# 'THE RIGHT TO DISCONNECT': AN INTERVENTION STUDY TO EXAMINE THE EFFECT OF CONSTANT CONNECTIVITY THROUGH WORK EMAILS ON WORK-HOME CONFLICT, RECOVERY, BURNOUT AND PERFORMANCE

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# ABSTRACT

Research exploring the impact of work-related information communication technology (ICT) demands has grown rapidly over the past 15 years and evidence for a dark side is mounting. The ever-increasing reliance on work-related ICT, such as emails, which leave workers inundated with incoming messages, create spillover into non-work domains and facilitate constant work connectivity, can be detrimental to employee health and wellbeing. Despite concerns of employees, organisations, and policy makers and repeated calls for interventions, research progress on this matter remains slow. Thus, while recent European legislative actions citing workers "right to disconnect" signal that this is taken as a serious health threat and needs to be managed, the evidence base that supports such actions is largely absent. This thesis addresses this gap through three well-aligned research articles.

The first research article identifies the vastly emerging yet divergent research streams that have formed in the technostress and wider ICT demands literature as a barrier to progress as this can make it difficult to fully understand what is known about certain ICT stressors and how to address them. Subsequently, a comprehensive systematic review (N = 114 articles) was conducted which a) clarifies the conceptual nature of different ICT demands by creating a taxonomy and unifying framework and b) reviews associated negative outcomes in the work and home domains. This framework more readily captures stressors relevant to mobile ICT which offers a starting point for well-informed intervention research.

The second article presents a quasi-experimental intervention designed to reduce email-specific ICT demands, through the team-level implementation of new email guidelines, as a means for improving employee wellbeing and performance outcomes. The results reveal that the implementation of certain email rules is effective in reducing techno-overload, techno-invasion, email monitoring frequency and time spent on emails during non-work time. This reduction in demands functioned as the mediating mechanism that facilitated significant improvements in work-home conflict, psychological detachment, burnout and performance.

The third paper presents a conceptual replication of this intervention to test whether the intervention effects generalise to a private sector sample that works in an international context. The results highlight that the effects on constant connectivity demands and burnout can be replicated in other samples and industries however, inconsistencies are highlighted and discussed. This thesis deepens understanding of demands- and resource-based stress theories, particularly the work-home resources model, and provides practical knowledge for the design of interventions relevant to the right-to-disconnect movement.

# DECLARATION

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

# COPYRIGHT STATEMENT

# DEDICATION

To Jamie and Rupert

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# Chapter 1: INTRODUCTION

## 1.1.    Thesis overview

Technological advancement has revolutionised the working world of the 21$^{st}$ century. Information communication technology (ICT) is defined as any technology or device that can acquire, store, process, or transmit information (Steinmueller, 2000), including personal computers, the Internet, mobile communication devices, and email (Day et al., 2010, p. 318). Its widespread use has led to a fundamental shift in how and where work is completed (Ragu-Nathan et al., 2008; Messenger & Gschwind, 2016) and while it is often celebrated for providing the flexibility to work from anywhere at any time (Joyce, et al., 2010; Adekoya et al. 2022), making it much easier to collaborate with colleagues, clients and partners all over the world, it seems that there can be too much of a good thing.

ICT is often described as a double-edged sword (Dén-Nagy, 2014; Stich et al., 2015), meaning that it can function both, as resource and a demand (Day ey et al., 2010).  For example, on the one hand, the improved availability to work through ICT can act as a positive capability spanning resource, that allows on-call workers to spend time at home with their family during their on-call hours (Lowry & Moskos, 2005) and helps employees integrate work and family demands through flexible working arrangements  (Singley & Hynes 2005), thus leading to improvements in work-life balance Chung & van Der Lippe, 2018).  Similarly, working with ICT has introduced new ways to perform one's work, such as telecommuting, virtual meetings and multiple communication channels, which can facilitate a great sense of control and autonomy over where work is completed (Day et al., 2010), which is linked to greater levels of job satisfaction and employee wellbeing (Sparks et al., 2001; Day et al., 2010; Jang et al., 2011; Joyce et al., 2010; Moen et al., 2011). Additionally, the almost effortless access to information can not only increase one's capacity to store and process information but also makes it much easier to gather, create and share these, which ultimately allows employees to work more efficiently and effectively (Dewett & Jones, 2001; Day et al., 2010). However, on the other hand, ICT can also simultaneously act as demand. For example,  although ICT can improve communication, the ability to access and receive more information faster, can increase workload,  productivity expectations and stress (Rosen & Weil, 1997; Day et al., 2010; Wang et al., 2008). Although it can be greatly beneficial for staff, colleagues, managers, or clients to be able to reach you whenever they need you, the ability to always be available can create

pressures to be constantly connected and make it difficult to detach from work (Barber & Santuzzi, 2015; Day et al., 2010; Ragu-Nathan et al., 2008). Although devices such as work mobile phones come with positive organisational gains and are often perceived as empowering by employees (Cavazotte et al., 2014), the autonomy paradox describes how mobile ICT can act an electronic leash which leads employees to work everywhere all the time (Mazamanian, 2013; Schlachter et al., 2018). Ultimately, creating work-home conflict as well as physical and mental health difficulties such as chronic exhaustion and burnout (Dettmers 2017; Wright et al., 2014). Due to the double-edged nature of ICT, it is difficult for organisations to find ways that provide employees with the technology they want and at the same time protect them from their adverse effects (Stich et al., 2018). To advance understanding in this area, this thesis will focus on the demands of ICT with the aims to shine greater light on the associated negative effects, and to develop effective strategies that enable organisations to better manage ICT. Ultimately, so that employees can utilise ICT resources to thrive at work rather than combat additional demands.

*Technostress*

As technology continues to advance and permeate every aspect of our lives, technostress which can be loosely described as stress experienced by individuals due to their use of ICT (Ragu-Nathan et al., 2008, p.418), is becoming an increasingly prevalent issue. Although the phenomenon of technostress has been a term for over 40 years (Brod, 1984), research that examines how and why the use of ICT creates demands that trigger stress responses has risen exponentially over the past 15 years, with work emails typically discussed at the heart of the problem. For example, while emails that entail information critical to one's work can enhance work performance (Mano & Mensch, 2010), constant emails unrelated to one's primary task can lead to reduced productivity due to the time it takes workers to recover from the interruptions (Jackson, Dawson & Wilson, 2001; Gupta & Sharda, 2008; Van Solingen, Berghout & Van Latum, 1998). Furthermore, such email interruptions and receiving high numbers of emails in general, are associated with perceptions of increased workload (Gupta, Li & Sharda, 2013) and feelings of overload (Barley, Meyerson & Grodal, 2011). Subsequently, workers often find that they need to work longer and faster to address their email-related workload. These feelings and reactions can be described as techno-overload (Ragu-Nathan et al., 2008) which can be detrimental to employees' mental and physical well-being (Stich et al., 2018). For example, qualitative research revealed how backlogs of emails combined with a perceived expectation to respond quickly, led workers to experience anxiety,

and to cope with this they extended their workday or continued working from home during non-work time (Barley et al., 2011). This example further highlights how emails can act as a vehicle for work demands to cross over into the home-domain.

Scholars have long suggested that the introduction of mobile ICT has changed organisational culture to the extent where individuals struggle to balance their need for autonomy with the ever-increasing demands of others (i.e. managers, team members, clients), and their work commitment (Ragu-Nathan et al., 2008; Mazmanian, 2013). A collective consequence of the increased embeddedness of mobile email access is the normative understanding that constant work availability is what is needed to be an effective professional in this hyper connected, always on, technological era (Mazmanian et al., 2013). Techno-invasion is a technostress creator that arises when individuals perceive that work demands interfere with non-work time, that their privacy is disturbed by surveillance, and that they face high response expectations and pressures of constant availability (Tarafdar et al., 2007; Ragu-Nathan et al., 2008; Day et al., 2012; Barber & Santuzzi, 2015). There is now substantial evidence that techno-invasion increases work family conflict, stress, and work exhaustion (Gaudioso et al., 2015, 2017; Molino et al., 2020). Further research demonstrates that the urge to check emails and respond to these quickly in - and outside of working hours, was associated with lower levels of psychological detachment and sleep quality, higher levels of physical and cognitive burnout and health-related absenteeism (Barber and Santuzzi. 2015). Similarly, organisational availability expectations (Becker et al., 2021; Dettmers et al., 2017) and subsequent mobile ICT use (Derks et al., 2014, 2015; Wright et al., 2014, Ferguson et al., 2016) were associated with increased work-life conflict, an inability to recover from work, and burnout.

*Combating the dark side of ICT*

In recognition of the long-term health threat that this dark side of ICT presents, legislative changes have been introduced across various European countries. In 2017, France was the first to introduce the 'right to disconnect', a law which inhibits organisations from sending emails to employees after hours or demands that firms introduce a charter that clearly outlines the rules and rights relating to out-of-hours communication (ERSP, 2020; Secunda, 2018). One early experimental study highlighted benefits of fully removing emails from the workplace, such as a lower heart rate variability and increased task focus, the study also highlighted reports from participants who felt a sense of isolation and a lack of control (Mark et al., 2012). Thus,

while workplaces may be unlikely to fully remove emails, this demonstrates the importance of research to evaluate the effects of email interventions to identify effective mechanisms that protect workers from the adverse impact of ICT while minimising the risk of unintended negative side effects and maintaining the beneficial resources mobile ICT offer. For example, scholars have suggested the implementation of email guidelines which limit the time workers spent on emails to working hours only (Piszcek, 2017; Becker et al., 2021).

However, despite the popular attention (BBC, 2014; 2021), and legislative changes, no intervention studies focussed on reducing out of hours emails have been conducted, despite frequent calls for them (Barber & Santuzzi, 2015; Derks et al., 2014; Stich et al., 2015; Stich et al., 2018). Thus, although there is clear practical relevance and need for intervention research this field, the literature is still in its infancy. As a result, the evidence-base to support legislative actions such as the 'right to disconnect' (i.e., in form of email interventions that address demands such a techno-invasion and constant connectivity) is largely absent.

One reason for this will certainly be the inherent difficulties that come with organisational research that involves experimental and quasi-experimental designs, such as the recruitment of an adequate control group, sample size and cross-group contamination (Nielsen et al., 2010). A further hurdle in the way of meaningful progress may be the lack of coherence regarding the conceptual nature and empirical value of the different ICT-related stressors that have emerged over time. The challenge here lays with an increasing amount of emerging research that is highly interconnected and yet dispersed across disciplines with little reference to a unifying framework (Schlachter et al., 2018). For example, the adverse effects of workplace ICT on people's health and wellbeing have been explored under the concept of technostress (Brod, 1984; Ragu-Nathan et al., 2008; Ayyagari et al., 2011; Tarafdar et al., 2019), ICT demands (Day et al., 2010); workplace telepressure (Barber & Santuzzi, 2015), organisational expectations for email monitoring (OEEM, Becker et al., 2021), work-related ICT use during non-work time (Fenner & Renn, 2010; Derks & Bakker, 2014); work-contacts during non-worktime (Schieman & Young, 2013), and extended availability for work (Dettmers, 2017), to name a few. While some of these constructs are almost identical but called differently, others tap into conceptually distinct demands but are difficult to differentiate by their labels. This can lead to jingle-jangle fallacies (Kelley, 1927; Marsh, 1994), where one may falsely assume that two distinct constructs are the same because they use the same label (jingle fallacy), or that two similar constructs are distinct because they have different labels (jangle fallacy). This threatens the development of a cohesive body of research (Casper et al.,

2018) and ultimately makes it difficult inform relevant practice and research about what is known about certain stressors and how to best address these.

Given the inconsistent terminology used to describe the various demands associated with work-related ICT, there is currently no inclusive term to refer to these. To ease the communication in this regard, from here on onwards the term ICT demands will be used as an umbrella term to encompass these stressors. In line with Demerouti et al., (2001)'s definition of work demands, ICT demands refer to those physical, social, or organisational aspects of work-related ICT that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs (p. 501). This conceptualisation is closely related to that of Day et al., (2010), and while it will encompass their multidimensional ICT demands construct, ICT demands in the context of the current thesis will go beyond the conceptualisations of specific authors to serve as an overarching umbrella term (framework) under which different conceptualisations will be unified and classified.

Overall, the complex interplay of ICT resources and demands present a difficult to manage trade-off between positive individual-and organisational gains and sacrificed privacy, mental and physical health. It is important for research to address the outlined research barriers to make much needed progress in this field. Thus, this thesis will carry out a systematic review focused on ICT demands to provide conceptual clarity as well as insights regarding associated adverse outcomes. Most importantly, intervention research aimed at mitigating the adverse impact of out of hours email use will be conducted to develop evidence-based recommendations on how to manage ICT such that it can serve employee wellbeing and performance.

### 1.2. Theoretical framework

The Work-home boundary theory (Ashforth et al., 2000; Hall & Richter, 1988; Nippert-Eng, 1996) describes that individuals strive to create and maintain a balance between their work and home domains to increase role-functioning and wellbeing. However, work-home boundaries have become increasingly blurred through mobile ICT. Now workers can easily respond to work emails at home which can lead work to encroach on personal time such as evenings and weekends (Kossek & Lautsch, 2012). Although the ability to work flexibly and integrate work and home demands has made mobile ICT as an invaluable resource (Day et al., 2010; Joyce, et al., 2010; Messenger, 2018; Adekoya et al. 2022) for many, studies have shown that the increased permeability between work and home boundaries associated with ICT (e.g.,

Kim & Hollensbe, 2018; Piszczek, 2017; Valcour & Hunter, 2005) can cause work-home interference and stress (Derks et al., 2014; Leung, 2011). Thus, to adequately study the adverse effects of ICT demands and develop an effective intervention, the theoretical foundation needs to be based on a model that accounts for effects across both, the work- and home domain.

The work-home resources (W-HR) model (ten Brummelhuis & Bakker, 2012) offers a well-suited theoretical framework for to study the effects of ICT. That is because it considers how stress occurs due to a conflict between work and home domains and acknowledges both the beneficial aspects of resources as well as draining effects of demands. Thus, although this thesis focuses on the effects of demands, it captures the double edged and intertwined nature of effects applicable to ICT. In its essence, the model proposes a reciprocal process where demands in one domain drain personal resources which causes adverse outcomes in the other domain. Resources have the opposite effect, build personal resources and facilitating positive outcomes. The model is based on the Conservation of Resources (COR) theory (Hobfoll, 2001) which sets out that an individual's primary goal in life is to retain, foster and accumulate resources so they can cope with the demands and challenges they face. Resources can be contextual resources, located within the social or organisational context of individuals (e.g., marriage, home, career, job characteristics, social support from friends, colleagues and managers at work etc.), or personal resources, located within individuals (e.g., energy, attention, time, mood, mental resilience, health, skills, knowledge, and personality characteristics). Resources are typically invested to cope with stressors. If these are threatened, lost or not regained after significant resource investment psychological strain will follow and a loss spiral begins (Hobfoll, 1989, Hobfoll, 2002).

The WH-R model has resources at its centre, however, it attributes a key role to demands as the trigger of adverse home and work outcomes. It views stressors as contextual demands that require sustained physical and/or mental effort, categorised as either overload, emotional, cognitive, or physical (ten Brummelhuis & Bakker, 2012; Demerouti, et al., 2001; Peeters et al., 2005). Contextual demands, such as working overtime, deplete personal resources (e.g., time, focus, physical energy, sleep, mood, health) which diminishes home outcomes (e.g., less quality time with family, missed leisure activities, reduced home-related happiness and wellbeing). In turn, existing contextual home demands (e.g., coordinating and engaging in home tasks, spousal conflict) further deplete personal resources which leads to adverse work outcomes such as feelings of burnout and reduced work productivity and quality (ten Brummelhuis & Bakker, 2012). In line with this, a longitudinal study by Dettmers (2017),

has demonstrated that high availability requirements (contextual work demands) lead to decreased psychological detachment (adverse home outcomes) and increased work-family conflict (home demands), which ultimately lead to an increase in emotional exhaustion (adverse work outcome).

In addition to outlining the adverse impact of work demands through loss spirals, the model proposes positive work-home processes (enrichment or gain spirals). Although these are typically studied in the context of resources, the principles can be applied demands to predict positive work and home outcomes and form the basis for ICT demands interventions. Specifically, the COR theory predicts that gain spirals occur in the absence of stressors, as this allows the utilisation of existing resources to generate additional resources which can act as a buffer and increases wellbeing (Hobfoll, 2002). Because an important condition for the recovery of personal resources is the absence of the stressors that trigger resource investment and load reactions (Hobfoll, 1989; Meijman & Mulder, 1998), an effective interventions strategy should focus on minimising the exposure to those contextual work demands that facilitate ongoing resource investment (i.e., ICT demands). Thus, in line with Dettmers (2017) findings, an intervention that reduces ICT demands such as high availability requirements, should improve home outcomes (e.g., higher levels of psychological detachment), reduce work-home conflict, and improve work outcomes (e.g., lower levels of burnout and higher levels of performance).

Most studies examine the effect of an intervention on an outcome such as well-being, but it is often not clear why it improves wellbeing. Unless the mediating mechanisms of the proposed underlaying effects are formally tested (e.g., a reduction in demands or an increase in resources), it leaves the question whether the intervention works because of a change in job characteristics, or merely due to the participants involvement in the intervention (Holman et al., 2010). At their core, most stress theories discuss the draining and health threatening effect of demands, and the motivational or alleviating impact of resources (e.g., Demerouti et al., 2001). Demands and resources can have direct as well as more complex interaction effects and, theoretically, both reducing demands and increasing resources should facilitate positive effects on employee wellbeing and performance outcomes (Bakker & Demerouti, 2007). However, while the mechanism of increasing resources is often tested in intervention research, that of demands is less frequently explored. Studies suggest that increasing resources may not be sufficient to buffer the adverse impact of poorly managed ICT (e.g., Ninaus et al., 2021), suggesting that a closer focus on the of demands may be needed. Thus, while the WH-R model

acknowledges the important role of resources, this research homes in on advancing the demands-element of this model. Specifically, we propose that a fundamental first step to effectively manage the negative health impact of ICT (such as emails) is to address the demands these create. To test this, the intervention will specifically examine the impact of reducing ICT demands as the underlying mechanism through which the intervention improves wellbeing and performance outcomes. For example, taking Dettmers (2017) findings,  as connectivity pressure reduces, less work-home conflict would be experienced, and the ability psychologically detach from work would increase. Subsequently, work exhaustion reduces, and may performance improve. Thus, showing a reciprocal negative relationship between demands in one domain and outcomes in the other. The proposed effects predict gain spirals based on a reduction in work demands which is in line with the directionality of the W-HR model, principles of COR theory and the JDR model's health impairment process (Demerouti et al., 2001; Bakker & Demerouti, 2007). Ultimately, by taking this novel approach, the results will not only add to our theoretical understanding of these theories by testing this mechanism formally through mediation analyses but also provide a more comprehensive evaluation and understanding of the efficacy of ICT interventions.

