolated tool | We do not have emergency pagers or anything like that, so we still have to use our business device and could get caught up in business-related stuff. |
| | | | Unintended | Fear of abuse | If it is OK to take breaks, I worry that some colleagues will constantly take breaks the whole day. |
| | | | Unintended | Abuse of breaks burdens others with more work | If some take long breaks and others do not, it burdens the remaining team with additional work. |
| | | | Unintended | Need for core working hours | I understand the mitigation, but we still need core working hours where breaks that last longer than 15 minutes are prohibited. |
| | Social | Valuable break/free time culture – Clear communication of expectations | Intended | No feeling guilty for not keeping up to date every minute at home | Knowing that I am not expected to answer or work after work frees my mind. |
| | | | Intended | Fosters disconnection from work | If my executive is ok with me disconnecting from work, I am too. |
| | | | Intended | Shared understanding of the value of recreation | If everyone respects others' private time and understands that they need that time for recreation that helps to relax and disconnect in the evening. |
| | | | Unintended | Dependency on mutual agreement with all employees | If there is only one who does not go with the flow and disturbs everyone in their private time, the mitigation is useless. |
| | | | Unintended | Abuse burdens others | Just because we worship breaks, we cannot burden our colleagues for our own sake. |
| Techno-overload | Techno-logical | Good practices for internal communication | Intended | Employees receive fewer requests | Restricting the number of recipients also reduces the number of unnecessary requests. |
| | | | Intended | Fewer interruptions | If we mute certain tools, we can focus on our tasks more. |
| | | | Intended | Fosters informal communication and culture of information pull | I enjoy writing via the instant messaging tool because it is informal, and people use the channels to provide information that I can read when I am ready for it. |
| | | | Unintended | Fosters multi-channeling | I often realize that colleagues first write me via the instant messaging tool and later find out they sent the same request via email. So, I must deal with the request twice on multiple channels. |
| | | | Unintended | Need for guidelines on when to use which tool | I'm afraid that without guidelines on which requests can be written via short message tools and which requests need an email, the number of interruptions and redundant requests will rise. |
| | | | Unintended | Need for awareness that an instant message does not mean an instant response | Some people think that their request is the only thing I have to deal with now. After a while, they even send question marks to remind me that they are still waiting. However, I have other tasks, too, and sometimes you have to wait. |

| Techno-stressor | Mitigation dimension | Mitigation measure | Intended/ unintended effects | Assessments | Coding examples (quotations) |
|---|---|---|---|---|---|
| | Cultural | Introduction of 'pull not push' culture | Intended | Employees receive less unneeded information | When I have to get the information myself, I am also not spammed with unneeded information. |
| | | | Intended | Fewer interruptions by standard requests | If we do not have to handle the standard repeating requests because people can find the information elsewhere, we get fewer interruptions. |
| | | | Intended | Strengthens organizational IT infrastructure | Implementing tools for knowledge management also strengthens the IT infrastructure because we have to build reliable systems and databases. |
| | | | Intended | Strengthens work autonomy | I believe getting the information when I want to fosters my work autonomy because I do not have to wait for or rely on others. |
| | | | Intended | Better support through higher reliability | The information in wikis is reliable and not dependent on specific colleagues. |
| | | | Intended | Based on wikis, first-level support can help with elaborated tasks | Even first-level support can look up standard procedures and try them first before contacting a specialist. |
| | | | Unintended | Extra work and extra screen time | Getting the information via the system takes more time than asking the colleague, and we must use the computer again. |
| | | | Unintended | No guaranteed usage | I doubt people will use that instead of asking their colleagues. |
| | | | Unintended | High dependency on employees' willingness to contribute | If everyone contributes knowledge, this is extremely valuable, but we depend on employees' willingness to share and process that knowledge, which creates extra effort. |
| | | | Unintended | High dependency on IT infrastructure | If the system does not work, the knowledge cannot be acquired, and people get overwhelmed with support requests. |
| | Social | Communication with executive | Intended | Better prioritization of requests | My executive can help me recognize what is important and prioritize better. |
| | | | Intended | Reduction of workload | If possible, the executive can redistribute tasks. |
| | | | Intended | Early mitigation possible | If employees speak to us as executives, we might be able to prevent severe consequences, such as burnout. |
| | | | Unintended | Highly dependent on specific executive and trust towards that person | The required level of trust is not achievable with every executive. |
| | | | Unintended | Fear of being perceived as less competent and less resilient than others | To open up about being overwhelmed with requests is not easy because it can be used against me, labeling me less competent and resilient. |
| | | | Unintended | Reduction is not always possible | Sometimes there is work that must be done, and we cannot take that away from employees. |
| | | | Unintended | Higher workload for executives and too much involvement in employees' private affairs | I think a certain professional distance can be helpful, so I do not want to get too deeply involved in employees' problems, which causes additional work for me. |

| Techno-stressor | Mitigation dimension | Mitigation measure | Intended/ unintended effects | Assessments | Coding examples (quotations) |
|---|---|---|---|---|---|
| | | | Unintended | No substitute for professional help | Talking to your executive does not replace professional help, and both employees and executives should be aware of that. |
| | | Introduction of 'off-screen' communication opportunities | Intended | Reduction of ICT use and screen time | I enjoy every minute that I can work without a screen. |
| | | | Intended | Working break | Working outside feels like a constructive break. |
| | | | Intended | Motion and fresh air | Going outside for meetings and even playing foosball is healthy as we get to stand up and move and get fresh air. |
| | | | Intended | Higher creativity | Being in a different context, such as outside, can foster creativity in discussions. |
| | | | Intended | Potential for social support | If I have a bad day and feel overwhelmed by the requests, I enjoy playing foosball with my colleagues. We then talk about our workdays and realize that we are all in the same position, which is comforting. |
| | | | Unintended | Extra coordination, preparation, and the post-processing effort | When we cannot use slides or tools, we must ensure that the meeting is still effective and structure it accordingly. |
| | | | Unintended | Only particular meetings suitable for off-screen | I would say that updates or performance reviews can be done outside, but not every meeting fits the approach. |
| | | | Unintended | Dependency on team structure and relationships | If the employees in a team are very heterogeneous and do not have much in common, they will not come together to play foosball. |

Paper VIII

# DIGITAL HEALTH-ORIENTED LEADERSHIP

## MAINTAINING AND IMPROVING EMPLOYEE WELL-BEING

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# DIGITAL HEALTH-ORIENTED LEADERSHIP

## MAINTAINING AND IMPROVING EMPLOYEE WELL-BEING


## Abstract

Digital health in the workplace attracts practitioners' and scholarly attention because digital health is relevant to employee health and organizational performance. We draw attention to the role leaders play in digital health in the workplace and introduce the concept of digital health-oriented leadership. Based on related literature, we define health-oriented leadership as a leadership style that models and supports the healthy use of information systems (IS) to maintain and improve employee well-being. We leverage insights from 37 interviews with leaders and team members to conceptualize digital health-oriented leadership consisting of three dimensions: Awareness of digital health and potential threats, the importance that leaders attach to their own and team member digital health, and behaviors of leaders to support one's own and team members' digital health. The new concept specific to the digital health context paves the way for an enhanced understanding and promotion of healthy working with IS in the digital age, leading us to develop six avenues for future research.


**Keywords:** Leadership, digital health, qualitative research, well-being, technostress, intervention

## 1 INTRODUCTION

Digital health in the workplace refers to the healthy use of information systems (IS) for maintaining and improving the well-being of employees (Montagni et al., 2018; Smits et al., 2022). On the one hand, digital health implies the healthy use of IS, such as by establishing rules or skills for non-stressful IS use (Benlian, 2020) or using IS for transmitting health-relevant knowledge that maintains or improves employee well-being (Baumel et al., 2019; Heber et al., 2017). On the other hand, when the digital health of employees is impaired, e.g., reflected by an unhealthy use of IS such as email overload (Stich et al., 2019), employees have an increased risk of burnout, and organizations' functioning is challenged by reduced productivity, increased employee absenteeism, and turnover (Maier et al., 2019; Tarafdar et al., 2019). Thus, digital health in the workplace has attracted practitioners' and scholarly attention.

Initial evidence suggests that leaders have a significant role in team members' digital health (Fieseler et al., 2014; Harris et al., 2015). The general health literature informs us about a leadership style focusing on health-specific issues, namely health-oriented leadership (Franke et al., 2014). Health-oriented leadership improves health among leaders and their team members (Kaluza & Junker, 2022; Klug et al., 2019) and strengthens team members' well-being in times of crisis (Klebe, Felfe, et al., 2021).

Given that there are specific causes and consequences of digital health (Grehling & Maier, 2021) compared to general health, we contextualize health-oriented leadership. We *aim to offer a concept relevant to digital health in the workplace* and define digital health-oriented leadership as a digital health-specific leadership style that models and supports the healthy use of IS to maintain and improve employee well-being. With our qualitative approach to interviewing leaders and team members, we conceptualize digital health-oriented leadership as consisting of three dimensions: an *awareness* of digital health, the *value* leaders put on digital health, and *behaviors* directed at digital health.

The paper contributes to digital health in the workplace by providing a framework for digital health-oriented leadership that consists of cognitive, motivational, and behavioral dimensions. Thus, the increments in digital health-specific behaviors at work increase our ability to predict, assess, and improve digital health in the workplace grounded in the employment group of leaders.

# 2 THEORETICAL BACKGROUND

We first illustrate digital health and explicate the concept of health-oriented leadership. Based on these illustrations, we define and conceptualize digital health-oriented leadership.

## 2.1 DIGITAL HEALTH

Digital health implies that employees use IS in a healthy way that maintains and improves their physical, mental, and social well-being (Montagni et al., 2018; Smits et al., 2022). In light of physical well-being, digital health is connected with fewer physical diseases (Ahsen et al., 2019) and reduced mortality (Venkatesh et al., 2016). Regarding mental well-being, digital health is related to positive emotions (Wenninger et al., 2018) and vitality (James et al., 2019) as opposed to exhaustion (Ayyagari et al., 2011) and burnout (Srivastava et al., 2015). Digital health in terms of social well-being is connected with better social relationships and inclusion as opposed to relationship problems (Kuem et al., 2021; Salo et al., 2019). In summary, digital health is related to wide-ranging consequences that influence employee health and organizational performance (Tarafdar et al., 2019).

There are two subaspects inherent in digital health: IS as the subject of digital health and IS as the object of digital health (Figure 1).

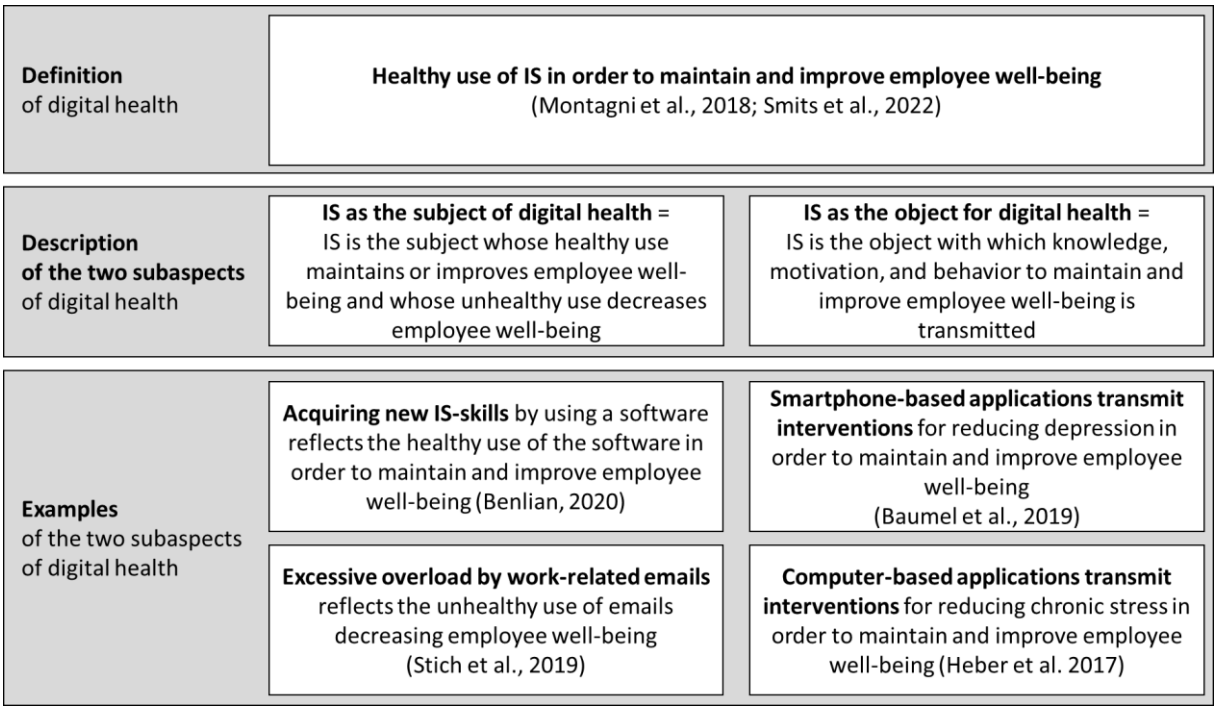


**Figure 1. Definition and description of digital health and its subaspects**

As a subject, the IS is the subject whose healthy use maintains or improves employee well-being and whose unhealthy use decreases employee well-being. For instance, an excessive overload by work-related emails can limit the well-being of employees (Stich et al., 2019), whereas acquiring new IS skills using the software can increase well-being (Benlian, 2020). As an object, the IS is the object with which knowledge, motivation, and behavior in order to maintain and improve employee well-being are transmitted, such as smartphone applications that transmit interventions for reducing depression (Baumel et al., 2019) or computer-based applications that transmit interventions for reducing chronic stress (Heber et al., 2017). Given the ubiquity of IS use for work tasks, IS is of significant importance for digital health in the workplace. That said, related literature from general health suggests that leaders shape health in the workplace, supported by profound research into health-oriented leadership.

## 2.2 HEALTH-ORIENTED LEADERSHIP

Health-oriented leadership refers to health-promoting leadership that is both – team member-directed and self-directed at the leaders. Team member-directed health-oriented leadership, also called staff care, means that leaders provide external resources to the team members, such as providing health-promoting working conditions and support. Self-directed health-oriented leadership, also called self-care, refers to strengthening the internal resources such that leaders and team members are able to promote their health, e.g., by being able to deal appropriately with demanding working conditions that threaten their health (Franke et al., 2014; Kaluza et al., 2021; Klebe, Felfe, et al., 2021).

Health-oriented leadership consists of three dimensions: health awareness, value, and behavior. Health awareness refers to "*attention, sensitivity, and reflection related to health, job-related strain, and conditions that influence these states*" (Franke et al., 2014, p. 143). In that sense, awareness implies that leaders notice and pay attention to stress and signs of strain among their team members and themselves. Health value describes leaders' "*interest in health and the extent to which they attach importance to health*" (Franke et al., 2014, p. 143). Health value implies that leaders are concerned about their team members' and own health and feel responsible for their health. Finally, health behavior is defined as "*personal activity and engagement in health-relevant actions*" (Franke et al., 2014, p. 143). Health

behavior encompasses that leaders provide healthy working conditions to team members and their own, such as a healthy working climate, support their team members in healthy working behavior, such as protecting team members from working excessively over time, as well as providing team members with relevant information about health at work.

The relationship between health-oriented leadership and team members' health is well established (Table 1). Besides others, health-oriented leadership leads to better physical health in terms of fewer psychosomatic complaints among employees (Klug et al., 2019) and improvements in mental health, such as less exhaustion or emotional strain (Kaluza & Junker, 2022; Stuber et al., 2021). Moreover, there is evidence that interventions for health-oriented leadership based on increasing mindfulness and skills lead to better health in leaders and higher self-care as well as higher staff care for their team members (Vonderlin, Müller, et al., 2021). When leaders are exhausted and engage in less health-oriented leadership regarding less staff care, team member health suffers (Köppe et al., 2018). Thus, health-oriented leadership does not only increase team member health, but its absence impairs team member health.