### 1.3.Research aims and questions

To address the discussed shortcomings, the current thesis presents three publishable research articles which will address the following research aims and questions:

**Aim 1:** To  develop a systematic review and taxonomy of existing ICT demands and their associated adverse outcomes. This will answer the following research questions:

Research Question 1: What are the different conceptualisations of work-related ICT demands? (Article 1)

Research Question 2: What are the negative outcomes associated with work-related ICT demands? (Article 1)

A clarification of the existing ICT demands conceptualisations, and a review of their associated adverse outcomes will highlight their unique value and overlap and contribute to a more integrated approach to studying ICT demands. This will serve as a basis for developing an intervention strategy where a reduction in selected email-related ICT demands is targeted as a mechanism for improving wellbeing and performance outcomes.

**Aim 2:** To empirically examine the effectiveness of an email intervention across different samples and settings.

For this, an email guidelines intervention will be designed, implemented, and evaluated across two organisations (private vs. public sector), so that answering the following research questions will shine a light on a) how to better manage emails to minimise the demands this places on workers, b) the effectiveness of this in reducing associated adverse outcomes in the work and home domain, c) the relative importance of different ICT demands in driving these intervention effects, and d) whether these effects can be replicated.

Research Question 3: *How does an email (guidelines) intervention affect ICT demands? (Article 2 & 3)*

Research Question 4: *How does an email intervention affect specific employee wellbeing outcomes? (Article 2 & 3)*

Research Question 5: *How does an email intervention affect employee performance ? (Article 2 & 3)*

Research Question 6: *What underlying mediating mechanisms drive the effects of an email intervention ? (Article 2 & 3)*

Research Question 7: *How generalisable are the effects of an email intervention across different sample and settings? (Article 3)*

# Chapter 2: POSITIONING AND OUTLINE OF THE THREE RESEARCH PAPERS

To best address the overarching research aims and objectives of this thesis, an alternative format was chosen, which consists of three interconnected research articles (Figure 2.1). All articles are presented in a publishable state and have either been submitted or are ready for submission to a peer-reviewed journal. Article 2 has received an invitation to revise and resubmit to Work and Stress and has been presented at international conferences (i.e., European Agency of Occupational Health Psychology 2022 and Wellbeing at Work 2022 - Partnership for European Research in Occupational Safety and Health).

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Systematic literature review

Article 1                          Empirical examination of intervention effects
What kinds of ICT
demands exist and
what are their          Article 2
negative                How can ICT
consequences?           demands be addressed
                        to minimise these
                        negative outcomes ?
                                                        Article 3
                                                        Does this work across
                                                        different samples?

Research output: A taxonomy of ICT demands
conceptualisations and their negative outcomes

                Research output: An email guidelines intervention effective in reducing
                ICT demands and improving employee wellbeing and performance

                            Research output: A conceptual replication to attest the
                            generalisability of the email guidelines intervention
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**Figure 2.1.** Positioning of the three research articles

## 2.1.    Article 1: Never Free of ICT: A Systematic Review of the Negative Outcomes of Work-related ICT Demands

Article one addresses the lack of agreed terminology and synthesis evident in the literature that explores ICT related stress and aims to clarify the conceptual components of the ICT demands construct. Currently, the incoherent conceptual approaches used to study the adverse outcomes of ICT, can make it difficult to fully understand the state of research and to address important challenges. Therefore, this article aims to take a careful look at the divergent conceptualisations and synthesise these into a framework that comprises a taxonomy of ICT demands and their associated adverse outcomes. The final sample of this review included 114 quantitative studies which were first analysed to identify how each ICT demand construct was conceptualised and assessed. This revealed three distinct categories of ICT Demands conceptualisations : 1) multidimensional techno-stressors, 2) ICT-related pressures and expectations, 3) ICT-based connectivity behaviour. From this, the adverse outcomes associated with each ICT demand were reviewed and synthesized using the work-

home-resources model (Ten Brummelhuis & Bakker, 2010) as a framework for integration. This classes the results as either attitudinal, behavioural or production outcomes in the work and home domain. With the scope of its review, the article makes a unique contribution to the literature by bringing together all different types of ICT demands under one unifying framework to show where these overlap and diverge regarding their identified negative outcomes. This advances knowledge by allowing for a more holistic understanding of this field and offering a framework that can be applied by researchers to integrate findings into a more coherent body of literature. This study also proposes that, to provide a comprehensive explanation of the adverse outcomes associated with ICT demands, theoretical approaches should account for the complexity of long- and short-term effects evidenced across both the work and home domains. Finally, the article addresses the need for experimental research that supports organisations in their effort to better manage ICT demands, such as the issue of constant connectivity via work emails, by emphasising practical implications for interventions.

## 2.2. Article 2: 'The Right to Disconnect': An Intervention Study to Examine the Effect of Constant Connectivity Through Work-Emails on Work-Home Conflict, Recovery, Burnout, and Performance

Article 2 responds to the lack of experimental research in this field and aims to empirically examine the effectiveness of an email intervention in reducing ICT demands as a mechanism for improving work-home conflict, psychological detachment, burnout, and performance. Given the diversity in which emails can manifest as stressors, the results of Article 1 were applied to identify five email stressors across each ICT demands conceptualisation: 1. techno-overload, 2. techno-invasion, 3. organisational expectations for email monitoring (OEEM), 4. email monitoring frequency during non-work time (EMF), and 5. time spent on emails during non-work time (TOE). It is the aim to explore how the intervention affects each ICT demand and whether change in ICT demands is the mechanism through which the intervention works. The active ingredient of this intervention was a set of email guidelines, which was developed from relevant academic literature and focus groups conducted in the participating organisation. The focus groups allowed for a participative design during the problem identification and action planning phase. Each focus group consisted of 4-7 participants, lasted approx. 2 hours, and used a creative mind-mapping exercise called

'Ketso' to stimulate discussions. The discussions were based around four main questions exploring themes such as the pros and cons of work emails, reasons for the negative impact of emails, and ideas for improvements (i.e., suggestions for a new email policy). The feedback provided to organisations can be found in Appendix A. The final email guidelines comprised of 12 email rules which were implemented in participating teams of a UK public sector organisation through a 1-hour virtual email guidelines implementation meeting. The effects were tested by using a quasi-experimental design where the experimental group consisting of 17 teams (N=101) was compared to a waitlist control group (N= 75). Data were collected in four waves over 6 weeks across all participants and analysed using latent growth curve modelling (LGCM) and parallel process analysis.

The results of Article 2 provide evidence for the effectiveness of the email guidelines intervention in significantly reducing ICT-demands (techno-overload, techno-invasion, EMF, and TOE) as well as significantly improving work-home conflict, psychological detachment, burnout (physical and cognitive exhaustion), and performance. Additionally, parallel process models confirm that the reductions in techno-overload and techno-invasion mediated the intervention effects on employee outcomes. Thus, Article 2 provides supports for the assumptions of the work-home resources model and confirms that changes in specific ICT demands as the underlying mechanism through which the email guidelines intervention impacts wellbeing and performance outcomes. Finally, by taking a closer look at the relationship between ICT demands and performance, this article shows that the reductions in techno-overload facilitate performance improvements through reductions in burnout.

Overall, Article 2 contributes to the literature by advancing our understanding of what and how changes in ICT demands influence important wellbeing and performance outcomes over time and provides a first step towards an evidence-based approach in better managing the adverse effects of work-related ICTs. It demonstrates that the implementation of email guidelines can be an effective intervention strategy and that a blanket ban on out of hours emails is not needed to achieve positive results.

## 2.3.   Paper 3: Evaluating the Effectiveness of a Team-based Email Stress Intervention on Employee Wellbeing and Performance Outcomes: A Quasi-Experimental Study and Conceptual Replication.

Article 3 addresses the need of replication studies in psychological research and aims to test the hypotheses of Article 2 in a different population to reach firmer conclusions about the generalisability of the effects demonstrated in Article 2. Article 3 discusses how differences between the characteristics of public and private sector organisations may influence the effectiveness of ICT interventions and presents a conceptual replication of the email guidelines intervention in a sample of private sector teams. Results from the multilevel analysis highlight that the intervention was effective in reducing ICT demands (techno-invasion and EMF) and burnout (physical and emotional exhaustion) and provide support for the role of techno-invasion in mediating the intervention effects. Article 3 discusses the differences between the results of Study 2 and Study 3 and suggests that these may stem from different underlaying pathways driving the effects of ICT demands on wellbeing, which opens the door for further theoretical and empirical exploration of mechanisms that shape this relationship over time. Overall, Article 3 contributed to the evidence base of the email guidelines by demonstrating that positive outcomes can be achieved across different sectors and samples. Nevertheless, several inconsistent replication results highlight the role of boundary conditions and that the generalizability of intervention effects might be complex. Considering that email related stress and constant connectivity to work are topics that have gained substantial attention across academic research and the mainstream media, with employees, organisations, and policy makers typically concerned, these findings contribute to a more empirically informed, theoretically sound, and practically relevant understanding of the work-related ICT and wellbeing field.

## 2.4.   Value and Original Contribution of the Research

The number of workers suffering from work-related stress, anxiety and depression have been rising consistently, especially since the covid-19 pandemic. Recent statistics show an all-time high of 914 000 cases which account for half of all work-related illness cases in Great Britain. 372 000 of these were newly diagnosed in 2021/22 alone and have resulted 17

million lost workdays that year (HSE, 2022). The psychosocial risk of traditional work demands has been well researched and included in workplace stress management tools such as the HSE stress management standards. Emerging research is demonstrating the significant psychosocial risks of modern stressors such as ICT demands and particularly emails, however, far less is known about how to manage these risks. Although mobile ICT offer valuable resources, recent research suggests that the negative health impact of poorly managed ICT far outweigh such benefits. Considering the substantial economic burden associated with work related stress and sickness absence, the importance of developing effective intervention strategies is undeniable. There have been efforts across European countries to address this issue from a legislative level by introducing the right to disconnect law. This law has been a pioneering step in the right direction and certainly sets the right tone regarding the importance of work-life balance and wellbeing. However, while the law has proven to be enforceable (Müller, 2020), its effectiveness in reducing the email related stress and subsequent adverse health outcomes is unclear. How the law has been introduced in the varying firms and how adherence is regulated, aside from individual employee action, are further open questions.

The cultural integration of a new work-life policy is crucial to the achievement of its planned positive effects (Kossek, 2016) and poorly scoped intervention designs and implementation processes are an often-cited source of disappointing and inconsistent results (Nielsen et al., 2010). Therefore, in the absence of experimental intervention research that demonstrates how to implement new email rules and evaluates their effectiveness, it is unlikely that the risk ICT poses can be reduced. Additionally, given the absence of experimental research in this field, there is currently no evidence base that supports changes made in line with the right to disconnect, and therefore, it cannot be ruled out that these come with unintended negative implications. For example, some workers prefer to integrate work and home lives and do not suffer from the adverse impact of out of hours email use to the extent that workers with preferences for work-home segmentation do (Derks et al., 2014). A blanket ban on out of hours emailing may hinder them from achieving this and be considered a step backwards in the drive for flexible working.

In summary, while there is an ever-increasing amount of cross-sectional research that highlights the negative impact of different ICT demands, there is a clear lack of longitudinal experimental research that can offer a way forward. Thus, the aims of this thesis are of clear

relevance to important psychosocial and economic issues as well as conceptual issues and will add value in both theoretical and practical ways.

From a conceptual perspective, the rapid increase in emerging research is calling for a review of the different strands to organise these within a unifying framework. While previous systematic reviews have attempted to create coherency, a constrained focus on one type of ICT demands conceptualisation, such as technostress (LaTorre et al., 2019) or voluntary ICT use (Schlachter et al., 2018), has left knowledge gaps. The current thesis makes a valuable and original contribution by conducting the most comprehensive review of the literature to-date, which looks across divergent conceptualisations to avoid potential blind spots. The resultant taxonomy of ICT demands, and the theory based integrated framework showing the overlap and differences in negative outcomes, provides a more holistic understanding of this field and offers a framework that can be applied by researchers to integrate findings into a more coherent body of literature. It will provide insights into the complexity of effects across domains and present the work-home resources model as an appropriate theoretical model for studying the psychosocial risk associated with work-related ICT. A better understanding of the relationships between different ICT demands and their potentially shared influence on outcomes will open the door for experimental researchers to develop targeted intervention strategies that address the right stressors at the appropriate level.

The thesis will make further valuable theoretical contribution by evaluating the effectiveness of an email intervention. Here, we will test an often-overlooked mechanism of work-stress theories by examining the beneficial effect of reducing work demands instead of increasing resources. Specifically, this will test whether the assumptions of the work-home-resources model can be applied to an intervention context by proposing gain spirals as an outcome of reduced contextual demands. By examining the mediating role of different ICT demands (such as techno-overload and techno-invasion), it shines a light on the underlying mechanisms through which this intervention affects wellbeing and performance outcomes. This provides a deeper understanding of how changes in ICT demands can influence outcomes over time and advances our knowledge regarding the relevant importance of different ICT demands in this process. Examining the effects of this intervention across two different samples, one operating in the UK public sector and one based in an internationally operating private sector firm, will make additional contributions by testing the generalisability of the initial findings. The results will provide an insight into which of the

proposed hypotheses hold across different contexts and highlight differences that can aid further theory development and refinement in this field.

From a practical perspective, this thesis adds substantial value by demonstrating how organisations can manage the threat that work-related ICT and an "always on" culture pose. Previous research has demonstrated that certain types of training can help workers cope with emails (Soucek & Moser, 2010; Rexroth et al., 2017; Rich et al., 2020; Altenhammer et al., 2021). However, interventions which target the reduction of ICT demands on a group level have, to the best of our knowledge, not been conducted to date. Therefore, this thesis makes original contributions by designing, implementing, and evaluating an email guidelines intervention in work teams. Because the email guidelines target issues of constant connectivity by, inter alia, limiting email traffic to working hours (or contracted hours), the findings of this thesis develop the evidence needed for legislative or organisational changes in line with the "right to disconnect". Since the UK does not legally recognise this law, this thesis will offer practical ways for managers to address ICT demands within their teams in the absence of legislative support.

By examining the mechanisms of change underlying this intervention, this thesis can provide insights regarding the relevant priority of targeting certain ICT demands and inform intervention strategies that can achieve meaningful improvements in employee outcomes. Subsequently, this will contribute to the improved sustainability in quality of working life by highlighting mechanisms through which work-home conflict, psychological detachment, burnout and performance can be improved in a modern workforce. Testing the intervention effects across the public and private sector will allow the exploration of potential sample or sector related differences and provide greater confidence that the intervention could achieve positive results if replicated again. Particularly in the context of the post-replication crisis era of psychological research, conceptually replicating this intervention will contribute to the reliable evidence base needed to make policy recommendations and to develop effective guidelines. Considering the growing reliance on ICT and the demand for remote/hybrid working (Messenger, 2018; Vu et al., 2020; Reznik et al., 2022; ONS, 2022; Wigert & Agrawal, 2022), as well as the rising levels of work-related stress and poor mental health, sickness absence and lost productivity (HSE, 2021), the outcomes of this thesis will be of value to worker wellbeing, organisation's bottom lines and the wider economy by developing a theoretically informed and empirically tested intervention targeted at important stressors that continue to increase in relevance in a post-covid world.

# Chapter 3: ARTICLE 1 – Never Free of ICT: A Systematic Review of the Negative Outcomes of Work-related ICT Demands

## Abstract

Research exploring the negative impact of work-related ICT demands has grown rapidly over the past 15 years and evidence for a dark side is mounting. Despite concerns of employees, organisations, policy makers and practitioners and repeated calls for interventions, research progress on this matter remains slow. A barrier to advancement is the lack of agreed terminology and synthesis in this field which makes it difficult to fully understand the state of research and how to address important challenges. Although previous reviews discussed aspects of ICT use, research findings span across multiple different ICT demands and disciplines, which remain largely dispersed without a unifying framework.

We addressed this by conducting a comprehensive systematic review of 114 quantitative studies to answer the following questions: *a) What are the different conceptualisations and methods used to study work-related ICT demands? b) What are the negative outcomes of work-related ICT demands?* The analysis identified three overarching conceptualisations of ICT demands: 1) multidimensional techno-stressors, 2) ICT-related pressures and expectations, 3) ICT-based connectivity behaviour. We applied the Work-Home-Resources model as a framework for integration and discuss findings for each ICT demand as attitudinal, behavioural and production outcomes in the work and home domain.

The discussion highlights that expanding theoretical approaches and conceptual models of ICT demands to account for the different mechanisms and effects across domains would advance knowledge in this field. We address the need for experimental research that supports organisations in their effort to better manage ICT demands by emphasising practical implications for interventions.

## 3.1. Introduction

Office work during the 21$^{st}$ Century has been revolutionised through the development of new information and communication technologies (ICT) and while it is undeniable that such technologies have provided various benefits (Messenger, 2018) there are suggestions that these come at a cost (Stich et al., 2018). The ever-increasing reliance on work-related ICT, such as emails, which leave workers inundated with incoming messages and create

spillover into non-work domains, have become much-discussed topics, with employees and organisations typically concerned. This is not only reflected in the academic literature (Stich et al, 2018; Becker et al., 2021[1]), where associations between constant work connectivity through ICT and greater work-life conflict, poor recovery, and burnout are evidenced (Barber & Santuzzi, 2015, Schlachter et al., 2018), but also the mass media (BBC, 2014), which highlights the unpaid overtime workers spend managing their emails each week.

Blurred lines between work and home lives and overworked employees are raising the question how to better manage work-related ICT. Recent research showed that the negative impact of ICT demands is disproportionate to the beneficial effects of ICT resources and stressed the need for organisations to focus on the management of ICT demands rather than resources (Ninaus et al., 2021).

Countries around the world (e.g., France) and large organisations (i.e., Volkswagen, BMW and Puma in Germany) have introduced changes to how emails are managed. For example, the "right to disconnect" legislation that was passed in France in 2017, demands that organisations either refrain from contacting staff during non-work time or introduce charters which clearly define the rules around ICT-based work availability (Secunda, 2018; ERSP, 2020). However, despite popular research interest and legislative changes, there have been few rigorous empirical examinations (Dettmers, 2017; Tarafdar et al., 2019), particularly when it comes to intervention research. This may be due to the lack of cohesion in this field. Multiple reviews highlight concerns that research is dispersed across disciplines without a unifying framework (Schlachter et al., 2018; LaTorre et al., 2019; Karnika et al., 2020), which can make it difficult to fully understand where the technological challenges lie and how to best address them.