**Table 1. Existing research on health-oriented leadership**

| Article | Summary |
|---|---|
| Arnold & Rigotti, 2021 | The article investigates the role of external (health-oriented leadership) and internal (psychological capital) resources for the health of novice teachers. The results reveal that the two resources improve novice teachers' physical and mental health and that health-oriented leadership also indirectly improves teachers' health by increasing psychological capital. |
| Arnold & Rigotti, 2020 | The article investigates the antecedents (job resources and job demands) of health-oriented leadership and the effect on the leaders regarding work engagement and emotional exhaustion. The results reveal that job resources and demands influence work engagement through the self-care of leaders and staff care, but there was no mediation effect for emotional exhaustion. |
| Franke et al., 2014 | The article introduces the concept of health-oriented leadership and provides a validated scale for measuring the new concept. The empirical result supports that health-oriented leadership in staff care relates to team members' health, irritation, and work-family conflicts. The results indicate incremental validity over transformational leadership, and that team members' self-care mediates the effects. |
| Hoppe-Herfurth et al., 2021 | The article investigates factors that increase teachers' uptake of health promotion measures to prevent stress-related disorders. The health-oriented leadership dimensions of health awareness and health value are investigated. The results show that health value increases the uptake of health-promotion measures, while the results for health awareness are mixed. |
| Horstmann, 2018 | The article investigates how health-oriented leadership influences team member burnout. The results reveal that the beneficial effect of health-oriented leadership on team member burnout is partially mediated by increasing the team members' self-care. Moreover, health-oriented leadership leads to more team member self-care when the leaders are proactive and show personal initiative. |
| Kaluza et al., 2021 | The article examines how team members' expectations shape the effectiveness of health-oriented leadership on team member well-being. The results reveal that high expectations strengthen the relationship between health-oriented leadership and leader-member exchange, improving team member well-being. |
| Kaluza & Junker, 2022 | The article reveals mechanisms through which health-oriented leadership leads to better team member well-being, namely an improved team health climate and team members' self-care. |
| Klebe et al., 2022 | The article examines how situational (crisis) and personal factors (leaders' strain) influence the extent of health-oriented leadership. In times of crises and when leaders experience strain, leaders show less health-oriented leadership regarding staff care. However, despite these factors, leaders still engage in staff care and even more when the team members experience strain. |
| Klebe, Felfe, et al., 2021 | The article investigates the effectiveness of health-oriented leadership in times of crisis. The results reveal that the existing positive relationship between health-oriented leadership and team member well-being is even more important in times of crisis. |
| Klebe, Klug, et al., 2021 | The article examines the extent and effectiveness of health-oriented leadership during a crisis in the context of the covid-19 pandemic. The results reveal that staff care is reduced in times of crisis, but the more robust the crisis, the stronger the effectiveness of health-oriented leadership in staff care. |

| | |
|---|---|
| Klug et al., 2019 | The article explores profiles of health-oriented leadership comprising different levels of team member self-care, leader self-care, and staff care. A profile where all three dimensions are high leads to the best health. Health is impaired if there are inconsistencies in the profiles, such as leaders only caring for themselves or leaders caring for their team members but not themselves. |
| Köppe et al., 2018 | The article examines possible crossover effects of leaders' health on team members' health with leaders' health-oriented behavior toward team members as a possible underlying mechanism. The findings indicate an indirect crossover effect, meaning that leaders' exhaustion negatively affects team members' health by lowering health-oriented leadership regarding staff care behavior. |
| Köppe & Schütz, 2019 | This article focuses on the health-oriented leadership dimension of the self-care behavior of leaders and investigates personal characteristics as antecedents of self-care. The findings reveal that core self-evaluations lead to higher self-care behavior and that this relationship is mediated by reduced emotional exhaustion. |
| Kranabetter & Niessen, 2017 | The article examines how the health-oriented leadership dimensions of health awareness and health behavior influence the relationship of transformational leadership on team member exhaustion and cynism. Overall, the results reveal that team members profit more from transformational leadership when leaders themselves are aware of their health and engage in health behavior. However, the health behavior of transformational leaders only led to less exhaustion among team members in one of the two samples. |
| Krick et al., 2022 | The article examines how the relationship between job demands, adverse health, and job outcomes can be buffered. The findings reveal that health-oriented leadership in staff care reduces the negative impact of job demands on team member health and job satisfaction. |
| Pischel et al., 2022 | The article examines health-oriented leadership in terms of leaders' awareness of their team members' warning signals regarding depression and burnout. The results reveal that only half of the leaders recognize such warning signals as a health risk and show even lower awareness when they perceive high stress, have low autonomy, and the warning signals are less clear. |
| Vonderlin, Müller, et al., 2021 | The article develops and evaluates a mindfulness- and skill-based intervention for health-oriented leadership. The evaluation revealed that the intervention leads to lower mental distress in leaders and higher self-care as well as higher staff care toward their team members. |
| Vonderlin, Schmidt, et al., 2021 | The article investigates how leaders' and team members' ratings of health-oriented leadership correspond to each other and predict team members' mental health. The results indicate that leaders rate themselves higher on health-oriented leadership and that the leaders' and team members' ratings correspond to each other only on the behavioral dimension rather than on the awareness and value dimension. Only the team members' self-ratings of health-oriented leadership but not the leaders' ratings, predict the team members' mental health. |
| *Note:* For this overview of existing literature on health-oriented leadership, we searched for empirical articles in English in the databases Business Source Complete and PsychInfo with the search term "health-oriented leadership". | |

Health-oriented leadership has also been investigated along with related leadership styles, such as transformational leadership. Empirical evidence supports that health-oriented leadership provides incremental validity over transformational leadership for explaining team member health (Franke et al., 2014). The effect of transformational leadership on team member exhaustion depends on health-oriented leadership. When leaders are aware of their own health and engage in health behavior themselves (two dimensions of health-oriented leadership), transformational leadership reduces team member exhaustion (Kranabetter & Niessen, 2017). Moreover, the relationship between transformational leadership and team member health has been found to be fully mediated by health-oriented leadership in terms of staff care (Franke et al., 2014). Thus, health-oriented leadership captures the health-specific aspects of transformational leadership that build the positive effect of transformational leadership on team member health. In contrast to general leadership behavior such as transformational leadership, domain-specific leadership in terms of health-oriented leadership is about specific health-related aspects of leaders and captures effects beyond transformational leadership (Franke et al., 2014).

Given these promising effects of health-oriented leadership on general health, the relevance of leadership for the specific form of digital health is worth investigating. However, for two reasons, concepts of general health, such as health-oriented leadership, may need to be more specific about digital health. First, unlike other general health threats, such as sitting at a desk or overeating junk food in the canteen, the use of IS constitutes a threat to digital health but cannot easily be eliminated or avoided. Digital health-oriented leadership needs to develop awareness, values, and behaviors

regarding how the use of IS can be shaped healthily rather than eliminated. Second, maintaining or improving digital health might extend beyond non-IS solutions, given that IS can be the subject and object of digital health. Our investigation might pave the way for starting points in health and digital health promotion grounded in the IS themselves, such as how threats to digital health due to IS can be mitigated by IS themselves.

### 2.3 DEFINITION OF DIGITAL HEALTH-ORIENTED LEADERSHIP

To provide a context-specific conceptualization, we investigate digital health-specific leadership and base on the definitions of digital health and health-oriented leadership. Digital health in the workplace is defined as the healthy use of IS in order to maintain and improve the physical, mental, and social well-being of employees (Montagni et al., 2018; Smits et al., 2022) and health-oriented leadership refers to a health-specific leadership style (Franke et al., 2014). Based on the tenets of those definitions from related literature, *we define digital health-oriented leadership as a digital health-specific leadership style that models and supports the healthy use of IS in order to maintain and improve employee well-being.*

Turning to the conceptualization of digital health-oriented leadership, we account for the behavioral but also motivational, and cognitive dimensions of digital health-oriented leadership. Most existing studies on digital health promotion in the workplace have concentrated on behaviors leaders can engage in, such as supporting the employees in their boundary management (Benlian, 2020). However, motivational and cognitive dimensions might extend digital health-specific behaviors and even be a precursor to the behaviors of leaders. When leaders are aware of digital health as they are sensitive when team members experience digital health threats and attach importance to their team members' digital health, leaders might be cognitively prepared and more motivated to engage in behaviors to promote digital health in their team.

## 3 METHODS

We engaged in qualitative interviews with leaders and team members to strengthen our conceptualization of digital health-oriented leadership and provide initial qualitative evidence for the beneficial effect of digital health-oriented leadership on team members' and leaders' digital health.

### 3.1 DATA COLLECTION

To conduct the interviews, we constructed a semi-structured interview guideline based on established procedures (Myers, 2013), which we adjusted based on the pre-test feedback. We ensured the voluntariness of participation, such that interviewees could stop the interview at any time and that the answers were processed anonymously. At the beginning of the interview, we explained the objective of the research project and the interview topic in more detail to strengthen the transparency and confidentiality of the interviews. We asked demographic questions, including age, gender, education level, the size of the organization, and the number of years that the interviewees have already been working at their current position. To ensure a common understanding of the research topic, we explained the concepts of digital health and digital health-oriented leadership to the interviewees. The core questions followed this introduction. We asked team members questions like "What does a digital health-oriented leadership style [a leadership style that improves your digital health] imply and look like for you?", "Do you have the feeling that your leader notices when you struggle in terms of digital health? How do you come to this assessment/notion? How does it affect your digital health?", "Do you feel your leader views digital health as important? How do you come to this assessment/notion? How does it affect your digital health?" and "Which behaviors of leaders are beneficial for your digital health?". We asked the

leaders questions like "What does a digital health-oriented leadership style [a leadership style that improves your and your team members' digital health] imply and look like for you?", "How do you as a leader notice when you or someone in your team is struggling in terms of digital health? How does it affect your digital health?", "Under which circumstances do you as a leader view digital health as important? How does it affect your digital health?" and "What do you do to support digital health as a leader? How does it affect your digital health?". At the end of the interviews, the interviewees had room for further questions or statements. Despite these predesigned questions, we remained open to asking additional questions to gain deeper insights into the interviewees' expressions.

We conducted 37 interviews with 31 team members and six leaders (Table 2) until we reached theoretical saturation, i.e., the interviews provided insights similar to earlier ones (Myers, 2013). The interviews took about 30 minutes. Among the interviewees were 16 women and 21 men, and the average age was 34.7 years (SD = 10.1) (leaders: M = 45.83 years; team members: M = 32.58 years). Most interviewees work in large organizations, but team members and leaders of micro, small, and medium-sized organizations were also represented. The interviewees worked in diverse fields, including engineering, human resources, marketing, and sales.

**Table 2. Interview partners**

| | Type | Age | Gender | Educational level | Size of the organization | Years in the position |
|---|---|---|---|---|---|---|
| T1 | T | 30 | F | Master | Micro | 2 |
| T2 | T | 34 | M | Master | Micro | 1 |
| T3 | T | 26 | F | Bachelor | Medium-sized | 1.5 |
| T4 | T | 28 | M | Master | Large | 2 |
| T5 | T | 29 | M | Master | Large | 0.5 |
| T6 | T | 29 | M | Apprenticeship | Micro | 1 |
| T7 | T | 28 | F | Bachelor | Large | 1 |
| T8 | T | 27 | F | Master | Large | 0.5 |
| T9 | T | 38 | M | Bachelor | Large | 5 |
| T10 | T | 23 | M | Bachelor | Small | 0.5 |
| T11 | T | 26 | F | Apprenticeship | Large | 1 |
| T12 | T | 37 | F | Master | Medium-sized | 2 |
| T13 | T | 32 | M | Bachelor | Large | 2 |
| T14 | T | 25 | F | Master | Large | 0.5 |
| T15 | T | 34 | F | Apprenticeship | Large | 2 |
| T16 | T | 30 | F | Bachelor | Large | 3 |
| T17 | T | 21 | M | High school diploma | Large | 1.5 |
| T18 | T | 28 | F | Master | Large | 0.5 |
| T19 | T | 48 | M | Diploma | Large | 10 |
| T20 | T | 33 | M | Apprenticeship | Large | 3 |
| T21 | T | 22 | M | Apprenticeship | Large | 1 |
| T22 | T | 56 | F | Apprenticeship | Large | 30 |
| T23 | T | 28 | F | Apprenticeship | Large | 0.5 |
| T24 | T | 34 | M | Diploma | Large | 1 |
| T25 | T | 42 | M | Diploma | Large | 14 |
| T26 | T | 29 | F | Bachelor | Large | 3 |
| T27 | T | 51 | M | Diploma | Medium-sized | 27 |
| T28 | T | 54 | F | Apprenticeship | Large | 20 |
| T29 | T | 34 | M | Bachelor | Large | 3 |
| T30 | T | 24 | M | High school diploma | Large | 0.5 |
| T31 | T | 30 | F | Master | Large | 3 |
| L1 | L | 52 | M | Diploma | Large | 3 |
| L2 | L | 57 | M | Apprenticeship | Small | 29 |
| L3 | L | 42 | M | PhD | Large | 2.5 |
| L4 | L | 53 | M | Diploma | Large | 4 |

| | Type | Age | Gender | Educational level | Size of the organization | Years in the position |
|---|---|---|---|---|---|---|
| L5 | L | 32 | M | Master | Small | 4 |
| L6 | L | 39 | F | Master | Micro | 8 |

*Note:* T = team member, L = leader; size of the organization: micro < 10 employees, small < 50 employees, medium-sized < 250 employees, large ≥ 250 employees

## 3.2 DATA ANALYSIS

We anonymously transcribed all interviews and analyzed the data using MAXQDA 2020. The coding combined deductive and inductive coding with the deductive codes of awareness, value, and behavior from existing literature (Franke et al., 2014). The coding consisted of four subsequent steps: descriptive coding, interpretive coding, review of interpretive coding, and categorizing. For descriptive coding, we identified relevant text passages that described an aspect of digital health-oriented leadership and integrated both the team members' and leaders' perspectives. Next, we applied interpretive coding to link the descriptive codes with subdimensions of awareness, value, and behavior (e.g., awareness of team members' digital health; awareness of own digital health). The review of the interpretive codes included that a second researcher went through the codes, and inconsistencies in the coding were discussed between the first and the second researcher. Lastly, the interpretive codes were categorized into the cognitive dimension of awareness, the motivational dimension of value, and the behavioral dimension of behavior (for a coding example, see Appendix). The data analysis builds the grounding for our conceptualization of digital health-oriented leadership fueled by the team members' and the leaders' perspectives. We will summarize our conceptualization and describe each dimension referring to the relevant interview data.

# 4 CONCEPTUALIZATION OF DIGITAL HEALTH-ORIENTED LEADERSHIP

Digital health-oriented leadership describes a leadership style that consists of three dimensions, with each dimension being directed at both the team members and the leaders themselves: awareness of digital health and potential threats to digital health (awareness), the importance of digital health (value), and behaviors directed at digital health promotion (behavior). Thus, digital health-oriented leadership includes leadership behaviors to maintain digital health but moves beyond and provides a more holistic picture of the role of leaders in promoting digital health on their own and in their team members. The concept includes underlying cognitions and motivation, which are not necessarily visible but set the grounding for resulting leadership as well as team members' behaviors. The definitions of digital health-oriented leadership and its dimensions are summarized in Table 3.

**Table 3. Definitions of digital health-oriented leadership and its three dimensions**

| Construct / dimension | Definition (derived from Franke et al., 2014) |
|---|---|
| **Digital health-oriented leadership** | A digital health-specific leadership style that models and supports the healthy use of IS in order to maintain and improve employee well-being |
| **Awareness of digital health** | Leaders' attention, sensitivity, and reflection related to digital health |
| **Value of digital health** | Leaders' interest in digital health and the extent to which they acknowledge its importance to the well-being of employees |
| **Behavior directed at digital health** | Leaders' personal behaviors and actions to support digital health |

The three dimensions of digital health-oriented leadership can be interdependent. For instance, specific leadership behaviors can be enacted even without leaders' digital health awareness or value. However, when leaders are aware of digital health threats and attach importance to digital health, this makes the engagement of leaders in digital health-oriented behavior more likely. Overall, considering all three dimensions is relevant for improving the healthy use of IS in order to maintain and improve team members' and leaders' well-being.

Awareness of digital health implies the leaders' awareness of the team members' digital health but also their own digital health. Value includes that leaders attach importance to the team members' digital health but also attach importance to their own digital health. Behavior directed at digital health incorporates behaviors that touch the team members, the IS, and the leaders themselves (Figure 2). We illustrate each dimension in more detail, building on our qualitative interview results.

| **Digital health-oriented leadership** | | | | | | |
|---|---|---|---|---|---|---|
| Awareness | | Value | | Behavior | | |
| Team members | Self | Team members | Self | Team members | IS | Self |

**Figure 2. Conceptualization of digital-health-oriented leadership with its three dimensions**

## 4.1 AWARENESS OF TEAM MEMBERS' DIGITAL HEALTH

A digital health-oriented leader is aware of the team members' digital health. This awareness means that leaders notice situations or circumstances when their team members perceive threats to digital health, such as stress from using IS, and attribute this stress to their team members' use of IS. "*My leader expressed he had realized the team felt overburdened by the virtual format of the meetings. I think such awareness is good because that is the first step that he can help us with these issues*" (T31). For digital health, it is relevant that the leader pays attention to the digital health of team members, which builds the grounding for providing solutions to enhance digital health.