To address these concerns and contribute to the literature in this field, a comprehensive systematic review, which provides an overview of the different ICT demand conceptualisations and synthesises associated negative outcomes under an overarching framework, will be conducted. In this, the review will bring well-needed cohesion to this field and serve as a starting point for intervention research targeting ICT demands.

### 3.1.1. Workplace ICT demands

The adverse impact of workplace technology on employee's health and wellbeing has been studied for over four decades. Technostress was first defined by Brod, in 1984 as "a

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[1] This paper was first published online in 2019, the reference has since been updated.

modern disease of adaption caused by an inability to cope with the new computer technologies in a healthy manner" (p.16). At this time, desktop computers were only just introduced to the office world, with librarians and secretaries being among the first to use this technology. Workers had to learn how to type, use a new "artificial language", and never seen-before software on machines that cannot be compared to those we use today (Brod, 1982). Subsequently, the early concept of technostress focused on workers insecurity around computers. Additionally, there were many health complaints related to poor ergonomics such as back pain, eye pain and headaches and frustrations due to the slow, not user-friendly, and overall, badly designed software (Brod, 1984; Kupersmith, 1992; Weil & Rosen, 1997; Ahmad et al., 2009).

Although ergonomic issues still present a problem today (Lima & Coelho, 2018), the conceptualisation of technostress has shifted. A more recent and widely used definition of technostress is that of Ragu-Nathan et al., (2008) who describe it as "any stress experienced by the end-users in organisations as a result of their use of ICTs" (pp. 417-418). The authors were the first to develop a multi-dimensional model and measure of technostress, comprising of 5 techno-stressors which allowed a more precise investigation into the kinds of technological characteristics (stressors) that elicit negative consequences (Table 3.1). While stressors such as techno-complexity, -uncertainty and -insecurity capture Brod's early conceptualisation, techno-overload and techno-invasion present new stressors that have become increasingly prevalent over the past 15 years.

**Table 3.1.** Dimensions of Technostress (Ragu-Nathan et al., 2008, pp. 427)

| Technostress creator | Definition |
|---|---|
| Techno-overload | Situations where ICTs force users to work faster and longer |
| Techno-invasion | The invasive effect of ICTs in situations where employees can be reached anytime and feel the need to be constantly connected, thus blurring work-related and personal contexts |
| Techno-complexity | Situations where the complexity associated with ICTs leads users to feel inadequate with regard to their computer skills and forces them to spend time and effort in learning and understanding ICTs. |
| Techno-uncertainty | contexts where continuing ICT changes and upgrades unsettle users and create uncertainty so that they must constantly learn and educate themselves about new ICTs. |
| Techno-insecurity | Situations where users feel threatened about losing their jobs, either because of automation from ICTs or to other people who have a better understanding of ICTs. |

The improved availability of internet connection and new devices (i.e., smartphones) have accelerated the pace of work and enabled us to work from almost anywhere at any time (Barber & Santuzzi, 2015, Messenger, 2018). The dark side of this is illustrated by situations where individuals perceive that work demands interfere with non-work time, that their privacy is disturbed by surveillance, and that they face high response expectations and pressures of constant availability (Tarafdar et al., 2007; Day et al., 2012; Barber & Santuzzi, 2015; Becker et al., 2021).

The negative impact of techno-invasion, specifically driven by e-mails, has received increasing attention in the literature. Emails that entail information critical to one's work can enhance work performance (Mano & Mensch, 2010). However, constant emails unrelated to one's primary task led to reduced productivity due to the time it takes workers to recover from the interruption (Van Solingen et al., 1998; Jackson et al., 2001; Gupta & Sharda, 2008) Such interruptions were also associated with perceptions of increased workload (Gupta, Li & Sharda, 2013) and the number of emails received was associated with feelings of overload (Barley et al., 2011). Qualitative research has revealed how backlogs of emails combined with a perceived expectation to respond quickly, led workers to experience anxiety, and to cope with this they extended their workday or continued working from home during non-work time (Barley et al., 2011). These feelings and reactions can be described as technological overload which is detrimental to employees' mental and physical well-being (Stich et al., 2018).

In addition to this, Barber and Santuzzi (2015) found that the urge to check emails and pressures to respond to these quickly in - and outside of working hours, was associated with lower levels of psychological detachment and sleep quality, higher levels of physical and cognitive burnout and health-related absenteeism. Similarly, research findings suggest that the constant availability from using ICT during non-worktime is associated with increased work-life conflict (Derks et al., 2015; Wright, et al., 2014), an inability to recover from work (Derks et al., 2014) and burnout (Wright et al., 2014). Over time, accumulation of these negative effects can lead to significant mental and physical health impairments (Meijman & Mulder, 1998; Geurts & Sonnentag, 2006; de Lange et al., 2009; Barber & Santuzzi, 2015; Derks et al., 2015; Sonnentag & Fritz, 2015), adding to the substantive economic burden associated with poorly managed workplaces and subsequent work-related mental health problems which the UK and Europe are facing (Hassard et al., 2018, HSE, 2021).

### 3.1.2. Review Rationale

Considering the significant adverse effects of workplace ICT and the increasing organisational and legislative interest in addressing this, it is important to establish a clear overview of what is known in this field to inform relevant practice and aid rigorous future research in this field. A challenge in this is an increasing amount of emerging research which is highly interconnected and yet dispersed across disciplines with little reference to a unifying framework (Schlachter et al., 2018). For example, the adverse effects of workplace technology on people's health and wellbeing has been explored under the concept of technostress (Brod, 1984; Ragu-Nathan et al., 2008; Ayyagari et al., 2011; Tarafdar et al., 2019), ICT demands (Day et al., 2010); workplace telepressure (Barber & Santuzzi, 2015), organisational expectations for email monitoring (OEEM, Becker et al., 2021), work-related ICT use during non-work time (Fenner & Renn, 2010; Derks & Bakker, 2014); work-contacts during non-worktime (Schieman & Young, 2013), and extended availability for work (Dettmers, 2017), to name a few. What adds to this, is that some of these constructs are almost identical but called differently, while others tap into conceptually distinct demands but are difficult to differentiate by their labels. This can lead to jingle-jangle fallacies (Kelley, 1927; Marsh, 1994) , where one may falsely assume that two distinct constructs are the same because they use the same label (jingle fallacy), or that two similar constructs are distinct because they have different labels (jangle fallacy), which ultimately threatens the development of a cohesive body of research (Casper et al., 2018).

Several systematic reviews have been carried out in this field which acknowledge this issue. However, their focus has been to review research on a specific conceptualisation individually such as technostress (La Torre et al., 2020) or voluntary ICT use (Schlachter et al., 2018), which can leave gaps in knowledge. For example, past reviews on research of technostress would discuss the adverse outcomes of techno-invasion but not workplace availability expectations (the demand to respond immediately even beyond regular working hours, expectations to be constantly available and connected, feelings of never being free of technology or the workplace, Day et al., 2010, 2012) and workplace telepressure (a preoccupation with- and pressure to respond to work-related ICT messages quickly, Barber & Santuzzi, 2015), despite the similarities between these constructs.

In addition, previous reviews acknowledge limitations from restricting their sample based on certain types of workers (e.g., mobile workers, Schlachter et al., 2018), specific

moderators (age, Berg-Beckhoff et al., 2017) or outcomes (e.g., mental health, Borle et al., 2021) and suggest that future research may benefit from a more inclusive approach to sampling.

Thus, to build on previous reviews, a comprehensive systematic literature review of the adverse effects of workplace ICT is proposed. Here it is essential to identify and include the different conceptualisations under which this has been studied. To encompass these, a broad overarching definition of ICT demands, based on Demerouti et al., (2001)'s definition of work demands was chosen. Therefore, ICT-demands refer to those physical, social, or organisational aspects of work-related ICT that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs (p. 501).

Further, to provide a coherent overview of the adverse effects of ICT demands, the outcomes are discussed within the overarching framework of the Work-Home Resources model (W-HR, Ten Brummelhuis & Bakker, 2012). Unlike other work demands, ICT demands are experienced in the work- and in the home domain, thus, leading to adverse outcomes in both. For example, while the La Torre et al., (2018) review on technostress, highlighted negative implications for work performance, Schlachter (2018)'s conceptual model of voluntary ICT use discusses adverse effects on the work-home interface, recovery processes and wellbeing.

The W-HR model is a well-suited framework as it explains negative work-home processes by linking demands in one domain to negative outcomes in the other. Based on the Conservation of Resources Theory (COR, Hobfoll, 2001), it suggests that a loss of personal resources experienced due to high contextual demands (e.g., working overtime) leads to adverse production, behavioural and/or attitudinal outcomes in the home and work domain (see Ten Brummelhuis & Bakker, 2012, p. 6-7 for examples).

### 3.1.3. Research Questions and Contributions

This review aims to answer the following questions:

    a) *What are the different conceptualisations and methods used to study work-related ICT demands*?

    b) *What are the negative outcomes of work-related ICT demands?*

The current findings will make several contributions. First, we will synthesize a broad body of literature by examining the similarities and differences of existing ICT demands

currently dispersed across disciplines. Then, we will review the adverse outcomes of the different ICT demands and integrate the results into a coherent and unifying framework. This will allow comparisons between related, yet different ICT demands to be made, highlight research gaps and enable scholars to approach this field in a more streamlined and coherent manner, so that important future research questions can be addressed. Finally, we conclude by discussing the practical implications relevant for organisational interventions and policy development.

## 3.2.  Methodology

### 3.2.1.   Search Strategy

To review the empirical research focused on the adverse outcomes of workplace ICT demands, a systematic literature search was conducted using a predefined data collection-, analysis- and reporting strategy in accordance with the PRISMA statement (Moher et al., 2009). The data was collected using two strategies: first, the four electronic databases (PsychINFO, Web of Science, Scopus, Google Scholar) were searched for the following keywords "technostress" OR "techno*stress" OR "techno stress" OR "techno-stress" OR "ICT demands" OR "telepressure". To focus the review on the recent phenomenon of technostress applicable to the modern and globalised world of work, this search was limited to studies published between 2007 - 2020.  The cut-off year of 2007 was chosen as this was the first time a multidimensional conceptualisation of technostress (Tarafdar et al., 2007) was published. Considering the comprehensive focus of the current review, it was decided to limit it to quantitative research in this field.

### 3.2.2.   Data Extraction

The search identified 1261 relevant papers of which 855 remained once the duplicates had been removed. To analyse the data, all titles and abstracts of the identified studies were screened against the inclusion and exclusion criteria.  Papers were considered if they empirically assessed the outcomes of work-related ICT demands. Although theoretical articles informed the paper and are cited throughout, these were not formally included in the systematic review despite its conceptual element. That is to ensure that any developed

framework and findings are evidence based and supported by empirical data. Studies were excluded if they did not use a working sample, did not focus on a work-related context, or did not measure relevant ICT demands (e.g., smartphone/internet/social media addiction or social media-related technostress; Brooks et al., 2020). After the first screening process, 592 studies did not meet the inclusion criteria and were removed.

During the second screening process, the full texts of all remaining papers (N=263) were retrieved to evaluate their eligibility for inclusion against the set inclusion/exclusion criteria. The detailed screening revealed additional research streams that were not captured in the initial search. These were specific to mobile ICT and focused on ICT demands that a) created pressure for constant connectivity in workers (e.g., availability expectations) and b) led to further work-related ICT use during nonwork time (e.g., Derks & Bakker, 2014). Therefore, to fully capture research on these ICT demands, the search was expanded by searching specifically for those demands in the above search engines (keywords: "ICT use during nonwork time" OR "ICT use after hours" OR "work-related smartphone use during off job time" OR "availability expectations" or "organisational expectations for email monitoring") and in already included reference lists. An overview of the entire process and reasons for exclusion can be seen in Figure 3.1.

Ultimately, a total of 135 papers met the inclusion criteria and were included in the final stage of eligibility screening. This comprised of a quality assessment to ensure that low quality studies do not distort the summary of outcomes (Wells et al., 2000; Stang, 2010).

### 3.2.3. Quality Assessment

A risk of bias assessment was conducted to review the quality of included studies using the adapted Newcastle-Ottawa scale for cross-sectional studies (Herzog et al., 2013). The scale is divided into three sections which evaluate the quality of the sample selection, the comparability of the subjects and the assessment of outcomes and their statistical reporting using a total of 7 items. The quality is expressed through star ratings varying from 0-10 stars per paper (some answers are worth two stars).

The scale and possible discrepancies in interpretation were discussed between the authors until a consensus was reached. A subset of 10 per cent of papers (N=15) was then rated by the second author to examine interrater reliability. The interrater reliability was 62.5 per cent (SD= 4.48), suggesting moderately adequate agreement between the researchers

(McHugh, 2012). The studies where authors lacked agreement were discussed in detail until all parties agreed on the same score and its justification. Once all differences were resolved, the first author continued to rate the remaining studies.
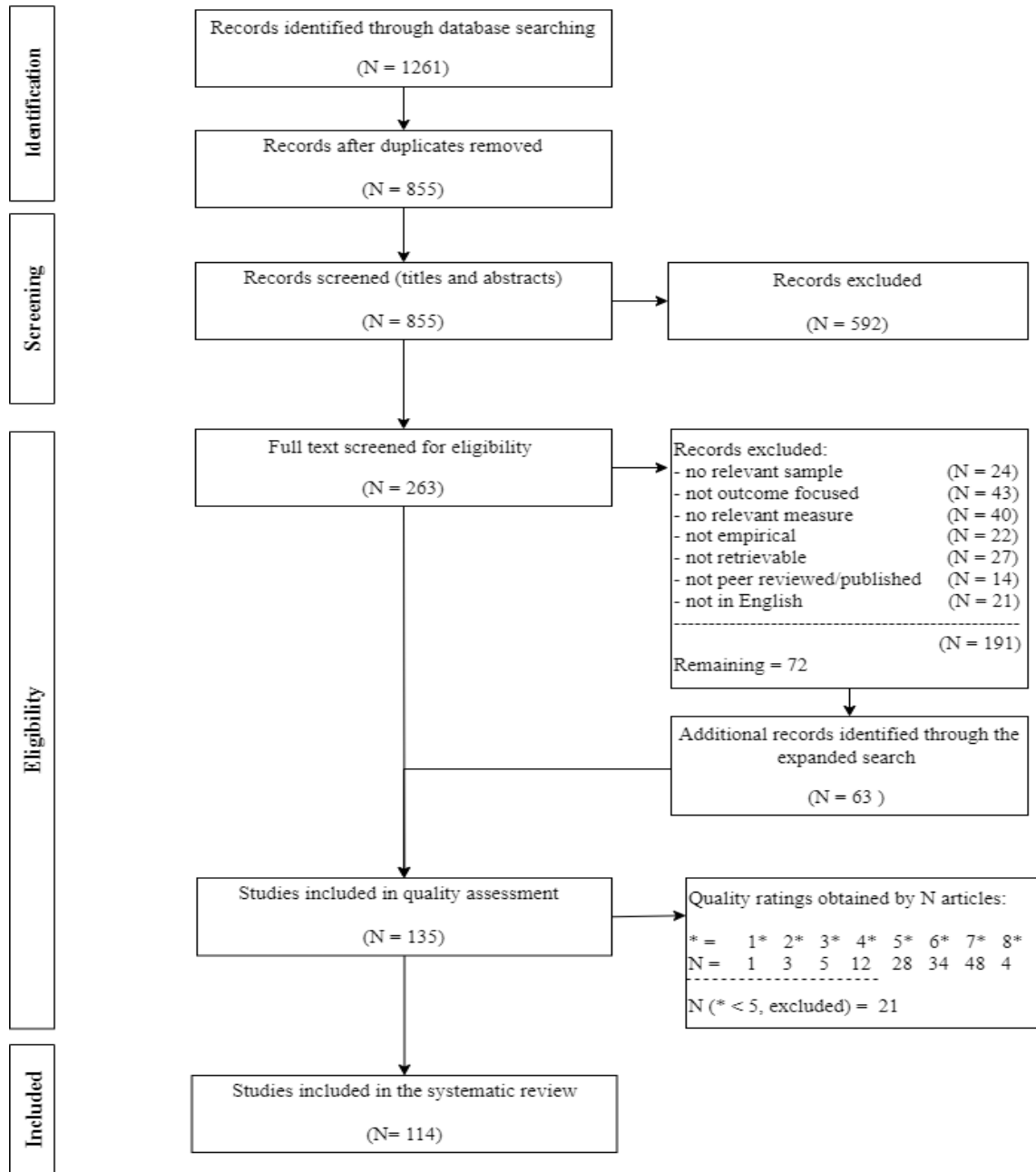


**Figure 3.1.** Flow diagram of the systematic review process

On average, studies received a quality rating of 5.79 stars, with a minimum of 1 and a maximum score of 8 out of 10 stars. 15 per cent of studies (N = 21) scored a four or below and 36 percent scored a five or below (N = 49). 21 percent of studies scored a 5 (N=28), 25

per cent scored a six (N=34), 36 per cent scored a seven (N= 48) and 3 per cent scored an 8 (N=4). Overall, 64 per cent of studies (86) scored within the mean or above.

During the rating process it was particularly noticeable that almost all studies failed to provide a justification for their sample size and to assess the comparability between respondents and non-respondents. Since the scale only awarded stars for the sample size if it was also justified and for the response-rate if the comparability between respondents and non-respondent's characteristics was established, even studies with large samples and high response rates, received 0 stars in these categories. Furthermore, the scale awards up to two stars if the "most important confounding factor" and additional factors were controlled for. However, while the use of control variables is common in analyses such as ANCOVAs and regression, it is less common in advanced statistical analysis (i.e., SEM). Therefore, studies which used a more complex and advanced method of analysis were disadvantaged during this quality assessment.

Nevertheless, a significant decline of quality was noticed in studies which scored 4 stars or below. Such papers rarely described their measurement tools, which hinders the replication of findings, creates difficulty when comparing results to other studies and increases the risk of ascertainment bias. Additionally, the applied statistical tests were often inappropriate or incomplete. Hence, it was decided to exclude studies with star-ratings of 4 and below from the review as their findings may not paint a reliable picture of the negative impact associated with ICT demands. What provides confidence in this process is that during prior screening stages, the excluded studies received comments highlighting concerns of poor quality. Thus, although the adapted NOS is not the ideal risk assessment tool for cross-sectional studies, only few quality assessment scales exist for this purpose and applying its criteria has independently led to the identification of the 15% of studies which had the highest risk of bias (lowest level of quality).