However, the awareness of team members' digital health itself can be a challenge for leaders. "*One of the biggest challenges is to find out when employees are overburdened with digital media and where there are still gaps or potential for improvement*" (T3). Individual differences in digital health and stress perception make it harder for leaders to be aware of the team members' threats to digital health. *"One of the problems is, of course, that each person perceives stress individually. […] What represents an enormous burden for one person, another perceives as completely normal"* (L5).

To increase the leaders' awareness of the team members' digital health, open communication can be helpful. "*Open communication creates more awareness of the possible health risks due to IS"* (L5). "*Here, communication should take place on a social level so that employees dare to tell how they feel when dealing with digital tools and to what extent this leads to excessive stress*" (T15). The interview partners suggest internal surveys to increase the leader's awareness of the team members' digital health, given that they are helpful "*to determine the general feeling of stress due to the use of information systems*" (T7). Surveys are a means for increasing awareness of team members' digital health next to practicing open communication.

## 4.2 AWARENESS OF OWN DIGITAL HEALTH AND CROSSOVER EFFECTS

For leaders, it is relevant to be aware of their team members' digital health but also of their own digital health. This means that leaders notice situations or circumstances when they perceive threats to their digital health, such as stress due to the use of IS, and attribute this stress to their use of IS. The interviews support that the awareness of leaders' digital health cannot be taken for granted, and unawareness may lead to negative consequences for the team members. "*They [risks to*

*digital health] are not always consciously perceived. And the perceived stress is not always directly attributed to the use of digital media*" (T14). Leader F5 explains that the lack of awareness results from the focus on external demands, such as the successful completion of work, rather than on the own level of digital health. "*The focus is primarily on the successful execution of work [...] The awareness of one's own stress due to IS and possible health-related consequences has been pushed into the background*" (L5).

The interviews reveal that when a leader perceives stress due to IS, it does not stop at the leader; it may also burden the team members and result in impaired digital health among the team members. Crossover effects, such as the transmission of stress due to IS from the leader to the team members, make the awareness of leaders even more relevant. "*In the case of digital problems, the CEO gets annoyed, since he bears the responsibility. This harms the mood and stress in the team*" (T6). Leaders and team members alike mention these crossover effects and the crossover effect can be due to the crossover of affective states, such as negative affect, as well as leadership resources that are no longer available for the team members. "*Of course, this also affects my mood from time to time. The employees also notice when I spend longer on a technology problem because I am not available for other company-related issues at that moment*" (L2).

## 4.3 VALUE OF TEAM MEMBERS' DIGITAL HEALTH

Awareness of digital health does not necessarily imply that the leaders take action to improve their team members' digital health. Here, the interviewees highlight that the value in terms of importance leaders hold towards their team members' digital health is a crucial step in between. The importance of team members' digital health describes that leaders consider the digital health of the team members to be important. While the importance that leaders give to their team members' digital health is not directly visible to them, the actions resulting from the importance are visible. "*I think something like that [giving pieces of advice on how to deal with the information systems] is good because that is, first of all, a sign that he has taken seriously what we communicated last week*" (T19).

Leaders considering team members' digital health to be important also implies that they view the responsibility of digital health not only in the team members but also as a leadership responsibility. One interviewee describes how the leader takes responsibility for the team members' digital health, gives importance to the team's stress, and makes this clear to the team members. "*He says if I am not available from time to time, it is not so bad, or I should pay more attention to my health*" (T20).

Moreover, the importance of team members' digital health implies that leaders educate their team members about the importance of digital health and possible risks, such as stress due to IS. The interviews reveal that more discourse and education should be provided. "*At the same time, every employee should be informed about the effects that the omnipresence of digital media and constant availability have on the human psyche*" (T10). "*The problem with implementing measures to improve digital health is the frequent lack of knowledge of possible consequential damage*" (T10). Explaining the importance of digital health by highlighting negative consequences such as stress due to IS builds the grounding so that measures to improve digital health lead to the intended effects.

## 4.4 VALUE OF OWN DIGITAL HEALTH

Leaders should attach importance to their team members' digital health but also to their own digital health. As a result, the leader respects their limits about stress due to IS and takes care of themselves. While the importance that leaders give to their digital health is not directly visible to the team members, the actions that result from the importance are visible to the team members. "*When I have the feeling that my leader thinks it is important that everyone cares for their digital health and sets an example by his actions, it is kind of relieving for me, and I feel like I have the permission to tell when I feel burdened due to the speed of digital inquiries*" (T31). Thus, the value of their digital health acts like a role model. When leaders consider their own digital health to be important, this importance launches positive processes for the leaders' and team members' digital health.

## 4.5 BEHAVIOR DIRECTED AT THE TEAM MEMBERS

Complementing the awareness and values of leaders for digital health, digital health-oriented leadership involves multiple behaviors of leaders towards their team members.

**Social support by a leader.** As one subdimension of digital health-oriented leadership, the interviewees pointed to the relevance of social support by the leaders. Social support involves the leader supporting the team members in difficult situations and thus reducing stress due to IS. "*For example, we have a core system failure, and our leader would have finished work at 5 p.m. […] However, our leader stays there until you have worked through the problem and takes over communication with colleagues, for example. That takes much stress off me*" (T20). In this case, the leader reduces stress and improves digital health by taking over communication with stakeholders and offering support in urgent situations. In addition, the desire for concrete solutions or suggestions provided by the leader is highlighted. "[…] *that [my leader] then also provides solutions such as how one could better deal with it when technology causes stress*" (T18).

**Open and understanding communication.** However, support is only sometimes openly requested when IS impair digital health. "*Many employees wait until they see no way out instead of asking for help directly*" (T7). This refrainment from asking for support is because the team members want to avoid admitting weaknesses to their leaders. "*This could quickly give the impression to the boss that one is not up to the task*" (T7). Team member T15 states that he does not want to appear incompetent, since "*digital media are now part of the natural way of working in many people's eyes and a certain knowledge of them is assumed.*" To improve digital health and reduce this refrainment from asking for support, a team member mentions "*more intensive communication and development of coping strategies to deal with the situation together*" (T3). "*Here, it is important to maintain close contact between leaders and employees to be able to provide targeted help"* (L5). Communication between the leader and the team members is considered one of the most critical drivers in improving digital health (T12).

The results show the need for open and understanding communication by and with leaders, which means, for instance, that problems related to IS are openly discussed. Leader L5 reports initial difficulties in transferring work to the home office due to the Corona pandemic and that the compassionate attitude of colleagues and leaders, in particular, helped reduce the team's stress. His goal is to "*react with understanding and composure to my problems as well as those of other employees in dealing with digital media. This should prevent stress due to IS in the workforce*" (L5). Team members who feel they can communicate openly with their leader and experience understanding generally experience a positive effect on digital health. Leader L6 views a high degree of error tolerance as necessary when dealing with IS and views it as his responsibility to develop a culture in his team where errors are tolerated. This opinion is shared by team member T12 – "*even if mistakes happen, [...] it is important not to punish employees; otherwise, this can result in fear of contact [...] a high level of error tolerance is fundamental*".

**Involvement of team members in IS change processes.** The interviewees highlight the relevance that leaders involve their team members in IS change processes and thereby account for the needs of the team members. The involvement of the team members in the IS development is essential "*because ultimately the employee is the one [...] who has to work with the program in the operational business*" (L1). Accordingly, leader L2 discusses IS implementations in the team and accepts suggestions for improvement from his team members. "*The fact that we do not force employees to use certain programs, but that decisions are made jointly, means that the IS stress in our company is not as strong"* (L2). Similarly, leader L4 involves the team members and allows them to express their preferences and suggestions regarding the use of IS.

These insights are supported by the team members' perspective, which highlights that not accounting for the team members' needs can result in worse digital health. "*Too often, the technology is just ordered without responding to the needs of the employees*" (T2). However, addressing the team

members' needs is complex due to individual differences in digital health and stress perceptions among the team members. "*As a possible problem, I see that individual perceptions differ concerning the perception of stress. […] And here I see it as difficult to find a common solution or approach, […] because the topic of stress is more individualized*" (T4). This difficulty can be alleviated by an internal survey of all employees "*in order to ask for suggestions for improvement directly from the different employees*" (T7).

In sum, leaders' behavior toward their team members is relevant to support team members' digital health. Next to the behavior towards the team members, leaders can also engage in behavior that changes the IS environment and indirectly influence team members' digital health.

## 4.6 BEHAVIOR DIRECTED AT THE IS ENVIRONMENT

Digital health-oriented leadership also incorporates actions by leaders to shape the IS working conditions of the leaders and their team members. The qualitative results identified multiple subdimensions to promote digital health by addressing the IS environment.