Overall, this leaves a final dataset of 114 papers which were included in the systematic synthesis of this review (Appendix B).

## 3.3. Results

There were 96 cross-sectional studies, 11 diary studies, two experimental studies and two longitudinal studies. Additionally, three mixed methods studies were included based on their quantitative components comprising of one additional diary and two cross-sectional designs. All studies used individual level data and samples of working adults.

The diverse range of journal publications included in this review highlights the interdisciplinary nature of research in this field. A large proportion of papers was published in psychology journals (N=47), mostly with a focus on organisational psychology, and occupational stress and health (e.g., Work and Stress, Journal of Occupational Health Psychology), but also on human computer interaction (e.g., Computers in Human Behaviours, N=15). There were 21 publications in business and management journals, which include journals such as the "Journal of Management, Human Resource Management and Organisation Science" but also a small number of less typical outlets (e.g., Journal of Electronic Commerce, Journal of Personal Selling and Sales Management, Journal of Business and Industrial Marketing). 11 papers were published in information systems journals, 15 were conference papers (predominantly focused on information systems or human-computer-interaction) and 8 were published in social science journals. Lastly, 6 papers could not be allocated to an overarching discipline as the journal's focus was either interdisciplinary (e.g., PLOS ONE or Sustainability), on travel and leisure research or 'Networking and Virtual Organisations' (see Table 1 Appendix B for more details on the included papers).

A review of the conceptualisations of work-related ICT demands across all included studies revealed similarities and differences in how these were studied. A large proportion of studies investigated the negative impact of ICT through the concept of technostress (Ragu-Nathan et al., 2008). Technostress is a multi-dimensional concept that comprises of several technostress creators which describe job characteristics aligned with technology use that could trigger adverse reactions depending to employees individual coping ability (Ragu-Nathan et al., 2008; Ayyagari et al., 2011; Day et al., 2012). Job stressors conceptualised through the transactional model of stress are comparable to the job demands definition by Demerouti et al., (2001) which underlays the conceptualisation of ICT demands in that can be perceived as stressful and cause negative outcomes (Day et al., 2010). An important distinction the model makes is that not all individuals react similarly to the same stressors. Instead, the extent to which job characteristics are perceived as stressful or exceeding one's resources determines whether technology is appraised as negative and has the potential to trigger a strain reaction (Lazarus & Folkman, 1984; Day et al., 20100). While techno stressors could be applied to many kinds of workplace technology (information systems), a significant number of studies focused on assessing the negative impact of mobile ICT. These studies differed from those on techno-stressors in that they were unidimensional and homed in on the specific demands associated with mobile ICT. These were separated into those

studies that focused on the organisational and social aspects of work-related mobile ICT in form of connectivity pressures,  and the physical aspects of work-related mobile ICT in form of usage behaviours during non-work time that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs. Based on these differences in individual, organisational and social, and physical (behavioural) ICT demands, the literature was synthesised into three overarching categories:

(1) 'Multidimensional techno-stressors', which includes technostress creators (Ragu-Nathan et al., 2008) and other ICT demands which are based on a multi-dimensional measurement framework (e.g., Ayyagari et al., 2011; Day et al., 2012) that assesses workers adverse reactions to their interactions with information systems based on individual subjective coping appraisals;

(2) 'ICT-related pressures and expectations', which includes unidimensional conceptualisations of ICT demands focused specifically on personal, social and/or organisational pressures and expectations that workers face around response times of ICT-based work communication and work availability beyond their contracted hours.

 Lastly, (3) 'ICT-based connectivity behaviour during non-work time' looks at the extent and duration of work-related ICT use beyond contracted hours (referred to as voluntary ICT use by Schlachter et al., 2018).

While categories two and three emerged as additional categories to the technostress literature due to researchers heavy focus on the specific impact of mobile ICT, the categories are seen are interlinked and building on one another rather than mutually exclusive. Specifically, the technostress framework captures the situations where technology causes pressures to always be available (techno-invasion), and the need to work faster and longer due to technology use (techno-overload), however, it appears that these specific arms of Ragu-Nathans and colleagues (2008) model have expanded into their own research strands with a unique focus which is captured in the present framework.

There was an almost equal number of studies examining the adverse effects of techno-stressors (N=47) and ICT-based connectivity behaviour (N=46), whereas the negative outcomes of ICT-related pressures and expectations were assessed least frequently (N=21). However, it is worth noting that certain sub-dimensions included in the first conceptualisation (i.e., techno-invasion or availability expectations; Day et al., 2012) assess this specific demand within their multidimensional framework. Occasionally these subdimensions have

been assessed individually under which circumstance they have been moved to the second conceptualisation to reflect the focus of these studies.

In line with the W-HR model, the adverse outcomes of the three ICT demands were allocated to the domain they are experienced in (work or home) and discussed as either production, behavioural or attitudinal outcomes (Table 3.2).

**Table 3.2. Summary of Main Findings: Adverse outcomes of work-related ICT Demands**

| Work-related ICT Demands | Adverse contextual outcomes | | References |
|---|---|---|---|
| **Multidimensional Techno-stressors N=47** | **Home** | | |
| | Attitudinal | Work-family/life/home conflict (+) N=7 | Yun et al., 2012; Gaudioso et al., 2015, 2017; Harris et al., 2015; Maier et al., 2015; Cho et al., 2020; Molino et al., 2020. |
| | **Work** | | |
| | Production | Productivity & Performance (-) N=10 | Tarafdar et al., 2007, 2014, 2015; Hung et al., 2014; Jena, 2015; Ioannou & Papazafeiropoulou, 2017; Delpechitre et al., 2018; Li & Wang, 2020; Pirkkalainen, et al., 2019; Zhao et al., 2020. |
| | | (ICT-enabled) innovation (-) N=4 | Tarafdar et al., 2011; 2014; 2015; Chandra et al., 2019. |
| | Behavioural | Turnover intentions (+) N=3 | Maier et al., 2015; Califf & Brooks, 2020; Califf et al., 2020; |
| | | Attrition (+) | Califf et al., 2020 |
| | | Discontinuous usage intentions, resistance to work smartphone use (+) N=3 | Yun et al., 2012; Fuglseth & Sorebo, 2014; Issa & Bahli, 2018; |
| | | Minor cyber slacking (+) | Güğerçin, 2020 |
| | Attitudinal | Negative affect and emotions (+) N=3 | Jena, 2015; Cho et al., 2020; Sarabadani et al., 2020 |
| | | Negative coping response (+) N=2 | Weinert et al., 2019; Zhao et al., 2020 |
| | | Techno-exhaustion/ICT-related strain (+) N=10 | Ayyagari et al., 2011; Fieseler et al., 2014; Harahap & Effiyanti, 2015; Maier et al., 2015; Suh & Lee, 2017; Mahmud et al., 2017; Issa & Bahli, 2018; Kim & Park, 2018; Hauk et al., 2019 |
| | | Work-related stress (incl. stressors), distress, and strain (+) N=13 | Tarafdar et al., 2007, 2014; Wang & Shu, 2008; Day et al., 2012; Yun et al., 2012; Gaudioso et al., 2015, 2017; Maier et al., 2015; Stadin et al., 2016; Delpechitre et al., 2018; Turel & Gaudioso, 2018; Pirkkalainen, et al., 2019; Molino et al., 2020; Califf et al., 2020 |
| | | Burnout and exhaustion (+) N=11 | Day et al., 2012; Fieseler et al., 2014; Reinke et al., 2014; Kim et al., 2015; Maier et al., 2015; Srivastava et al., 2015; Gaudisio et al., 2017; Mahapatra & Pati, 2018; Turel & Gaudioso, 2018; Weinert et al., 2019; Califf & Brooks, 2020 |
| | | Suboptimal self-rated health (+) | Stadin et al., 2016 |
| | | Satisfaction with ICT use; N=4 | Tarafdar et al., 2010, 11; Fuglseth & Sorebo, 2014; Ioannou & Papazafeiropoulou, 2017 |

| | | | |
|---|---|---|---|
| | | Job satisfaction (-); N=8 | Ragu-Nathan et al., 2008; Tarafdar et al., 2011; Fieseler et al., 2014; Jena 2015; Maier et al., 2015; Suh & Lee, 2017; Yin et al., 2018; Califf et al., 2020 |
| | | Organisational commitment (-) N=3 | Tarafdar et al., 2011; Jena, 2015; Maier et al., 2015 |
| | | Commitment to change (-) | Zainun et al., 2019 |
| **ICT-related Pressures and Expectations N=21** | **Home** | | |
| | Production | Recovery (-) – incl. relaxation, psychological detachment, sleepy quality and quantity Insomnia, cortisol awakening response (+) N=11 | Barber & Santuzzi, 2015; Dettmers et al., 2016; Dettmers et al., 2016a; Dettmers, 2017; Van Laethem et al., 2018; Barber et al., 2019; Cambier et al., 2019; Hu et al., 2019; Belkin et al., 2020; Büchler et al., 2020; Park et al., 2020 |
| | | Relationship quality (-) | Becker et al., 2021 |
| | Behavioural | Home-boundary permeability (+) | Kim & Hollensbe, 2018 |
| | | Negative work rumination (+) | Park et al., 2020 |
| | | ICT use during non-work time (+) N=8 | Adkins & Premeaux, 2014; Barber & Santuzzi, 2015; Piszczek, 2017; Cambier et al., 2019; Hu et al., 2019; Belkin et al., 2020; Cambier & Vlerick, 2020; Palm et al., 2020; |
| | Attitudinal | Control over off-job time, boundary control (-) N=2 | Dettmers et al., 2016; Piszczek, 2017; |
| | | Work-life balance, work-family enrichment (-) Work-to-home/life/family conflict (+) N=4 | Dettmers, 2017; Kim & Hollensbe, 2018; Barber et al., 2019; Belkin et al., 2020; Kao et al., 2020 |
| | | Relationship satisfaction (-) | Becker et al., 2021 |
| | | E-anxiety, cognitive irritations, negative affect, anxiety (+), start of day mood, health, and wellbeing (-) N=7 | Dettmers et al., 2016a; Dettmers & Biemelt, 2018; Becker et al., 2021; Büchler et al., 2020; Lutz et al., 2020; Park et al., 2020; Wu et al., 2020; |
| | **Work** | | |
| | Attitudinal | Burnout, emotional exhaustion (+) N=8 | Barber & Santuzzi, 2015; Dettmers et al., 2016; Dettmers, 2017; Piszczek, 2017; Dettmers & Biemelt, 2018; Hu et al., 2019; Belkin et al., 2020; Kao et al., 2020; |
| | Behavioural | Turnover intentions, Absenteeism | Barber & Santuzzi, 2015; Belkin et al., 2020 |
| **ICT-based Connectivity Behaviour N=46** | **Home** | | |
| | Production | Recovery (-) – incl. psychological detachment, sleep quality, sleep problems, morning state of recovery N=9 | Park et al., 2011; Derks et al., 2014; Ohly & Latour, 2014; Mellner, 2016; Wang et al., 2017; Bowen et al., 2018; Braukmann, et al., 2018; Lei & Su, 2019; Thörel et al., 2020 |
| | Behavioural | Workaholism, work-home spillover, Internet addiction (+), N=3 | Berkowsky, 2013; Molino et al., 2019; Vayre & Vonthron, 2019 |
| | Attitudinal | Boundary control (-) | Mellner, 2016 |
| | | Home-related wellbeing (-) incl. happiness, PA, life satisfaction, Ego depletion, anger, need for recovery (+), N=4 | Ohly & Latour, 2014; Butts et al., 2015; Chen et al., 2018; Gombert et al., 2018 |

| | | |
|---|---|---|
| | Work-non-work conflict (+) incl. work-life and -family conflict, work-home interference, work interference with leisure, spousal family-to-work conflict<br>Work-life balance (-) N=22 | Boswell & Olson-Buchanan, 2007; Fenner & Renn, 2010; Diaz et al., 2012; Chen & Karahanna, 2014; Kotecha et al., 2014; Wright et al., 2014; Derks et al., 2015; Butts et al., 2015; Ferguson et al., 2016; Ragsdale & Hoover, 2016; Ghislieri et al., 2017; Wang et al., 2017; Bowen et al., 2018; Carlson et al., 2018; Chen & Casterella, 2018; Gadeyne et al., 2018; Son & Chen, 2018; Tennakoon, 2018; Vayre & Vonthron, 2019; Yang et al., 2019; Bauwens et al., 2020; Tams et al., 2020; |
| | Relationship tension (+) | Carlson et al., 2018 |
| **Work N=** | | |
| Production | Spousal job performance (-) | Carlson et al., 2018 |
| Behavioural | Work intensification, Multitasking (-)<br>Turnover attention (+) | Mark et al., 2012; Chesley 2014;<br>Emanuel et al., 2018; Ferguson et al., 2016; |
| Attitudinal | Work-related stress (+) – incl. overload, distress, physical stress (HRV), strain; N= 10 | Barley et al., 2011; Mark et al., 2012; Chesley, 2014; Chesley & Johnson, 2015; Stich et al., 2017, 2018, 2019; Chen et al., 2018; Son & Chen, 2018; Yeh et al., 2020 |
| | Negative emotions (+) | Stich et al., 2018 |
| | Burnout and exhaustion (+) N= 8 | Brown et al., 2014; Wright et al., 2014; Ferguson et al., 2016; Ragsdale & Hoover, 2016; Emanuel et al., 2018; Xie et al., 2018; Molino et al., 2019; Park et al., 2020 |
| | Engagement (-) N=3 | Ragsdale & Hoover, 2016; Lei & Sue, 2019; Vayre & Vonthron, 2019 |
| | Organisational commitment, spousal organisational commitment (-)<br>Spousal resentment to org. (+), N=2 | Ferguson et al., 2016; Stich et al., 2018; |
| | Job satisfaction, spousal job satisfaction (-), N=4 | Diaz et al., 2012; Haeger & Lingham, 2014; Wright et al., 2014; Carlson et al., 2018 |

Note: N (included studies) = 114

### 3.3.1. Multidimensional Techno-stressors

There are several multidimensional technostress constructs. Each subdimension typically describes a different scenario in which work-related technology presents a stressor (Table 3.3). The negative impact of technostress creators (Ragu-Nathan et al., 2008) was examined in 33 different studies, making it the most frequently studied construct across this review. Two of these studies did not explicitly reference the measure but described identical dimensions (Kim & Park, 2018; Wang & Shu, 2008) and two used an adapted version (Kim et al., 2015; Mahapatra & Pati, 2018). Further, 57.6 per cent of studies used the full techno-stress creators scale and techno-uncertainty was excluded most often (N=9).

**Table 3.3.** Multidimensional conceptualisations of various Techno-stressors

| Conceptualisation | Stressors |
|---|---|
| Technostress creators (Ragu-Nathan et al., 2008) | 1) Techno-overload, 2) Techno-invasion, 3) Techno-complexity, 4) Techno-uncertainty, 5) Techno-insecurity |
| ICT-induced stressors (Ayyagari et al., 2011) | 1) ICT-induced Work Overload, 2) ICT-induced Invasion of Privacy 3) ICT-induced Work-Home Conflict, 4) ICT-induced Role Ambiguity, 5) ICT-induced Job Insecurity |
| ICT Demands (Day et al., 2012) | 1) Workload, 2) Response expectations, 3) 24/7 Availability; 4) Employee monitoring, 5) ICT Learning Expectations, 6) Hassles using ICT, 7) Lack of control over ICT, 8) Ineffective communication |
| Technology overload (Karr-Wisniewski & Lu, 2010) | 1) Information overload, 2) communication overload, 3) system feature overload |
| Single scale measures of ICT-overload and demands | Email overload (Dabbish and Kraut, 2006); Information Overload due to mobile ICT (Yin et al., 2018); Work overload due to Office-Home Smartphone use (Yun et al., 2012), ICT demands at work (Stadin et al., 2016) |

Note: N = 33 technostress creators; 6 ICT-induced stressors; 2 ICT demands; 2 Technology overload; 4 unidimensional scales of ICT overload/demands.

The main theoretical framework used to study technostress was the transactional model of stress (Lazarus, 1966; Lazarus & Folkman, 1984), which describes stress as a process involving the interaction between an individual and their environment (Tarafdar et al., 2019). Specifically, when individuals face a technological environmental condition, which is appraised as a demand that exceeds their ability to cope, they experience techno-distress which facilitates maladaptive coping mechanisms and strain outcomes (Lazarus & Cohen, 1977; Lazarus & Folkman, 1984; Ragu-Nathan et al., 2008; Srivastava et al., 2015; Dragano & Lunau, 2020).

Further, a five-dimensional technostress concept stems from Ayyagari et al., (2011) and was examined in six different studies (Harahap & Effiyanti, 2015; Maier et al., 2015; Mahmud et al., 2017; Suh & Lee, 2017; Weinert et al., 2019; Califf et al., 2020). The authors used a Person-Environment fit perspective to study its effects (PE-fit, Edwards 1991) and derived the ICT-stressors from established sources of strain (job demands) in the work environment (Cooper and Cartwright, 2001; Cooper et al., 2001; Ayyagri et al., 2011).

Additionally, Day et al., (2012) defined an 8-dimensional ICT-Demands framework, which was examined twice in the included studies (Cho et al., 2020; Day et al., 2012). The individual dimensions are based on the general stress literature and describe technology factors that may require employees to extend physical and/or psychological effort (Day et al., 2010, p.324). While the authors also draw on the transactional model of stress, the job-

demands resources theory (Demerouti et al., 2001) provides the main theoretical foundation of effects.

Lastly, two studies used a multi-dimensional construct to specifically examine the impact of technology overload (Karr-Wisniewski & Lu, 2010) and four studies used single scales of ICT-related overload. These were allocated to the 1st conceptualisation despite their unidimensional nature because they assess workers subjective ability to cope with ICT-related workload, which most closely resembles the subdimensions of techno-overload (Ragu-Nathan et al., 2008), ICT-induced work-overload (Ayyagari et al., 2011) and overload (Day et al., 2012).

### 3.3.1.1. Outcomes

### Home domain

There were six studies which highlighted negative outcomes of technostress in the home domain. These demonstrated that the experience of certain ICT-stressors was associated with increased levels of work-family, work-life, and work-home conflict. Specifically, studies show that this occurs when ICT creates situations in which workers feel that their privacy is invaded and that there is a constant exposure to work which they cannot break away from (Gaudioso et al., 2015, 2017; Molino et al., 2020). ICT-related overload (Harris et al., 2015) and insecurity (Maier et al., 2015) can further amplify this. For example, Cho et al., (2020) found that in addition to extended availability, technology-related hassles had a significant main effect on WFC due to the negative spillover into the home domain through end-of-work negative affect.