**IS training and time for development.** A high level of competence with IS is expected in most jobs these days (L3 and L6, T5). One interviewee (T8) views this expectation as impairing digital health "*because you feel pressured to bring along certain requirements concerning digital media and to develop and train yourself independently"*. Therefore, "*it is important to receive training and instruction, to be informed about new tasks or programs so that no fear arises*" (T22). The team members rate a detailed introduction to new IS with sufficient time for familiarization and training as relevant. Thus, leaders can actively influence digital health by creating IS training offers. Most interviewees stated that their employers provide training and continuing education for team members to help them get familiar with new IS and learn how to use them. The training occurs both within the organization, in person and online, and by external providers, primarily online. Another team member (T14) states that the immediate and interactive solution to problems within these training sessions leads to improved digital health. "*The introduction of new information systems [...] is often carried out according to a three-step scheme*" (T3). In the first step, general training is given. The second step includes the possibility for team members to ask questions, and in the third step, tips and tricks are communicated to facilitate independent work with the tool. "*This has a reducing effect on my stress due to the system*" (T3).

**IS support structures.** Despite the training sessions, the team members need help dealing with IS in their day-to-day work. A team member (T5) reports that using new IS or IS that are less frequently used can sometimes lead to excessive demands, especially if no corresponding contact person is available. To counteract these problems, the management introduced the offer of decentralized and centralized contact persons within the organization. Decentralized services include support services such as the service desk. "*This functions as a decentralized point of contact that is managed and controlled via a ticket system, so if a problem arises, a ticket is opened, forwarded, and then a responsible service desk employee gets in touch with the respective employee*" (L1). In addition to the support service, a large number of organizations provides internal centralized contact persons. According to a leader (L1), these are used in particular "*for hardware problems or if the service desk cannot find a solution via remote diagnosis*". Other leaders (L1 and L2) state that they select team members to take part in training sessions to act as contact persons and be available to the team in the case of queries. However, many team members do not know whom to turn to for help, often due to a lack of information. Thus, a digital-health-oriented leader should install contact persons or support structures and ensure that the team members are informed about these structures.

**Rules and guidelines for the use of IS.** Moreover, the interviewees mention that leaders can improve their digital health by establishing guidelines on how to use the IS. These should be intended to counteract the accumulation of excessive information, interruptions, and omnipresence and need to be developed individually and concerning the specific characteristics of the organization, team, tasks, and IS. For instance, a team member (T3) suggests that "*digital*

*exchange platforms [...] should be integrated into a communication strategy and thus improve internal consultation within the company"*. Frequent interruptions during the workday due to requests by coworkers through IS impair digital health. Here, leaders can establish communication rules to improve digital health. For instance, in one organization, there is the possibility to set oneself to "Busy" or "Do not disturb" in the IS so that others know when the team member does not want to be disturbed, is attending a meeting, or has other tasks to perform. Team member T8 experiences the flood of unprocessed emails, inquiries, and pending tasks as burdensome and considers rules for limiting work-related requests after work or on vacation to be helpful. These rules and guidelines must be developed with caution and awareness of possible adverse side effects. For instance, due to these regulations, team members could feel patronized (L3). In addition, a team member (T11) considers the time restriction on using IS challenging to implement, especially when working with countries from other time zones.

## 4.7 BEHAVIOR DIRECTED AT THE SELF

The awareness and importance of the team members' or own digital health do not necessarily translate into self-directed digitally healthy behavior. Although the leaders state they are aware of the additional burden caused by the constant use of IS and they specifically pay attention to the digital health behavior of their team members, they admit to not necessarily behaving in a digitally healthy way themselves. The leaders explain their behavior with the responsibility assigned to them or the self-employment – "*It is my company and I am responsible for everything*" (L2). "*This constant availability has become a habit, but I do not want to pass it on to my employees as a guiding principle*" (L5).

From the team member's point of view, the leaders' behavior is often imitated since the team members assume that the leaders expect the same behavior from their team members, which often results in pressure. "*You get that from your boss [...] if the leader does not follow the agreements, […] then that is more stress for me because I think he kind of expects that I answer the phone*" (T21). A team member (T1) feels obligated by the leader's behavior to check emails even during vacation – "*It also happens that you receive one or two messages with important requests via WhatsApp. When something like that happens, you are expected to respond and get the problem out of the way as quickly as possible"*. A team member (T4) also takes an example from the work behavior of his leader – "*You tend to copy that. I would say that one tends to be willing to do more than would probably be normal. You also try to be available, work off things that you should not have had to work off*".

To address this pressure resulting from the leaders' behavior, the interviews highlight that digital health-oriented leadership also includes behaviors that support the digital health of the leaders themselves. "*For me, the best leader is someone who takes care of themselves and treats themselves with respect, because they also resonate this inner harmony*" (T24). Behaviors in this light include that the leaders themselves adhere to the rules established in terms of the IS environment. For example, one team member reported that the leader positively influences him by setting an example regarding limited availability. "*So we have precise rules that my leader and I adhere to, of course, so that it reduces my stress level as much as possible*" (T17). "*If you are sick, […] you also need to communicate clearly that you are ill and that you are not available*" (T29). Leaders pay attention to their digital health by, for example, limiting the time they can be reached by email or telephone or effectively structuring the workday to avoid digital interruptions. "*She [a leader] uses her digital calendar to indicate her availability, such like an availability list, where time slots are free, appointments can be booked as well as time slots when she is neither available by phone, nor Skype, nor email*" (T23). In sum, the behavior directed at the leaders themselves has multiple purposes as it positively affects the digital health of the team members but also implies positive influences for the leaders themselves.

# 5 DISCUSSION

Inspired by the relevance of digital health for employee health and organizational functioning, we base on literature in related fields (Franke et al., 2014) and introduce the concept of *digital health-oriented leadership*. We complement the conceptualization with data from interviews, offerings insights into the leaders' and team members' perspectives on digital health-oriented leadership. All that results in a holistic conceptualization of digital health-oriented leadership and lets us contribute to the leadership literature and digital health in the workplace.

## 5.1 THEORETICAL CONTRIBUTIONS

Considering the wide-ranging effects digital health implies for employee well-being (Ahsen et al., 2019; Kuem et al., 2021; Wenninger et al., 2018), we contribute to leadership literature by highlighting the relevance of leaders for digital health promotion and introduce a new concept, i.e., *digital health-oriented leadership*, specific for the context of digital health. The empirical results support that the leaders' influence on team members' digital health can be direct, such as a change in the organization of IS work, enriched communication with the team members regarding IS, or IS support for the team members. However, the influence of leaders can also be indirect in a way that leaders act as role models. When leaders are *aware* of their digital health, put *importance* on their digital health, and *behave* in a way that supports their digital health, these three dimensions can be contagious as our results offer first indications that they can influence the team members' awareness, value, and behavior regarding their digital health (self-care of team members).

Our work extends existing research on overcoming the dark side of IS and strengthening the bright side of IS (Tarafdar et al., 2019) by focusing on the specific employment group of leaders (Pflügner et al., 2021). Moving beyond leaders' behaviors, our conceptualization highlights two more essential dimensions: the awareness and value that leaders hold towards their and team members' digital health. Related research on the bright and dark side of IS can integrate these insights by considering cognitive, such as awareness, and motivational dimensions, such as value, beyond actual behaviors (Pirkkalainen et al., 2019). We complement those research insights by accounting for all three dimensions, which offers valuable opportunities to address the bright and dark sides of IS. For instance, it points to the fact that employees can enact specific strategies for reducing technostress (behavior) (Pirkkalainen et al., 2019). However, they also need to be aware that their digital health is threatened (awareness) and consider themselves and their digital health as necessary (value) so that they advocate the enactment of specific strategies.

The conceptualization of digital health-oriented leadership adds to related research from the general health literature (Franke et al., 2014) by providing a sociotechnical lens on digital health promotion. Although digital health concerns the employees, i.e., leaders and team members, digital health-oriented leadership also implies caring for the IS, such as establishing IS-related rules and guidelines. Thus, the research highlights the relevant interplay among the employees – team members and leaders – and the IS inherent in this digital context. Digital health can refer to the IS as the subject of digital health (Benlian, 2020) and the object of digital health (Baumel et al., 2019). Similarly, digital health-oriented leadership encompasses both aspects, meaning that leaders engaging in digital health-oriented leadership can address IS as the subject of digital health, such as establishing rules and guidelines for the use of IS, but can also use IS as the object for digital health, such as transmitting social support via IS.

## 5.2 PRACTICAL IMPLICATIONS

We provide an inventory of digital-health-oriented leadership aspects to promote the digital health of leaders and their team members. Thus, the results can help leaders reflect on their level of digital health-oriented leadership and draw attention to the multiple dimensions relevant to digital health-oriented leadership. Leaders should also be aware of crossover effects. How leaders think, feel, and behave regarding their digital health can cross over to how team members think, feel, and behave regarding their digital health. However, digital health-oriented leadership is only sometimes visible to team members (Vonderlin, Schmidt, et al., 2021), limiting the effectiveness of digital health-oriented leadership in improving team members' digital health.

Our results explain why some measures implemented by leaders for increasing digital health might not work as expected. For instance, if organizational rules are implemented to improve team members' digital health, such as limitations to permanent connectivity with work, they might not have the expected result when leaders do not follow the rules. The interviews highlight that leaders act as role models, influencing team members' digital health. Moreover, more is needed than solely focusing on digital health-related behaviors. Digital health promotion should follow a more comprehensive approach, focusing also on underlying awareness and values leaders hold towards digital health.

## 5.3 LIMITATIONS

Our research is not free of limitations. With our qualitative study, we focus on leaders' awareness, value, and behavior towards their team members, IS, and themselves, and on the team members' perceptions of those leaders' awareness, value, and behavior. We do not specifically focus on the self-care of the team members, i.e., what the team members do to strengthen their digital health and how this relates to digital health-oriented leadership.

Moreover, our qualitative data reflecting the perspectives of team members and leaders indicate that health-oriented leadership effectively improves team members' and leaders' digital health. For instance, our results describe possible positive effects of digital health-oriented leadership on mental well-being, such as reducing the extent to which IS use leads to exhaustion, and on social well-being, such as improved communication through IS inherent in digital health-oriented leadership strengthening the relationship of leaders and their team members. However, the perceptions of digital health-oriented leadership might differ between leaders and team members, shaping its effectiveness (Vonderlin, Schmidt, et al., 2021). We need to systematically quantitatively investigate the effectiveness of digital health-oriented leadership on digital health and the size of this effect.

Finally, we do not consider differences in the knowledge and skills of leaders, such as emotional intelligence (Law et al., 2004) or IS-related skills (Compeau et al., 2022). These characteristics of the leaders might shape their abilities and effectiveness to engage in digital health-oriented leadership, e.g., the ability to be aware of digital health threats or enact certain digital health-relevant behaviors. These limitations pave the way for future research.

## 5.4 FUTURE RESEARCH AVENUES

The research at hand sets the grounding for further research on healthy working with IS focusing on leadership and paves the way for five future research avenues (RA) (Figure 3).

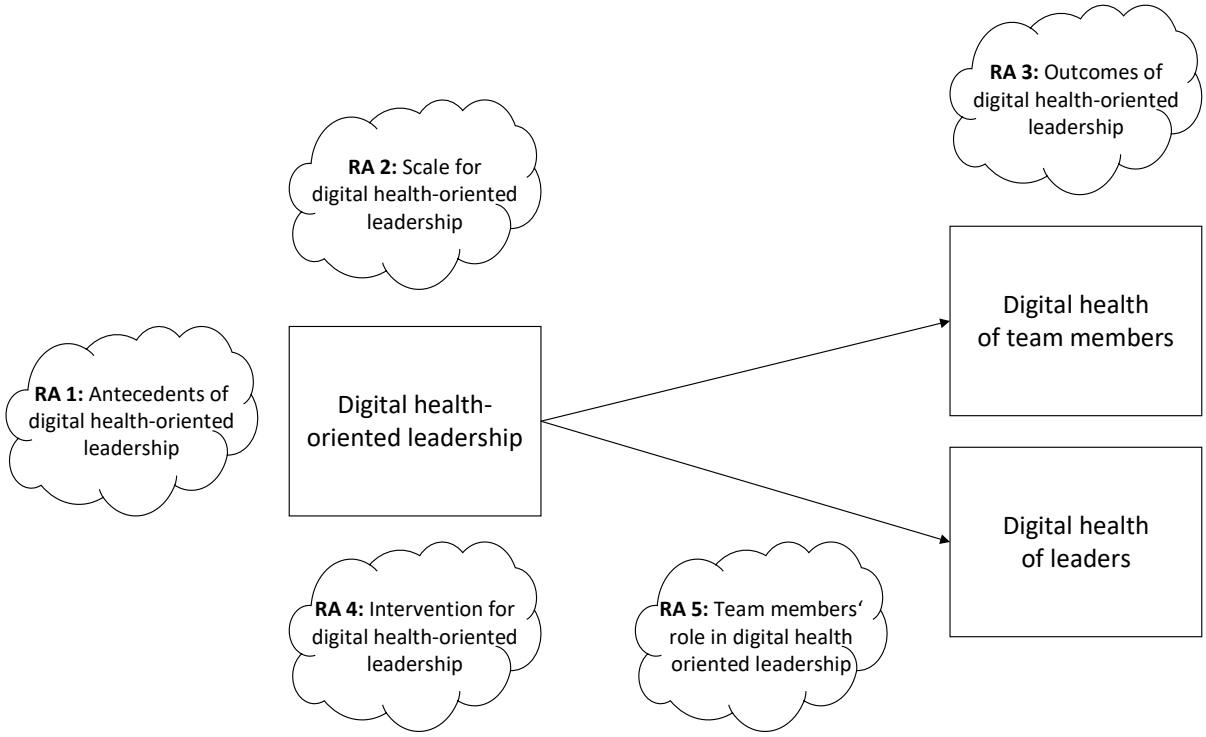


**Figure 3. Future research avenues**

**RA 1: Antecedents that facilitate digital health-oriented leadership**. While the study reveals the dimensions of digital health-oriented leadership and the qualitative data supports the digital health-promoting effect, there is room for investigating the antecedents of digital health-oriented leadership. Some leaders' characteristics, such as personality traits or abilities, might enhance or be necessary for leaders to engage in digital health-oriented leadership (Köppe & Schütz, 2019). Also, context-specific factors such as leaders' IT self-efficacy (Compeau et al., 2022) or IS-related disruptions such as a new IS implementation (Sykes, 2020) might have a substantial influence on whether and to which extent leaders engage in digital health-oriented leadership and thereby influence team members' digital health.

**RA 2: Development of a scale to measure digital health-oriented leadership**. Our paper defines and conceptualizes digital health-oriented leadership drawing from related literature (Franke et al., 2014) and empirical qualitative data. Future research would profit from developing a scale to measure digital health-oriented leadership that draws from the conceptualization provided in this paper. Such a scale can fulfill multiple purposes, such as revealing the effectiveness of health-oriented leadership in enhancing team members' and leaders' digital health, a self-evaluation for leaders themselves, and a tool for evaluating the effectiveness of possible interventions or training for increasing digital health-oriented leadership.

**RA 3: Outcomes of digital health-oriented leadership**. Starting from our empirical indications for the digital-health-promoting effect of digital health-oriented leadership, we encourage future research to systematically investigate the effectiveness of digital health-oriented leadership on the physical, mental, and social well-being of team members and leaders. There are also boundary conditions to the effectiveness worth investigating, such as the team size, the IS used in the organization, or the amount of in-person vs. remote interaction between the leaders and team members.

**RA 4: Interventions for digital health-oriented leadership**. Digital health-oriented leadership refers to a leadership style that is not stable but can be trained. Thus, we encourage

future research to develop an intervention for leaders to strengthen their digital-health-oriented leadership and evaluate the training effects. Given that digital health-oriented leadership consists of the three dimensions of awareness, value, and behavior, and our empirical results support that these three dimensions are interrelated, the intervention should contain training parts for all three dimensions.

Regarding awareness, an intervention could inform leaders about possible signals that indicate digital health risks (Pischel et al., 2022) and methods for systematically assessing digital health, such as questionnaires or one-on-ones with the team members.

Turning to value, following the belief system theory (Ball-Rokeach et al., 1984), leaders, just like any other individuals, seek positive self-conceptions. Providing leaders feedback on the extent to which they engage in digital health-oriented leadership, for instance, with a self-assessment, can induce a state of self-dissatisfaction. Such a negative state and confrontation with their values can change their values toward digital health (Grube et al., 1994).

Turning to behavior, it is relevant that leaders know and are competent in selecting and implementing the variety of behaviors directed at the team members, the IS, and themselves identified in this study. Given that the leaders act as role models, the training should also increase the understanding of how influential their digital health-oriented behavior is for the behavior of the team members.