### Work domain

Most negative effects explored for this ICT demand concept fell within the work domain. Particularly, attitudinal outcomes were most frequently examined, as 23 studies demonstrate significant increases in techno-exhaustion (ICT-strain, Ayyagari et al., 2011) and work-related stress and strain (e.g., Tarafdar et al., 2007; Day et al., 2012; Turel & Gaudisio 2018; Califf et al., 2020). Qualitative studies highlight that ICT such as emails create environments where workers are inundated with a constant stream of new incoming information, which need to be read, understood, processed, and managed. This creates new competing tasks and often requires the collaboration of others which can leave workers with

conflicting role requirements and more work than they can effectively handle (Mano & Mesh, 2011). In line with this, technostress was associated with increased levels of role-conflict and role-overload which contributed to the experience of role-stress (Tarafdar et al., 2007; 2014; Wang & Shu, 2011).

In line with theoretical perspectives, Hauk et al., (2019) found that negative coping responses, such as behavioural disengagement partly explained the effect of technostress creators on the development of strain over time (Hauk et al., 2019). Significant negative effects on wellbeing were identified by 12 studies, showing associations with increased levels of burnout and exhaustion. While some show direct effects (Day et al., 2012; Reinke et al., 2014, Srivastava et al., 2015), others identify underlaying mechanisms that drive such effects, For example, Gaudioso et al., (2017) found that increases in job-distress and work-home conflict mediated the effects of techno-overload and invasion on work-exhaustion. Thus, demonstrating how the constant exposure to techno-stressors at work and at home lead to significant long term mental and physical health implications.

Research findings have demonstrated that negative attitudinal outcomes linked to increased levels of technostress had further consequences for behavioural outcomes. For example, reductions in ICT user satisfaction were associated with discontinuous usage intentions (Ioannou & Papazafeiropoulou, 2017). This can have negative long-term implications for organisations as multiple studies have linked techno-stressors to reduced job satisfaction (Yin et al., 2018) and organisational commitment (Tarafdar et al., 2011; Jena, 2015) which subsequently increased turnover intentions and attrition (Maier et al., 2015; Califf & Brooks et al., 2020; Califf et al., 2020).

Following from this, 14 studies found negative production outcomes in form of reduced productivity, performance, and innovation. Multiple mechanisms for these effects have been discussed. For example, techno-uncertainty, -complexity and -insecurity were found to negatively impact productivity through an increase in venting (emotion focused coping; Zhao et al., 2020). Others found indirect effects on productivity through increased role-stress and reduced ICT-enabled innovation (Tarafdar et al., 2014). Studies further suggest that the link between technological overload, increased role stress (role-ambiguity, role-conflict) and poor performance (Delpechitre et al., 2018) occurs due to repeated ICT interruptions (e.g., emails) which lead to multitasking and a lack of effective focus (Tarafdar et al., 2015)

### 3.3.2. ICT-related Pressure and Expectations

Across the 21 included studies, there were 11 different conceptualisations of ICT-related pressures and expectations. All focus on the availability for work during non-work time and a need to respond to work messages which is either implicitly derived through workplace norms or explicitly through formal policies (Table 3.4). Most frequently examined was workplace telepressure (N=7), followed by extended work availability demands (N=3) and OEEM (N=2). Studies which focused solely on ICT-stressors of availability expectations (N=2) and techno-invasion (N=1) were also included here as well as five other studies, each using a different connectivity expectations scale. Lastly, one study used an experimental design to manipulate a high response pressure situation during non-work time.

**Table 3.4**. Different Conceptualisations of ICT-related Pressures and Expectations

| Conceptualisation | Description |
| --- | --- |
| Workplace Telepressure (Barber & Santuzzi, 2015) | A preoccupation with- and pressure to respond to work-related ICT messages quickly |
| Extended work availability demands (Dettmers, 2017, p.25. Dettmers et al., 2016) | The condition where employees have leisure/off-job time but are still accessible to their supervisors, co-workers, or customers and are explicitly or implicitly required to respond to work requests. This means that employees perceive an expectation by their organisation to react to demands regardless of formal regulations. |
| Organisational Expectations for Email Monitoring (OEEM, Becker et al., 2021, p.3) | Organizational expectations for availability, manifested through work email monitoring during nonwork hours. |
| Availability Expectations (Day et al., 2012 p.474-475) | The extent to which ICT increases the availability to work outside of business hours, i.e., the demand to respond immediately even beyond regular working hours, expectations to be constantly available and connected, feelings of never being free of technology or the workplace. |
| Techno-invasion (Ragu-Nathan et al., 2008, p.247) | The invasive effect of ICTs in situations where employees can be reached anytime and feel the need to be constantly connected, thus blurring work-related and personal contexts |
| Constant Connectivity (Büchler et al., 2020, p. 2) | Employees' employees' perpetual availability and 24/7 connectedness to the organization through their use of work-related communication media. |
| Technology-related pressure (Harris et al., 2011, p.2078) | The imposition of work-based technologies into an employee's personal life'. |
| After-hours electronic communication expectations (Piszeck, 2017 p. 593) | The degree to which an employee perceives the organization to require him or her to be available to perform technology- based work outside of the typical time and place of work (Fender, 2010). |
| Workplace norms and policies regarding connectivity to work | Subjective norms that guide workers in their beliefs about whether they should be accessible to colleagues after work hours and employer's |

| | |
|---|---|
| after hours (Adkins & Premeaux, 2014) | requirements for workers to be connected to the workplace after hours (Richardson & Benbunan-Fich, 2011) |
| Injunctive and descriptive norms of work availability during nonwork time (Palm et al., 2020) | Perceived employer expectations for integration behaviour (i.e., the enactment of behaviours relevant to the work role in the nonwork domain, thereby integrating work and nonwork roles) and co-worker integration behaviour. |
| Inconsistent work-related pressure to be available in the private domain (Lutz et al., 2020). | An experiment to manipulate setting- inconsistent pressure to be available (low vs. high) and type of setting- inconsistency (receiving a message from a colleague at home).  Participants were asked to imagine receiving a message from a colleague in a private environment. Pressure was manipulated through different vignettes of a screenshot of a WhatsApp conversation.<br>To check the manipulation of pressure to be available, participants rated on a scale from 1 (completely disagree) to 5 (completely agree) how much social pressure they perceived while reading the message introduced by the vignettes. They responded on a single item ("I had the feeling that my friend/colleague expected me to answer immediately.") |

N = 21 studies

Several different theoretical models are applied to study the adverse outcomes of ICT pressures. Broadly, these fall within the work-life boundary theories (Hall & Richter,1988; Nippert-Eng, 1996; Ashforth et al., 2000; Clark, 2000) and resource-based theories of stress, such as COR theory (Hobfoll, 1989), the JD-R model (Demerouti, et al., 2001; Bakker & Demerouti, 2007) and the Effort-recovery model (Meijman & Mulder, 1998).

The former suggest that the creation of boundaries between different life-domains provides individuals with a sense of balance and satisfaction. Thus, pressure to address work demands in the home domain leads to adverse outcomes as it increases the permeability between work-home boundaries (Ashforth et al., 2000; Dettmers 2017). The latter theories highlight the importance of personal resources (e.g., time, energy) and work resources (support, control) for individuals to cope with the demands they face. Because individuals thrive to protect and retain their resources, situations which threaten resource loss can trigger a stress response(e.g., prolonged exposure to work demands). For example, while it is normal to experience certain load reactions after work, such as fatigue (reduction in energy resources), adequate recovery from work during leisure time is important to avoid further resource loss (Sonnentag & Fritz, 2007, 2015). If individuals feel pressured to remain connected to work, they may continue to tax the same psychophysiological systems, used at work in the day, during evenings and weekends, which prevents the healthy return to base-line levels (incomplete recovery). Over time, this can trigger health impairment processes and turn normal load reactions into chronic strain (Meijman & Mulder, 1998; Shirom & Melamed, 2006).

*Home domain*

In contrast to techno-stressors, most negative effects of ICT pressures were experienced in the home domain. As pressures to remain available for work are experienced during non-work time, effects on wellbeing were categorised as home outcomes (e.g., home-related happiness). Attitudinal outcomes include reduced boundary control and increased work-to-home conflict, highlighted across several different measures, such as work -life and -family conflict, reduced work-family enrichment, and relationship satisfaction. A third of the studies also identified negative effects on health and well-being. For example, organisational expectations for email monitoring (OEEM) were found to have direct negative effects on relationship satisfaction and indirect effects on worker health and general anxiety through e-anxiety. Moreover, increased levels of e-anxiety were found to have spillover effects on significant-other health, anxiety, and relationship satisfaction (Becker et al., 2021). E-anxiety refers to email-related anxiety which arises due to a resource allocation dilemma (e.g., time, attention) that occurs when individuals attempt to complete competing work and home demands simultaneously. For example, workers may fear that they do not adequately fulfil their non-work roles due to constant work-related distractions and interruptions and worry about additional incoming work-tasks.

Although ICT-related pressures and expectations are said to trigger negative outcomes irrespective of the level of physical engagement with work tasks during leisure time (Dettmers et al., 2016a; Becker et al., 2021), studies repeatedly show behavioural outcomes of increased ICT use during non-work time and a mental preoccupation with negative work experiences. For example, studies found increases in home-boundary permeability through the completion of work tasks at home (Kim & Hollensbe, 2018), work-family technology use (Piszczek, 2017) as well as negative work rumination (Park et al., 2019). Such increases in negative work rumination and ICT use mediated negative effects on recovery (Cambier et al., 2019; Van Leathem et al., 2018). Subsequently, production outcomes in the home domain included the inability to recover from work and a reduction in relationship quality (Becker et al., 2021). The effects on recovery experiences have been examined most frequently (N=9) with studies showing significant decreases in relaxation and psychological detachment as well as reduced sleep quality and quantity. Moreover, diary studies have found that high availability expectations lead to increases in insomnia (Park et al., 2020) and cortisol

awakening response (Dettmers et al., 2016) which highlights the far-reaching psychosomatic impact.

### *Work domain*

Multiple studies (N=8) found negative attitudinal work-domain outcomes in form of increased burnout and emotional exhaustion. Longitudinal research showed that higher levels of availability expectations at time 1 led to higher levels work exhaustion at time 3 which was mediated by increases in work-family conflict and reduced psychological detachment at time 2 (Dettmers et al., 2016a). Additionally, workplace telepressure was linked to increased levels of cognitive and physical burnout as well as health related absenteeism (Barber & Santuzzi, 2015). In line with the W-HR model, this suggests an ongoing cyclical effect where constant exposure to ICT demands leads to negative home-domain outcomes and resource loss, which, over time, creates psychological and physical health problems that carry back over into the work domain (Demerouti et al., 2007). Belkin et al., (2020) further illustrate the behavioural impact by showing that OEEM led to higher turnover intentions through increased emotional exhaustion.

Lastly, studies repeatedly demonstrate that a reduction in boundary control mediates the effects of ICT pressure across outcomes, such as negative work rumination (Park et al., 2020), WHC (Kim & Hollensbe, 2018), physical fatigue and sleep problems (Hu et al., 2019), reduced start of day mood (Dettmers et al., 2016a) and emotional exhaustion (Piszczek, 2017). In line with boundary theory, this points to boundary control as the key mechanism that connects the experience of ICT demands and negative home outcomes. Specifically, Piszczek (2017) found that ICT pressure was only associated with increased emotional exhaustion if individuals associated ICT use during non-work time with reduced boundary control. A possible explanation for this may be that segmentation preferences (individual preferences around work-life integration or segmentation) interact with boundary control in a way where integrators see work-family ICT use as a resource that helps better manage their role boundaries. Therefore, a preference for integration can buffer the detrimental effects of ICT pressures whereas segmenters see it as a demand and threat to their boundary control (Kossek & Lautsch, 2012; Piszczek et al., 2017).

### 3.3.3. ICT-based connectivity behaviour

Although all studies in this category examine work connectivity through the use of ICT, the terminology has been the least coherent. Across the 46 included studies, 29 used different terminology to capture connectivity behaviour (CB) even when it was assessed in the same way. Overall, the analysis revealed there were six different methods used to assess CB: 1) the frequency of ICT use, 2) the extent of ICT use, 3) the time (hours/minutes) of ICT use, 4) a combination of frequency and duration of ICT use, 5) email volume and 6) the number of accepted work-contacts during non-work time (Table 3.5). All measures except email volume specify that use occurs during non-work time. While it was included in the current connectivity behaviour conceptualisation, it is important to note that studies assessing email volume include the numbers received and general access to emails in and outside of working hours (Mark et al., 2012; Stich et al., 2018).

**Table 3.5.** Different Conceptualisations of ICT-based Connectivity Behaviour

| Assessment of CB | Terminology used in different studies |
|---|---|
| Frequency of ICT use during nonwork-time<br><br>(e.g., how often they use ICT during non-work time from 1 (never) to 5 (very often, i.e., several times a day), Boswell and Olson-Buchanan, 2007) | 1) Work-related ICT use after hours (WIA; Bauwens et al., 2020; adopted from Boswell & Olson-Buchanan, 2007 and Richardson & Benbunan-Fich, 2011)<br>2) Off-work hours Technology-Assisted Job Demand (off-TAJD; Ghislieri et al., 2017)<br>3) Computer technology (CT) use after hours (Boswell & Olson-Buchanan, 2007; Diaz et al., 2012)<br>4) Work-related smartphone use on vacation (Chen et al., 2018);<br>5) Work contact outside working hours (Bowen et al., 2018; adopted from Schieman & Young, 2013<br>6) Mobile Device use for work during family time (mWork; Ferguson et al., 2016)<br>7) Technology use for work at home during off-job time (Park et al., 2011)<br>8) Work-related ICT use (Chesley, 2014)<br>9) Frequency of work-to-nonwork technology-mediated interruptions (Chen & Karahanna, 2014)<br>10) ICT use for work purposes outside of work (Berowsky, 2013) |
| Extent of ICT use during nonwork time<br><br>(e.g., 4-item scale measuring intensive smartphone use. Examples: "I use my smartphone intensively" (Derks & Bakker et al., 2014) | 1) Work-related smartphone use after work (Derks et al., 2014)<br>2) Work-related smartphone use during off-job time (Derks & Bakker, 2014)<br>3) Daily cross-domain ICT usage at home (TASW, Fenner & Renn, 2010)<br>4) Work-related use of Information and Communication Technologies after Hours (W_ICTs; adopted from Derks & Bakker, 2014)<br>5) Work-related smartphone use outside regular work hours (Mellner, 2016)<br>6) Negative ICT evening events (Braukmann et al., 2018)<br>7) Work-related cell phone use (WRCP use, Ragsdale & Hoover, 2016)<br>8) Using smartphones for work in the evening (SUWE, Ohly & Latour, 2014) |
| Time (hours/minutes) spent using ICT in and outside of working hours | 1) Daily internet use for professional purposes (Vayre & Vonthron, 2019)<br>2) Work-related ICT use beyond work time (WK_ICT, Tennakoon, 2018)<br>3) Electronic communication during non-work time (Butts, Becker & Boswell, 2015) |

| Frequency and duration (time/length) of ICT use during nonwork time | 1) Frequency and duration of work-related technology use during after-work time (Chen & Casterella, 2018)<br>2) ICT-facilitated work extension and ICT use and changes in overall work time (Chesley & Johnson, 2015)<br>3) Work-related communication technology use outside of regular work hours (Wright et al., 2014)<br>4) Work-related ICT communication (Barley et al., 2011) |
|---|---|
| Email Volume (e.g., numbers of emails received, read, and sent, Dabbish & Kraut, 2006) | 1) Email misfit (Stich et al., 2019)<br>2) Email load (Stich et al., 2018)<br>3) Absence or presence of emails and use (Mark et al., 2012). |
| Number of accepted work contacts during leisure time | 1) Work-related extended availability (WREA, Thörel et al.,2020) |

N= 46 studies

Studies most frequently assessed the frequency of ICT use (e.g., Boswell & Olson-Buchanan, 2007) and the extent of use (e.g., Derks & Bakker, 2014) and least frequently examined the number of accepted work contacts (Thörel et al.,2020).

Similarly, to ICT pressures, the majority of studies (72 %) refer to resource-based theories (incl. JD-R model, COR theory, W-HR model, and E-R model), boundary, and work-family border theory (Clark, 2000). Taken together, these suggest that CB creates sustained exposure to work demands and hinders worker's ability to create effective work-home boundaries, which then causes resource loss and strain. That the social-normative context in which employees operate has significant influence on their behaviour has been established theoretically (Ajzen, 1991; Bandurra, 1986) and empirically in ICT research (e.g., Belkin et al., 2020). Although theoretical foundations and effects of ICT pressures and CB overlap, researchers suggest that these effects can occur independently (Becker et al., 2019; Dettmers et al., 2016a). Nevertheless, whether effects of CB occur solely due to the use of ICT or because of additional influence of ICT pressures, cannot be inferred as studies did not control for this. Lastly, ten studies did not refer to any theoretical framework (e.g., Wright et al., 2014; Chesley, 2014; Chen & Karahanna, 2014)

### 3.3.3.1.  Outcomes

### Home domain

Negative attitudinal home outcomes include reductions in boundary control (Mellner, 2016) and home-related wellbeing such as lower levels of happiness and higher levels of anger (Butts et al., 2020), reduced positive affect (Ohly & Latour, 2014) as well as increased

ego-depletion and need for recovery (Gombert et al., 2018) Additionally, Chen et al., (2018) found that smartphone use on vacation increased work stress which led to a decrease in life satisfaction.

There was considerable evidence for the association between CB and increased work-to-non-work conflict, with 23 different studies highlighting effects such as increased work-life and work-family conflict (Diaz et al., 2012; Ghislieri et al., 2017) which was time and strain based (Kotecha et al., 2014; Wang et al., 2017) as well as work-home interference (Berkowsky, 2013; Derks et al., 2015) and reduced work-life balance (Chen & Casterella, 2018). Additionally, studies show an indirect effect on increased relationship tension, through work-family conflict which has further spill over effects on spousal family-to work conflict (Carlson et al., 2018). In the presence of high ICT use, employees who were expected to respond to work-related messages during nonwork time, experienced significantly higher work-home interference than those who did not face such pressures (Derks et al., 2015, 2016). Similarly, to the findings on segmentation preferences discussed earlier, this suggest that the drivers for connectivity behaviour play an important role in its potential impact (Yang et al., 2019).

There was a small number of behavioural outcomes in form of workaholism (Molino et al., 2019) and internet addiction, suggesting that the more time workers spend using ICT, the more problematic and compulsive their usage behaviours become (Vayre & Vonthron, 2019). Lastly, 10 studies found adverse production outcomes through various indicators of impaired recovery from work. For example, CB was associated with reductions in psychological detachment (Mellner, 2016; Park et al., 2011), sleep quality (Braukmann et al., 2018), and morning recovery levels (Lei & Su, 2019). Specifically, studies described how dealing with emails and work calls in the evening led to negative work-related rumination and stress, which stops workers from winding down and mentally detaching from work (Braukman et al., 2018; Mellner, 2016) which in turn mediated effects on sleep problems (Thörel et al., 2020).

### *Work outcomes*

The most frequently examined attitudinal outcomes in the work domain were increases in work-related stress (N=11) and strain as well as higher levels of burnout and exhaustion (N=9). The relationship between CB and burnout symptoms was facilitated by negative home-domain outcomes as indicated by indirect effects through workaholism (Molino et al., 2019), work-life conflict (Wright et al., 2014), work-family conflict (Ferguson et al., 2016) and psychological detachment (Derks et al., 2014). Similarly, a recent diary

study showed that reduced morning recovery levels mediated the negative effects of CB on work engagement (reduced vigour and dedication, Lei & Su. 2019).

Studies which examined outcomes of ICT use during working hours found that high email volume was associated with increased workload stress which facilitated increased negative emotions and psychological strain (Stich et al., 2018). Email volume was also linked to higher levels of emotional exhaustion which was enhanced in workers who experienced high response pressure (Brown et al., 2014). Additionally, experimental research showed that working with emails was associated with higher levels of physical stress (increased heart rate variability) and multitasking than working without (Mark et al., 2012). Immediate behavioural outcomes, such as multitasking are identified as underlaying mechanisms that connect ICT use at work to the experience of stress. Specfically, work intensification (increased work pacing, interruptions, and multitasking) was found to fully mediate the effects on work strain and distress (Chesley et al., 2014).

Further, studies found that CB had indirect negative effects on organisational commitment through increased work stress (Stich et al., 2018) and by crossing over through strain-based WFC, burnout and spousal commitment (Carlson et al., 2018). Additionally, evidence for direct (Haeger & Lingham, 2014; Yin et al., 2018) and indirect effects on job satisfaction through work-life conflict (Diaz et al., 2012; Wright et al., 2014) was found. Behavioural outcomes in form of increased turnover intentions were found to occur indirectly through increased exhaustion (Emanuel et al., 2018), and through increased WFC, burnout and reduced organisational commitment (Ferguson et al., 2016). Notably, these outcomes were also present in employee's significant others as studies found negative effects on spousal job satisfaction, organisational commitment and even work performance (Carlson et al., 2018; Ferguson et al., 2016). Lastly, there was further evidence for the role of segmentation preferences as a boundary condition for the adverse impact of ICT use during non-work time (Gadeyne et al., 2018; Yeh et al., 2020).

## 3.4. Discussion

The current paper discusses the findings of a systematic review on the adverse outcomes of work-related ICT demands. Research progress in this field may be compromised because of its dispersed nature which makes little reference to a unifying framework and is subject to jingle jangle fallacies. Previous reviews stress the challenge this creates in identifying, comparing, and clarifying research findings (Schlachter et al., 2018).

Thus, the first research question aimed to provide conceptual clarity by exploring "*what the different conceptualisations and methods used to study work-related ICT demands are*". This included a cross-disciplinary synthesis of 114 quantitative studies and identified three different ICT demand conceptualisations associated with adverse outcomes: (1) Multidimensional techno-stressors, (2) ICT-related pressures and expectations (3) ICT-based connectivity behaviour. To address the second research question: "*what are the adverse outcomes of work-related ICT demands*", the findings were discussed for each conceptualisation and organised into a framework aligned with the work-home resources model, thus highlighting attitudinal, behavioural and production outcomes in their respective domain (work and home).

### 3.4.1. Summary of findings

Overall, the synthesis revealed that the adverse outcomes associated with ICT demands vary depending on their conceptualisation. A summary of the shared and unique outcomes can be seen in Figure 3.2 and 3.3.
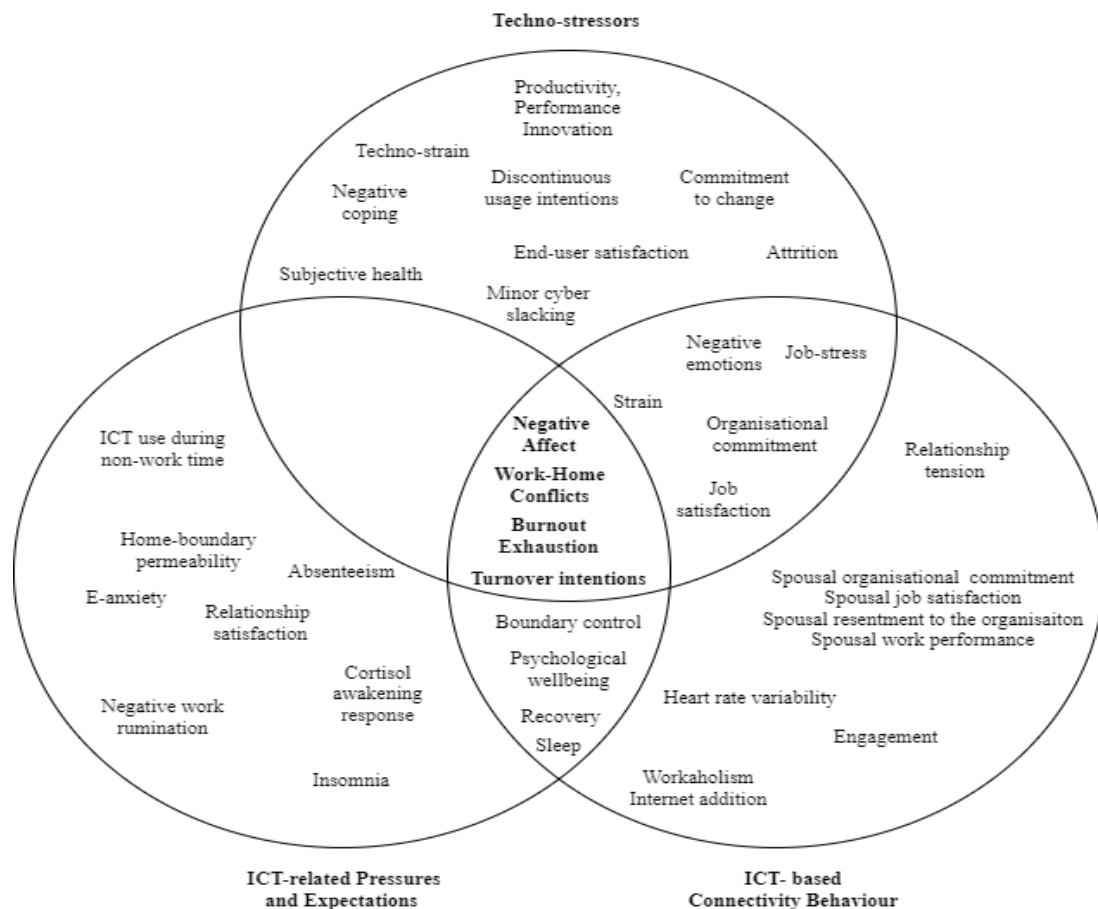


**Figure 3.2.** Shared and unique negative outcomes of work-related ICT Demands

| | Work domain | Home domain | Work domain | Home domain |
|---|---|---|---|---|
| **Work-related ICT Demands** | | | | |
| Techno-stressors | Negative coping, Techno-strain. Job stress, Negative Affect Productivity, Innovation | Work-Home Conflicts | Negative attitudes and behaviours towards ICT, Performance, commitment to change subjective health, strain, burnout, exhaustion, job satisfaction, , organisational commitment turnover intentions, attrition, | |
| ICT-related Pressures and Expectations | | Boundary permeability, Boundary control, E-Anxiety, ICT use, Wellbeing, WHC, Negative work rumination, Recovery | Burnout, exhaustion, absenteeism, turnover intentions | Relationship satisfaction, Insomnia, Cortisol awakening response, |
| ICT-based Connectivity Behaviour | Work intensification, Negative emotions, Job stress | Boundary control, Wellbeing, Work-home conflicts, Recovery | Engagement, heart rate variabilty, strain, burnout, exhaustion, job satisfaction, organisational commitment turnover intentions, spousal job satisfaction, -organsational commitment, -work performance, -resentment towards the organisation | Relationship tension |

Immediate effects ——— Longterm effects ⟶

**Figure 3.3**. Adverse outcomes of workplace ICT Demands in the home and work domain

Each ICT demand displays effects in both domains however, the outcomes of techno-stressors are most frequently found in the work domain while those of ICT pressures are commonly experienced in the home domain. The adverse effects of CB are more evenly distributed across both. A main finding was that all three ICT demands were significantly associated with increased negative affect and work-to-non-work conflict (immediate effects), as well as burnout, exhaustion, and turnover intentions (long-term effects). Further, outcomes of techno-stressors and CB overlapped in terms of increased work-related stress and strain, reduced job satisfaction and organisational commitment (work domain effects). Techno-stressors and ICT pressures did not share additional outcomes. Although ICT pressures and CB are separate constructs, they are significantly related, and IT pressures were found to predict ICT use in multiple studies. Shared outcomes of the two concepts were reduced boundary control, poor home-related wellbeing, and impaired recovery such as reduced psychological detachment and sleep quality (home domain effects).

Several unique outcomes were identified for the individual ICT demands. For example, only techno-stressors were linked to lower performance indicators such as reduced productivity and innovation. Researchers suggest that this is due to an increase in role-related stressors, such as role-ambiguity, -conflict and -overload (Delpechite et al., 2018; Tarafdar et al., 2014). Outcomes of ICT use such as increased work intensification and multitasking may contribute to this. Specifically, dealing with high email volume can lead to rushed and ineffective information processing which inhibits focused and creative ways of working (Amabile et al., 1996; Tarafdar et al., 2014).

Further, in line with research on the JD-R model, there may be long-term effects on performance through reduced work-engagement and increased burnout (Bakker &

Demerouti, 2007; Taris 2006). For example, the negative emotions (increased negative affect, reduced vigour and dedication) associated with ICT demands could reduce workers thought-action repertoire, and lead to a resource loss spiral, which affects motivational pathways and ultimately reduces job performance (Bakker and Bal, 2010). Simultaneously, health impairment processes activated through the prolonged exposure to ICT demands can lead to suboptimal working states (e.g., fatigue), the investment of compensatory effort to concentrate on tasks, and a subsequent deterioration in work performance (Meijman & Mulder, 1998; Taris, 2006; Demerouti et al, 2007). Accordingly, studies are showing time-lagged effects of home-work interference on concentration and subsequent reductions in in-role performance, suggesting that negative ICT-induced home outcomes, such as relationship tensions, transfer back into the work domain, causing worry, distraction, and lower work performance (Demerouti et al., 2007). Thus, while only technostress shows direct empirical links to work performance, there are multiple pathways through which ICT demands could exhibit such adverse effects.

The importance of having mental breaks from work pressures, was emphasised by the unique outcomes of ICT pressures. These range from immediate effects of increased feelings of anxiety, cognitive irritations, and negative work ruminations to more long-term psychosomatic health effects such as insomnia and increased cortisol awakening response and can ultimately result in health-related absenteeism (e.g., due to burnout, Barber & Santuzzi et al., 2015).

Certain individuals may have a greater predisposition for this due to their personal segmentation preferences (Kreiner et al., 2006; Derks et al., 2016). Multiple studies demonstrate that individuals who prefer to separate work and home lives (segmenters) experience greater difficulties psychologically detaching, increased work-family conflict and higher levels of job stress and exhaustion in response to ICT pressures and subsequent use, compared to individuals with a preference for work-life integration (Yeh et al., 2012; Butts et al. 2015, Derks et al., 2014, 2016; Piszczek et al., 2017; Gadeyne et al., 2018; Thörel et al., 2020). Thus, in the face of high ICT pressures, segmenters lose the capability to self-regulate their use and achieve their segmentation preferences, which creates a loss in boundary control (Kossek & Lautsch, 2012; Piszczek et al., 2017)., which highlights that "voluntary" ICT use is not always a personal choice that can be regulated with self-discipline. Considering that ICT pressures can be explicit (e.g., being on call) but are also shaped implicitly through the behaviours and expectations of managers and co-workers, these results demonstrate that

workplaces need to draw more attention to how voluntary connectivity behaviours of integrators may unintentionally affect segmenters.

Additionally, in line with the right-to-disconnect legislation, it reinforces the need for organisations to take responsibility in creating a culture for better work-life segmentation (Yun et al., 2012). Nevertheless, it is less clear how integrators could be affected by a culture change towards work-life segmentation. For integrators, ICT use during non-work time is a strategy to effectively navigate their boundary preferences and can therefore act as a resource that facilitates positive effects (Derks et al., 2015; Kossek & Lautsch et al., 2012; Piszczek, 2017; Yeh et al., 2012). Thus, blanket rules that ban out of hours ICT use may adversely affect their autonomy and boundary control, and subsequently cause unintended adverse outcomes.

Lasty a small number of studies examined the impact of ICT demands on spouses and found crossover effects of OEEM on partner health and relationship satisfaction (Becker et al., 2019). Additionally, CB-induced work-home and family-work conflict, increased spousal resentment and reduced commitment to their partners organisation (Ferguson et al., 2016) adversely affected spousal job satisfaction and work performance (Carlson et al., 2018). Thus, demonstrating that ICT demands do not only have implications for individuals and their organisations but also for significant others in their lives. Considering that, according to COR theory, individuals are primarily driven to protect and maintain their resources, the profound impact of ICT demands on their relationships outside of work, may explain why turnover intentions has been a consistent outcome identified in this review. Although both, marriage and employment are important structural resources (Ten Brummelhuis & Bakker et al., 2012), the prospects of leaving a job for one that inflicts less strain on a relationship may pose less resource loss than marriage breakdown.

### 3.4.2. Implications for theory and future research

The current findings show that research in this field has developed into sub-categories examining different ICT-demand concepts, which considered in combination, provide a more holistic interpretation of this field. Taken together, these demands represent how 1) negative situational appraisals of technological work environments (techno-stressors), 2) injunctive and descriptive norms regarding work availability (ICT-related pressures and expectations) and 3) the duration and extent of ICT use (CB), affect workers. By synthesising the

terminology and measurement into three overarching ICT demands, we provide a framework that can be applied by researchers to integrate findings into a more coherent body of literature and avoid jingle jangle fallacies. This review points towards the conceptual similarities between these categories and views research on ICT pressure and behaviour as extended arms of techno-invasion and techno-overload from Ragu-Nathans well-established techno-stress creators' framework. This work builds on Ragu-Nathan's model to incorporate more nuanced demands specific to mobile ICT and adequately captures the impact of ICT in the home domain. Therefore, this framework, which more readily captures stressors relevant to mobile ICT offers a better way to look at the existing literature.

The overlap in outcomes highlights the synergy and potential additive effects of the theoretical pathways applied to study these different demands. Thus, when examining the effects of ICT demands, one may need to consider different theoretical approaches to account for the complex mechanisms through which the long and short-term effects may occur. Because these occur in the work and home domain, theoretical frameworks should span across both to explain outcomes. In line with this, we demonstrate that the W-HR model is a suitable framework for studying ICT demands as it accounts for long- and short-term effects in work and home domains and is based on combined theoretical perspectives from the COR and JD-R model. Applying this approach to expand existing conceptual models of ICT demands, which focus largely on outcomes in one domain (e.g., Schlachter et al., 2018), to explain processes and outcomes in both could allow for a more comprehensive understanding.

Nevertheless, the W-HR model does not explicitly account for certain appraisal processes and person-environment perspectives. Because boundary conditions such as certain person characteristics (i.e., segmentation preferences) and the motivation for ICT use can play an important role in determining the impact of ICT demands, it would be valuable to include such a perspective. In line with resource theory (Hobfoll, 2002) and research on segmentation preferences (Piszcek, 2017), effects could be explained within this framework by viewing low segmentation norms as management resources. These "facilitate the selection, alteration, and implementation of other resources" (Thoits, 1994), and "enable more active and efficient coping mechanisms" (Hobfoll, 2002; Ten Brummelhuis & Bakker et al., 2012, p.548). Thus, individuals who possess such management resources should be better equipped to cope with ICT demands because they see a higher person-environment fit in organisations where segmentation norms are low. For example, Yang et al., (2019) have recently started following such an approach by applying COR and boundary theory to

propose a multilevel model which contains cross-level interactions between group segmentation norms and individual segmentation preferences.

Future research should build on this approach and consider interactions between individual differences and organisational norms to create work environments that enable all workers to achieve sufficient boundary control (Kossek & Lautsch, 2012; Piszcek, 2017). Specifically, examining how working under high segmentation norms affects integrators could ensure that organisational changes that create culture for segmentation do not pose hidden threats for certain workers.

Additional questions researchers may seek to answer are 1) whether the buffering effect of low segmentation preferences is a permanent protective factor or whether there are circumstances under which integrators succumb to the adverse effects of ICT demands, and 2) whether cross-over effects (i.e., Becker et al., 2019) are present in spouses of integrators. As integrators are less likely to experience WHC, their partners may remain unaffected or even experience positive outcomes. Examining their relationship dyadic and strategies for integrating ICT as a resource may highlight effective coping strategies. On the other hand, a relationship mismatch between segmentation preferences may be more difficult to manage and may lead spouses with different preferences to experience negative effects in response to their partners connectivity behaviour.

The most important direction for future research points towards longitudinal and experimental research. Currently this field is primarily populated by cross sectional research (86%) which does not allow for important causal inferences. Although an increase in diary studies and the two longitudinal studies have contributed to a more advanced understanding of the mechanisms that facilitate adverse effects of availability expectations (Dettmers, 2017) and technostress (Hauk et al., 2019), research that explores the long-term impact of ICT demands and identifies effective mechanisms for interventions is needed. Because multiple ICT demands manifest in the same outcomes, future research should examine these demands in combination to better understand the shared and incremental variance they contribute. This may identify which specific demands to prioritise in interventions to maximise effectiveness.

Lastly, the double-edged nature of workplace ICT could present a barrier for change because organisations and employees may associate productivity gains with mobile ICT use (Diaz et al., 2012; Stich et al., 2018) and use this to justify continued connectivity behaviour (Cavazotte et al., 2014; Villadsen, 2017). Although lower performance outcomes have been associated with techno-stressors (e.g., techno-overload), future research should take a closer look at the long-term impact of ICT demands on work performance. As discussed, constant

connectivity may adversely impact performance through increased work exhaustion or family-work conflict which may explain why it has been difficult to establish a performance-based business case for flexible working arrangements (De Menezes & Kelliher, 2011). Highlighting such a link may provide greater incentive for workplaces to invest into organisational interventions that tackle ICT demands and facilitate the appropriate cultural integration of work-family friendly policies (Kossek, 2016).