**RA 5: Team members' role in digital health-oriented leadership**. Related research on health-oriented leadership reveals that health-oriented leadership leads to positive effects on team members' health by improving the self-care of team members (Horstmann, 2018; Kaluza & Junker, 2022) and that team members' expectations influence the relationship between health-oriented leadership and team members' well-being (Kaluza et al., 2021). Based on these insights from related literature, team members might play a crucial role in digital health-oriented leadership. Self-care of team members in the context of digital health-oriented leadership implies a competent use of IS by the team members themselves. Thus, team members' IS-related characteristics and perceptions, such as IT self-efficacy (Compeau et al., 2022), IT mindfulness (Thatcher et al., 2018), or trust in IT (McKnight et al., 2011) might shape the effectiveness of digital health-oriented leadership enacted by the leaders.

# 6 CONCLUSION

Since digital health is relevant for employee health and organizational performance, digital health in the workplace has attracted practitioners' and scholarly attention. We draw attention to the leaders' role in digital health in the workplace and introduce the concept of digital health-oriented leadership. Digital health-oriented leadership consists of three dimensions, awareness, value, and behavior, directed at the team members, IS, or leaders themselves. The new concept paves the way for an enhanced understanding and promotion of healthy working in the digital age, leading us to develop six avenues for future research.

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# APPENDIX

We analyzed the qualitative interview data with the coding approach presented by Myers (2013). The inductive descriptive codes led to seven inductive interpretive codes, which in turn were assigned to three deductive categories. Coding examples of our coding approach are provided in Table 4.

**Table 4. Coding example**

| Categorization | Interpretive code | Descriptive code | Quotation |
|---|---|---|---|
| Awareness | Awareness of team members' digital health | Awareness is the first step | My leader expressed he had realized the team felt overburdened by the virtual format of the meetings. I think such awareness is good because that is the first step that he can help us with these issues. (Team member) |
| Awareness | Awareness of team members' digital health | Awareness of team members overburdening due to IS is a challenge | One of the biggest challenges is to find out when employees are overburdened with digital media and where there are still gaps or potential for improvement. (Team member) |
| Awareness | Awareness of own digital health | Risks to team members' digital health are not always perceived or correctly attributed | They [risks to digital health] are not always consciously perceived. And the perceived stress is not always directly attributed to the use of digital media. (Team member) |
| Awareness | Awareness of own digital health | Leaders' awareness of their own digital health is in the background | The focus is primarily on the successful execution of the work [...] The awareness of one's own stress due to IS and possible health-related consequences has been pushed into the background. (Leader) |
| Value | Value of team members' digital health | Giving advice is a sign of taking team members' digital health seriously | I think something like that [giving pieces of advice on how to deal with the information systems] is good because that is, first of all, a sign that he has taken seriously what we communicated last week. (Team member) |
| Value | Value of team members' and own digital health | Leaders attaching importance to digital health is relieving for team members | When I have the feeling that my leader thinks it is important that everyone cares for their digital health and sets an example by his actions, it is kind of relieving for me, and I feel like I have the permission to tell when I feel burdened due to the speed of digital inquiries. (Team member) |
| Behavior | Behavior directed at team members | Leader support takes stress off the team members | For example, we have a core system failure, and our leader would have finished work at 5 p.m. […] However, our leader stays there until you have worked through the problem and takes over communication with colleagues, for example. That takes much stress off me. (Team member) |
| Behavior | Behavior directed at team members | Close contact between leaders and team members is important | Here, it is important to maintain close contact between leaders and employees to be able to provide targeted help. (Leader) |
| Behavior | Behavior directed at the IS | A ticket system supports team members with IS problems | This functions as a decentralized point of contact that is managed and controlled via a ticket system, so if a problem arises, a ticket is opened, forwarded, and then a responsible service desk employee gets in touch with the respective employee. (Leader) |
| Behavior | Behavior directed at the IS | IS should be integrated into a strategy and guidelines | Digital exchange platforms [...] should be integrated into a communication strategy and thus improve internal consultation within the company. (Team member) |
| Behavior | Behavior directed at the self | Leaders taking care of their own digital health helps team members | For me, the best leader is someone who takes care of themselves and treats themselves with respect, because they also resonate this inner harmony. (Team member) |
| Behavior | Behavior directed at the self | Leaders can pass their own bad habits to their team members | This constant availability has become a habit, but I do not want to pass it on to my employees as a guiding principle. (Leader) |

# Appendix

# PUBLICATIONS

## SCIENTIFIC JOURNALS (PEER REVIEWED)

Pflügner, K., Maier, C., Thatcher, J.B., Mattke, J., & Weitzel, T. (forthcoming). Deconstructing technostress: A configurational approach to explaining job burnout and job performance. *MIS Quarterly*. https://doi.org/10.25300/MISQ/2023/16978 (VHB-JOURQUAL 3 Rating: A+).

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Pflügner, K., Maier, C., Mattke, J., & Weitzel, T. (2021). Personality profiles that put users at risk of perceiving technostress: A qualitative comparative analysis with the Big Five personality traits. *Business & Information Systems Engineering (BISE)*, *63*(4), 389-402. https://doi.org/10.1007/s12599-020-00668-7 (VHB-JOURQUAL 3 Rating: B)

Maier, C., Mattke, J., Pflügner, K., & Weitzel, T. (2020). Smartphone use while driving: A fuzzy-set qualitative comparative analysis of personality profiles influencing frequent high-risk smartphone use while driving in Germany. *International Journal of Information Management, 55*, Article 102207. https://doi.org/10.1016/j.ijinfomgt.2020.102207 (VHB-JOURQUAL 3 Rating: C)

## CONFERENCE PROCEEDINGS (PEER REVIEWED)

Pflügner, K., Maier, C., Lukic, Y.X., Teepe, G.W., & Kowatsch, T. (2022). Mobile stress management applications: An affordance-theoretic perspective on the adoption and use. *Proceedings of the 43rd International Conference on Information Systems (ICIS), Copenhagen, Denmark.* (Research in Progress)

Valta, M., Menzel, J., Maier, C., Pflügner, K., Meier, M., & Weitzel, T. (2022). Digital nudging: A systematic literature review and future research directions. *Proceedings of the 22nd ACM SIGMIS Conference on Computers and People Research, Atlanta (GA), USA.* (Best Paper Award)

Pflügner, K. (2022). Technostress management at the workplace: A systematic literature review. *Proceedings of the 17th International Conference on Wirtschaftsinformatik, Nuremberg, Germany.* (Best Paper Nomination)

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Pflügner, K., Maier, C., & Weitzel, T. (2021). Dyadic technostress coping: Theoretical foundation and empirical evidence complementing individual coping. *Proceedings of the 42nd International Conference on Information Systems (ICIS), Austin, Texas, USA.*
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(Best Paper Award)

Pflügner, K., Hrovat, F., & Maier, C. (2021). Medical teleconsulting applications: An empirical study on elderly peoples' satisfaction. *Proceedings of the 16th International Conference on Wirtschaftsinformatik, Essen, Germany.*

Valta, M., Pflügner, K., & Maier, C. (2021). Guiding companies to reduce technostress: A mixed-methods study deriving practice-oriented recommendations. *Proceedings of the 54th Hawaii International Conference on System Sciences (HICSS), USA.*

Weinert, C., Pflügner, K., & Maier, C. (2020). Do users respond to challenging and hindering techno-stressors differently? A laboratory experiment. *Proceedings of the 2020 NeuroIS Retreat, Vienna, Austria.* (Research in Progress)

Pflügner, K., Reis, L., Maier, C., & Weitzel, T. (2020). Communication measures to reduce techno-invasion and techno-overload: A qualitative study uncovering positive and adverse effects. *Proceedings of the 20th ACM SIGMIS Conference on Computers and People Research, Nuremberg, Germany.*
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Pflügner, K., Mattke, J., & Weitzel, T. (2019). Which combinations of techno-stressors harm users and organizations: A qualitative comparative analysis. *Proceedings of the Special Interest Group on Adoption and Diffusion of Information Technology (DIGIT) (Pre-ICIS Workshop), Munich, Germany.*

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## OTHER PUBLICATIONS

Weitzel, T., Maier, C., Weinert, C., Pflügner, K., Oehlhorn, C., Wirth, J., & Laumer, S. (2020). Generation Z - die Arbeitnehmer von morgen - Ausgewählte Ergebnisse der Recruiting Trends 2020 und der Bewerbungspraxis 2020. *Research Report, Otto-Friedrich-Universität Bamberg.*

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