### 3.4.3. Implications for interventions

To aid the development of interventions that tackle the adverse effect of ICT demands, several implications for interventions are discussed.

*First: design interventions beyond the individual level.* Stress-management interventions are typically designed at either the individual or the organisational level. While individual level interventions aim to reduce the impact of stressors on individuals by helping them cope with their demands (e.g., through workplace health promotion or specific training courses), organisational interventions aim to remove the causes of stress by making systematic changes to organisational practices and policies, such as leadership, working time, and occupational health and safety (Anger et al., 2015; Holman et al, 2018 p.4). Individual interventions have been predominantly implemented to help workers cope with stress and burnout (Halbersleben & Buckley 2004) and have shown benefits in improving email overload (Dabbish & Kraut, 2006).

However, considering the detrimental effects of ICT-pressures and expectations which are driven by injunctive and descriptive norms around work availability (meaning attitudes and behaviours of managers and colleagues), targeting interventions at this level alone may yield little success in reducing adverse effects discussed in this review.  Prior scholars have noted that employees do not exist within a vacuum but are affected by wider meso-and macro-level influences (Martin et al., 2016) and that such social and organizational factors play a much larger role in the development of burnout than individual factors do (Maslach et al., 2001; Schaufeli & Buunk, 2002 cf. Le Blanc et al., 2007, p. 214). Therefore, interventions targeted at the group or organisational level may be more effective. For example, Leblanc et al., (2007) conducted a team-level burnout intervention which included educational elements and support group meetings where workers could share their feelings and discuss and solve work-related issues. The results showed significant reductions in

burnout symptoms (emotional exhaustion and depersonalisation) over time which were significantly related to perceived improvements in job characteristics (workload, job control, social support).

Additionally, a group level work-life intervention, which included management training to increase supportive work-family behaviours and a shift away from a long-hours-culture have shown promising results in reducing work-family conflict and burnout (Moen et al., 2016). These designs could be replicated with a focus on ICT demands, for example, creating team-level interventions where workers can share how ICT demands affect them with their managers and colleagues to then discuss and develop team level strategies on how to solve such issues as a group.

A further implication for interventions would be to *include multiple initiatives to address the three ICT demands*. This review has highlighted that recovery, work-home conflict and burnout can be affected by different ICT demands that may be experienced simultaneously. For example, workers who experience techno-overload and face high response pressure are also likely to use ICT intensely beyond their working hours (Barley et al., 2011). Thus, interventions may include the introduction of new email policies, which limit the use of emails during non-work time (Stich et al., 2015; Piszczek 2017), but should also include training for employees, managers and leaders on boundary management tactics to emulate a culture that allows workers to form sufficient boundaries between work and home lives (Kossek 2016; Becker et al., 2019; Park et al., 2020). Additionally, interventions may include educational aspects to highlight the importance of connectivity behaviour change and provide specific email management training for employees to better cope with the email load they receive during the workday (Dabbish & Kraut, 2006; Soucek & Moser, 2010; Stich et al., 2015).

Lastly, it is recommended to *use a bottom up, participatory intervention design* to increase the effectiveness of planned outcomes. As individual segmentation preferences play an important part in whether ICT is seen as a demand or resource (Diaz et al., 2012; Schlachter et al., 2018; Yeh et al., 2020), it is important to design an intervention that reduces the adverse impact of ICT demands but still allows workers to gain benefits from ICT use. Including employees and managers in the design, planning and implementation process can increase person-intervention fit, positive attitudes towards- and participation in the intervention which are key determinants of intervention success (Nielsen et al., 2010; Randall & Nielsen, 2012, 2015).

### 3.4.4. Limitations

Similarly, to previews reviews (Schlachter et al., 2018), the lack of consensus on definitions in this rapidly growing and multidisciplinary research field presented a challenge when conducting the literature search. Although a specific search protocol was applied, to conduct such a comprehensive review, several additional iterative searches were required. While using a more inclusive approach towards ICT demands, outcomes and samples, addressed important limitations of previous reviews, it also identified a high volume of relevant studies which contained different concepts, theories and effects. This made it difficult to synthesise and integrate the findings into a coherent framework without creating further complexity. Thus, gathering, analysing and summarising the existing research findings has taken a considerable amount of time.

To identify an appropriate number of studies for review several limitations needed to be set. For example, it was not possible to include newer publications which emerged during the review. Studies are fast emerging in this field and the world of work, particularly interactions with workplace ICT, has advanced significantly throughout the covid-19 pandemic. Nevertheless, building on this review will allow researchers to identify the impact of the pandemic in this area. Additionally, due to the comprehensive nature of this review, the focus was limited to the adverse outcomes of ICT demands as opposed to a discussion of its nomological net. Although some important mediating mechanisms and moderating variables were highlighted, many such additional findings, as well as any antecedents, were not reviewed.

The present review was also limited to quantitative research and did not include any positive outcomes associated with workplace ICT. There are not only studies highlighting positive effects of ICT resources (Day et al., 2010) or techno-stress inhibitors (Ragu-Nathan et al., 2008) but also studies who found that ICT demands lead to positive outcomes, such as improved family role performance (Derks et al., 2016) and job performance (Yeh et al., 2020) [2].Therefore, although this review certainly paints a dark picture, there is another side to this coin. Although research interest does not appear as popular, future research focused on reviewing the positive effects of ICT may not only provide valuable insight into how it can be

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[2] Such positive effects are typically observed for integrators in studies using segmentation preferences a moderator

used to enrich workers lives but may also reveal additional fruitful strategies for interventions.

## 3.5.    Conclusion

This review built on previous reviews by presenting a comprehensive systematic synthesis of quantitative research examining the adverse effects of ICT demands, including multidimensional techno-stressors, ICT-related pressures and ICT-based connectivity behaviour. This developed taxonomy extends existing models and provides a framework that more readily captures stressors relevant to mobile ICT. The results highlighted unique and shared outcomes in the work and home domains, such as increased negative affect, work-home conflict, burnout and exhaustion as well as turnover intentions which were associated with all three demands.  The findings highlight that the extent to which ICT demands can adversely impact workers, their organisation and even their spouses if not managed well, which highlights the need for more comprehensive theoretical models and strategies for interventions. Future research must aim to advance this field by using experimental and longitudinal designs to explore longer term effects and inform strategies that alleviate such adverse outcomes.

By uniting fragmented and dispersed findings, this review provides a starting block for advancement in this research area. Specifically, the current findings should be applied to make connections between different ICT demands, compare theoretical approaches and outcomes, but also to inform the design of relevant interventions (e.g., participatory multimodal team-level intervention addressing all three ICT demands). Lastly, as individuals do not seem equally adversely impacted, research needs to explore the effects relevant interventions have on individuals with different segmentation preferences to better understand how we manage ICT in ways that allow everyone to thrive.

# Chapter 4: ARTICLE 2 – 'The Right to Disconnect': An Intervention Study to Examine the Effect of Constant Connectivity Through Work-Emails on Work-Home Conflict, Recovery, Burnout, and Performance

**Abstract**

This study examines whether an intervention based on the introduction of email guidelines is effective in 1) reducing email-related ICT-demands and 2) improving employee wellbeing and performance outcomes. We further investigate whether reductions in ICT-demands function as mediating mechanisms in the latter relationship. The effects were tested by using a quasi-experimental design where email guidelines were implemented in 17 teams (N=101) who were compared to a waitlist control group (N= 75). Data were collected in four waves over 6 weeks across all participants and analysed using latent growth curve modelling (LGCM). The results show significant reductions in ICT-demands (techno-overload, techno-invasion, email monitoring frequency, and time spent on emails during non-worktime) and increases in wellbeing (captured as improvements in work-home conflict, psychological detachment, and burnout) as well as performance. Parallel process models revealed that the reduction in techno-stressors (techno-overload and techno-invasion) mediated the intervention effects on employee outcomes. These results offer a first step towards an evidence-based approach to managing the adverse effects of work-related ICT within organisations and contribute to our understanding of the mechanisms that link these interventions to improved wellbeing and performance outcomes.

## 4.1.    Introduction

The way in which new information and communication technology (ICT) has revolutionised the workplace over the past two decades is often described as a double-edged sword (Dén-Nagy, 2014; Stich et al., 2015). While it was first celebrated for the newfound ability to work wherever, whenever (Messenger, 2018), offering greater autonomy, work-life balance, and performance (Gajendran & Harrison, 2007), evidence is mounting that this comes at a cost.

Studies show that ICT facilitates overload and pressures to constantly be connected and available to work, which ultimately places significant strain on workers' health and wellbeing (Ayyagari, et al., 2011; Barber & Santuzzi, 2015; Day et al., 2012; Dettmers, 2017), their relationships outside of work (Barber et al., 2019; Becker et al., 2021) as well as their performance at work (Pirkkalainen et al., 2019; Tarafdar et al., 2007). Considering the risk that the "dark side" of technology presents to employee health and wellbeing (Tarafdar et al., 2015), there is a need to develop effective strategies to better manage the demands work-related ICT (e.g., emails) place on workers (Gaudioso et al., 2016). This study will address the repeated calls for interventions in this field (e.g., Barber & Santuzzi, 2015; Derks, 2014; Stich et al., 2018) by implementing an organisational email intervention and evaluating its effectiveness in reducing ICT-demands and improving employee wellbeing and performance outcomes.

To date, interventions that focus on the work-home interface (work-life interventions, WLI) typically include the formal introduction of new work-life policies (e.g., flexible working, telework, part-time work) and their informal cultural integration (Kossek, 2016). Although reviews have found evidence for reductions in work-life conflict, almost none achieved improvements in wellbeing (Hammer et al., 2015; Moen et al., 2016). This may be due to an insufficient cultural integration, which can lead to work intensification and difficulties disconnecting from work emails for those who take up new arrangements (Kossek, 2016). Furthermore, WLIs often aim to increase resources such as schedule control (temporal and special control over where and when one works; Ashforth et al., 2000, Golden, 2008). Although this can be beneficial if no prior WL arrangements were in place, workers who struggle with constant work connectivity likely already have high levels of control over where and when they work (Mazamnian et al., 2013). In this instance interventions designed to further increase such resources may not be beneficial as very high levels of job scope can increase levels of burnout (Xie & Johns, 1995; Sørensen & Holman, 2014). Working conditions characterised by high demands and long hours have the highest levels of work-home conflict and psychological strain (Fan et al., 2019), thus, interventions which target the reduction of relevant work demands may be more effective.

Work demands are defined as "those physical, social, or organisational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs" (Demerouti et al., 2001. P. 501). In this study, ICT-demands refer to those work demands specific to work-related ICT (emails) that blur work-home boundaries and contribute to constant connectivity. Prior work has identified three

categories of ICT-demands empirically linked to adverse individual and organisational outcomes (Siegl et al., 2023a[3]) and several sources of email-related stress (Barley et al., 2011). Based on this, six ICT-demands will be examined (Table 4.1).

**Table 4. 1**. Categorisation and description of ICT-demands examined in the current study

|  | | ICT-demands 1 & 2 | | ICT Demand 3 | | ICT-demands 4, 5 & 6 |
|---|---|---|---|---|---|---|
| Conceptualisation of ICT-demands (Siegl et al., 2023a) | i) | **Technostress creators:** describe technological situations and characteristics that can cause stress in workers depending on their subjective appraisal (Ragu-Nathan et al., 2008; Day et al., 2010; Ayyagari et al., 2011) | ii) | **ICT-related pressures and expectations**: focus on organisational norms and pressures around constant availability for work (e.g., Barber & Santuzzi, 2015; Becker et al., 2021), | iii) | **Connectivity behaviour:** comprises of the amount of time workers spend interacting with work-related ICT during non-work time and ICT-behaviours associated with constant work connectivity (e.g., Derks & Bakker, 2014; Wright et al., 2014). |
| Sources of email stress (Barley et al., 2011): | a) | Overload associated with high email volume and the specific material features of emails | b) | The presence and interpretation of certain social norms. | c) | The time spent handling emails. |
| Specific ICT-demands examined in the current study: | 1) | **Techno-overload** (TO, "situations where ICTs force users to work faster and longer). | 3) | **Organisational expectations for email monitoring** (OEEM; "an employee's perception that he/she is expected to monitor electronic work communication during non-work hours based on implicit or explicit organisational norms which create a constant attention allocation dilemma between work and home demands"). | 4) | **Email monitoring frequency** during non-work time (EMF). |
|  | 2) | **Techno-invasion** (TI, "the invasive effect of ICTs in situations where employees can be reached anytime and feel the need to be constantly connected, thus blurring work-related and personal contexts"). |  |  | 5) | **Time spent on emails** during non-work time (TOE). |
|  |  |  |  |  | 6) | **Work-family multitasking** (WFM, the frequency with which individuals engage in work- and home-related activities simultaneously when they are at home (Voydanoff, 2005) |

*Note:* References for the definitions of Techno-overload & Techno-invasion (Ragu-Nathan et al., 2008, p.427) and OEEM (Becker et al., 2021, p. 1026)

To reduce the negative impact of ICT-demands, scholars have recommended the introduction of new email policies and emphasize the support from senior leaders and the alignment of management behaviours as critical conditions for success (Becker et al., 2021; Gaudioso et al., 2016). In 2017, France introduced the nationwide 'right to disconnect' legislation which inhibits organisations from sending emails to employees after hours or

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[3] Reference for Article 1 (Siegl. S., Clarke, S., Cooper, C.L. (2023a). Never Free of ICT: A Systematic Review of the Negative Outcomes of Work-related ICT Demands).

demands that firms introduce a charter which clearly outlines the rules and rights relating to out-of-hours communication to their employees (ERSP, 2020; Secunda, 2018). However, despite popular attention (BBC, 2014; 2021), European legislative changes and frequent calls from academic research (Barber & Santuzzi, 2015; Derks, 2014; Stich et al., 2015; Stich et al., 2018), no intervention studies have yet examined the effect that inhibiting email communication during non-work time has on employee wellbeing (Tarafdar et al., 2019). Hence, the evidence-base to support such changes is currently absent.

The unclear effectiveness of organisational changes targeting email-related stress and constant connectivity to work presents a critical gap in this field. Considering the current levels of stress-related sickness absence in the UK, developing evidence on how to create more sustainable work environments is an agenda of particular importance (HSE, 2021). Therefore, rigorous examinations of the effectiveness of email policy interventions for employee wellbeing and performance outcomes are needed to provide insight for organisations considering their implementation. To address this need, this study aims to provide a detailed understanding of (a) whether ICT-demands can be significantly reduced by an intervention which introduces and integrates new email guidelines, and (b) whether this intervention would subsequently be effective in improving employee wellbeing and performance outcomes.

We propose mechanisms based on the work-home resources (W-HR) model (ten Brummelhuis & Bakker, 2012) which offers a well-suited theoretical framework as it considers how stress occurs due to a conflict between work and home domains (see figure 4.1). Based on principles of conservation of resources (COR) theory (Hobfoll, 2001), it suggests that contextual work demands (e.g. working overtime) deplete personal resources (e.g. time, focus, energy, sleep, mood, health) which diminishes home outcomes (e.g. less quality time with family, missed leisure activities, reduced home-related happiness and wellbeing). In turn, contextual home demands (e.g., coordinating and engaging in home tasks, spousal conflict) further deplete personal resources which leads to adverse work outcomes (e.g., burnout or reduced on-job productivity; ten Brummelhuis & Bakker, 2012).

One key criterion for the improvement of wellbeing and performance outcomes is the absence of stressors which cause sustained activation and resource depletion as this would reduce conflict and allow for adequate resource recovery (Hobfoll, 1989, 2002; Meijman & Mulder, 1998). Thus, in the development of this intervention, the reduction of ICT-demands will be the foundation for improvements in work-home conflict, psychological detachment, as well as burnout and performance.
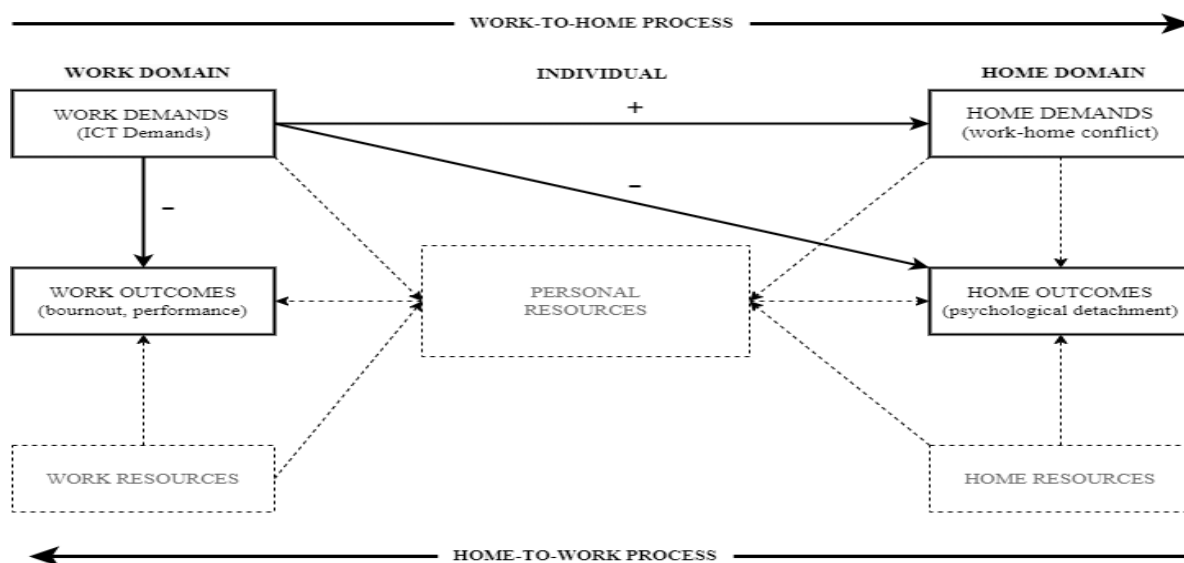
**Figure 4.1**. Theoretical model of proposed effects based on the W-H R model

In addition, we draw on existing literature to review effective boundary management tactics and outline how this intervention can strengthen these. We consider the need for cultural integration for the success of policy interventions (Kossek, 2016) and thus designed a thorough implementation strategy including a) the introduction of a new email policy that provides guidelines for work-related email use and b) its integration through team training that raises awareness of the risks associated with email stress and constant connectivity, thoroughly explains and demonstrates new email behaviours, and highlights the importance of role-modelling behaviours. In this, the delivery of the intervention draws upon the principles of stress inoculation training, which is a cognitive-behavioural intervention that consists of multicomponent training in three phases: 1. A conceptual education phase, 2. A skills acquisition and consolidation phase and 3. An application phase (Meichenbaum, 1985) An overview of the guidelines and phases can be seen in Table 4.2.

In sum, this study increases knowledge and contributes to the workplace technology, health and wellbeing, and interventions literature by (1) investigating whether the reduction of ICT-demands as a form of contextual work-demands within the W-HR model is a suitable theoretical basis for ICT specific work-life interventions and can be achieved through the implementation of new email guidelines, (2) creating an empirical evidence base of the effectiveness of interventions relevant to 'the right to disconnect' for employee and organisational outcomes, and (3) generating an insight into the mechanism through which this

intervention affects WHC, burnout, and performance by examining multiple ICT-demands (techno-overload, techno-invasion, OEEM, EMF, TOE & WFM) as proposed mediators (Figure 4.2).

**Table 4.2.** Overview of the Intervention

| INTRODCUTION OF NEW EMAIL GUIDELINES |
|---|

1. Limit E-mail traffic to working hours and days unless it is urgent.
2. Use Flexible Working Signature
3. Signal when you are not working
4. Do not monitor your E-mails while you are on annual leave.
5. Think before you send!
   5.1. Does it need to be seen by all these people?
   5.2. Does it need a response at all?
   5.3. Is this the best way to communicate this?
   5.4. Do I have to send it now?
6. Use a standardised format for subject lines
7. Keep emails brief and use bullet points where possible.
8. Always be professional and courteous.
9. Don't overuse exclamation marks or CAPS LOCK.
10. Try to reduce the amount of attachments on emails.
11. Turn off your E-mail notifications
12. Use the self-help tool for inbox management.

| INTEGRATION |
|---|

| Education & Awareness | Email training | Q&A/Discussion | Leadership support |
|---|---|---|---|
| - The adverse impact of certain email behaviours (e.g., academic research showing the health risk associated with constant connectivity and internal focus group results) | - Demonstration of how to apply new email rules in practice and why (e.g., rule 3 can act as a protective mechanism that facilitates disengagement for those who are off during regular working times/days such as part-timers). | - Allocated time for the team to ask questions, seek clarification or use the group format to raise and discuss related issues. | - Providing sources that show senior leadership support the new guidelines and healthy work-home boundaries |
| - The development and impact of social norms and ideal worker types | | | - Commitment from supervisors to role model new behaviours |
| - The importance of recovery | - Outlook training toolkit | | |
| | - Increasing segmentation norms through supportive work-home attitudes and behaviours | | |

Note: The intervention was implemented through individual 1-hour online team meetings.
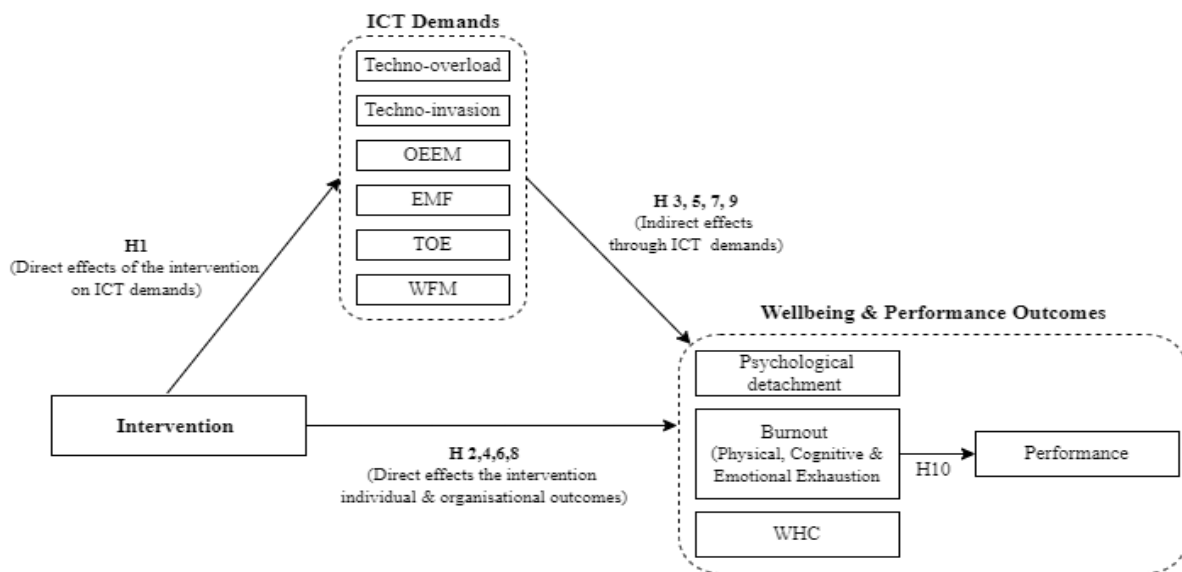
**Figure 4.2.** Hypothesised model of the intervention effect on employee outcomes mediated by changes in ICT demands.
Note: OEEM = organisational expectations for email monitoring; EMF = email monitoring frequency during nonwork time; TOE = Time spent on emails during nonwork time; WFM = work-family multitasking; WHC = work-home conflict.

### 4.1.1. Intervention effects on ICT Demands

#### 4.1.1.1. *Technostress creators*

Technostress is defined as stress that individuals experienced due to their use of information systems (Tarafdar et al., 2019, p. 7). Technostress creators describe characteristics of workplace technologies, that elicit negative stress reactions (Ragu-Nathan et al., 2008). Techno-overload and techno-invasion (Table 4.1) have been directly associated with strain outcomes such as increased work-home conflict and reduced wellbeing (Borle et al., 2021). An inability to cope effectively with these stressors can facilitate further adverse job outcomes such as work exhaustion (Gaudioso et al., 2016). Emails are a likely cause of increased techno-overload and invasion. For example, workers have described feeling overwhelmed and overloaded by the constant stream of incoming information which adds new tasks, requires prioritisation and often the input of others. Ultimately, this increases the amount and pace of work and creates a burden to get more done in less time. Additionally, workers report a fear of falling behind on their emails and therefore often extend their working day to meet this demand (Barley et al., 2011; Mano & Mesch, 2010).

Mobile ICT has turned emails into a medium for work demands to invade one's non-work life. Thus, facilitating work-home boundary blurring, difficulties disconnecting from

work during off-time, and overworking (Barley et al., 2011; Boswell & Olson-Buchanan, 2007; Ragu-Nathan et al., 2008). Gaudioso et al., (2016) suggest that teaching adaptive coping strategies and stopping out of hours emailing can reduce techno-overload. For example, email training that enhanced worker's ability to manage their inbox, deal with poorly written emails and communicate more effectively was found to reduce overload (Dabbish & Kraut, 2006; Soucek & Moser, 2010; Stich et al., 2015). Furthermore, a recent intervention showed that creating technological micro-boundaries between work and non-work roles (e.g., turning off email notifications and implementing out-of-office messages) improved boundary control (Rich et al., 2020). Overall, this suggest that interventions which a) improve participants information processing capabilities to better cope with high email demand and b) strengthen participants ability to create sufficient work-home boundaries will reduce feelings of techno-overload and -invasion.

### 4.1.1.2.    *ICT-related pressures and expectations*

The ability to deploy certain email-specific boundary management strategies may depend on the social norms around work availability that exist within the organisation. For example, high OEEM (table 4.1) are likely to develop in work-environments with flexible, non-enforceable work-home boundaries and are driven by the connectivity behaviour of supervisors and peers. These can lead workers to remain vigilant for incoming work communication during non-work time which limits their ability to adequately attend to home demands, threatens goal achievement in the non-work domain and ultimately creates adverse health and relationship outcomes (Becker et al., 2021).

Additionally, a long-hours culture where frequent work intrusions into home lives have become accepted may be driven by deeply rooted assumptions of the "ideal worker type" who "always puts work first" (Callan, 2007). Thus, in the absence of an explicitly followed email policy that discourages work connectivity beyond ones contracted hours, it is likely that workers feel an expectation to continue monitoring emails to signal that work remains their priority. Callan (2007) argues that for work-life policies to achieve significant culture change, a shift in the construction of this 'ideal worker type' is crucial. Research has shown that certain organisational climates can be improved through climate specific training interventions which improve policy and practice related communication, education and leadership behaviour (Lee et al., 2019).

Thus, a reduction in OEEM may be achieved through policies that set clear boundaries between work and home time and genuine efforts from leaders to value, enact and enforce these (Becker et al., 2021; Belkin et al., 2016; Piszecek, 2017).

### 4.1.1.3. *ICT-based connectivity behaviour*

The theory of planned behaviour (Ajzen, 1991) states that subjective norms (the perceived social pressure to perform or not perform the behaviour", p.188) influence individual's behavioural intentions. Research has shown that injunctive and descriptive norms of out of hours work availability are associated with increased work-to-non-work integration behaviour such as increased time spent on emails (Belkin et al., 2020; Palm et al., 2020). Thus, interventions which create norms favourable of disconnecting from work (e.g., limiting out of hours emailing) may facilitate behavioural intentions which results in reduced time spend monitoring and dealing with emails during non-work time. Social learning theory (Bandura, 1978; Manz & Sims, 1980) states that people tend to imitate the behaviours of other members, which suggests that any new email rules may be more effective if implemented in a group environment.

Additionally, factors that contribute to the time workers spend dealing with ICT during non-work hours are high schedule control (temporal and special control over where and when one works; Ashforth et al., 2000, Golden, 2008) and a high permeability between work-and-home boundaries. That is because these conditions facilitate work-related interruptions in the home-domain and role-blurring activities (boundary-spanning demands), such as work-family multitasking (WFM; Schieman & Young, 2010, Voydanoff, 2005). Permeability refers to "the degree to which a role allows one to be physically located in one role's domain but psychologically and/or behaviourally involved in another role" (Ashforth et al., 2000, p. 474). Since conditions of low work-home boundary permeability are characterised by infrequent multitasking (Clark, 2001) interventions which decrease permeability by helping workers segment work-home domains better (e.g., by reducing work contacts at home) should reduce WFM (Schieman & Young, 2010, Voydanoff, 2005). Taken together, the implementation of email strategies and rules which aim to improve workers abilities to process and manage their emails as well as draw stronger boundaries between work and home domains, should reduce email-related ICT-demands. Thus, the following hypothesis is made

***Hypothesis 1*:** Employees in an experimental group (EG) who are subject to the introduction and integration of new email guidelines, will experience a reduction in ICT-demands of a) techno-overload, b) techno-invasion, c) OEEM, d) email monitoring frequency during nonwork time, e) time spent on emails during nonwork time, and f) WFM, when compared to a wait-list control group (WLCG), where no significant change is expected.

## 4.1.2. Intervention effects on employee strain and performance outcomes

In line with the proposed theoretical model, the reduction in ICT-demands is expected to result in improved individual (home) and organisational (work) outcomes.

### *4.1.2.1. Work-home conflict*
Work-home conflict refers to an incompatibility between contextual work and home demands where one domain (work) requires resource investment (time, attention, energy) which compromises the performance in the other domain (home; Greenhaus & Beutell, 1985; ten Brummelhuis & Bakker, 2012). According to boundary theory (Ashforths et al., 2000), ICT-demands are seen as inter-domain transitions (Matthews et al., 2010) which refer to the frequency in which such resources are shifted cognitively between domains through specific actions (e.g., answering or monitoring emails during non-work time; Dettmers; 2017). Thus, if ICT-demands are high, the permeability between work and home demands is weakened, resources are continuously invested into work during non-work time and conflict arises. In line with this, techno-overload and invasion (Gaudioso et al., 2017), OEEM (Belkin et al., 2020) and connectivity behaviour (Wang et al., 2017) were found to directly increase work-home conflict.

A possible way to reduce work-home conflict could be to increase group segmentation norms (the extent to which the team you work in sees a strong boundary between work and home) as this would enable workers to engage in boundary management tactics which minimise ICT use during non-work time (e.g., removing work emails from their personal phone or not taking work calls or answering emails during vacation; Kossek & Lautsch, 2012) and allow for better separation between work-home domains (Yang et al., 2019). Furthermore, research on the relationship between work-overload, work-home spillover and work-family conflict (Leiter & Durup, 1996) suggests that a reduction in email overload may improve work-home conflict as the improved capability to deal with work emails may prevent an accumulation of stress that spills over into the home domain and further resource depletion. Lastly, the expectation to limit email communication to working

hours and a subsequent reduction in connectivity behaviours would reduce general email traffic during non-work time and inter-domain transition frequency. Thus, reducing work ICT-demands would improve workers ability to achieve their desired level of work-home segmentation and allow adequate resource allocation to the home domain (Yang, et al., 2019).

**Hypothesis 2:** Compared to the WLCG, employees in the EG will show a reduction in WHC.
**Hypotheses 3:** The intervention effect on WHC will be mediated by a reduction in ICT-demands of a) techno-overload, b) techno-invasion, c) OEEM, d) EMF, e) TOE and f) WFM.

### 4.1.2.2. *Psychological detachment*

Psychological detachment is a state of mental disengagement from work during non-work time where individuals refrain from work-related thoughts. This allows those psychophysiological systems activated throughout the workday to return to baseline levels (recovery), making it an important recovery activity workers need to engage in to remain healthy and productive at work (Sonnentag & Fritz, 2007, 2015). Studies show that pressures to monitor emails during non-work time and extended work connectivity through ICT are negatively associated with psychological detachment (Belkin et al., 2020; Cambier et al., 2019). Thus, while ICT-demands are high, work-related thoughts keep coming to mind, leaving individuals unable to effectively unwind and switch off after work.

Teaching workers about the beneficial effects of recovery (including psychological detachment) and segmentation tactics which stop work demands from intruding on their home lives was found to improve psychological detachment, stress and negative affect (Hahn et al., 2011).

**Hypothesis 4**: When compared to a WLCG, employees in the EG will experience increases in psychological detachment.
**Hypotheses 5:** The intervention effect on psychological detachment will be mediated by reductions in ICT-demands of a) techno-overload, b) techno-invasion, c) OEEM d) EMF, e) TOE and f) WFM

### 4.1.2.3. *Burnout*

Burnout can be understood as an individual's affective reaction to constant stressors at work, occurs due to the gradual depletion of an individual's energy resources over time and

has primary symptoms of physical, cognitive and emotional exhaustion (Shirom, 2003; 2009). Burnout is a serious health condition associated with low subjective health, insomnia and musculoskeletal pain (Shirom, 2009), depression and anxiety (Koutsimani et al., 2019) as well as sickness absence and work disability (Bekker et al., 2005). To prevent burnout, it is important that workers get a break from their work demands to recover from effort-expenditure. Otherwise, the constant demand that is placed on cognitive resources and energies can lead to chronic work exhaustion (Meijman & Mulder, 1998; Geurts & Sonnentag, 2006; Shirom & Melamed, 2006).

Studies suggest that the negative impact of high ICT-demands on recovery processes and the continuous depletion of resources contributes to the development of burnout (Santuzzi & Barber, 2018) and highlight the effects of poor boundary control and work availability expectations on WHC, psychological detachment, stress and impaired wellbeing (Derks & Bakker, 2014; Dettmers, 2017). In line with this, all six examined ICT-demands, techno-overload and invasion (Srivastava et al., 2015), OEEM (Belkin et al., 2020; Hu et al., 2019) and connectivity behaviour (Park et al., 2020), were positively associated with burnout symptoms.

Subjective coping appraisal and attitudes towards ICT play an important role in the relationship between high ICT exposure and burnout (Day et al., 2010; Gaudioso et al., 2017; Salanova & Schaufeli, 2000). Research suggests that interventions which provide workers with tactics to improve relevant technological skills (e.g., methods to manage emails in ways which reduce overload) and strategies to better segment work and home domains could improve such coping appraisals through increased self-efficacy, and reduce stress, negative affect and burnout (Beas & Salanova, 2006; Day et al., 2010; Hahn et al., 2011). Additionally, work-life research suggests that the structural and cultural integration of work-life policies and initiatives (e.g., management training to increase supportive work-family behaviours) can mitigate the adverse impact high work demands have on work-family conflict and reduce strain and burnout (Kossek, 2016; Kossek et al., 2011; Moen et al., 2016). Based on this, it is assumed that the current email guidelines intervention will reduce symptoms of burnout (physical, cognitive and emotional exhaustion).

**Hypothesis 6:** When compared to a WLCG, employees in the EG will experience a reduction in burnout.

**Hypotheses 7:** The intervention effect on burnout will be mediated by a reduction in ICT demands of a) techno-overload, b) techno-invasion, c) OEEM d) EMF, e) TOE and f) WFM

### 4.1.2.4.    *Performance*

Technostress (Tarafdar et al., 2015) and, particularly, information and communication overload (Delpechitre et al., 2019; Karr-wisniewski & Lu, 2010) can lead to productivity loss and lower performance. Bounded rationality due to overtaxed information processing capabilities (Eppler & Mengis, 2004) and excessive interruptions which reduce efficiency and increase stress (McFarlane & Latorella, 2002) are said to serve as possible explanations for this (Karr-wisniewski & Lu, 2010). Emails can be particularly problematic as incoming messages interrupt concentration (Jackson et al., 2001),  divert focus to new, additional tasks (Dabbish et al., 2005) and increase mental work-load, all of which adversely impacts productivity (Addas & Pinsonneault, 2018; Mark et al., 2008; Mark et al., 2012; Stich et al., 2018).

Furthermore, ICT-demands can drain personal resources needed by individuals to adequately address demands, which can negatively affect future work performance (ten Brummelhuis & Bakker, 2012). Empirical research confirms this, demonstrating that low recovery from work and work-home interference (Demerouti et al., 2007) and increased levels of exhaustions (Bakker et al., 2004) were associated with reduced concentration and in-role performance.

Providing strategies to improve email management can reduce overload (Soucek & Moser, 2010) and completely removing emails from the workplace can increase task focus and reduce stress (Mark et al., 2012). Although these studies focus on the email use during work and do not examine the absence of emails in relation to aspects such as work-life conflict or recovery, they highlight the positive effects that email training and not being connected to work emails could have on employee well-being and productivity.

**Hypothesis 8:** When compared to a WLCG, employees in the EG will experience an increase in performance.

**Hypotheses 9:** The intervention effect on performance will be mediated by a reduction in ICT demands of a) techno-overload, b) techno-invasion, c) OEEM d) EMF, e) TOE and f) WFM.

Considering the double-edged nature of workplace ICT, I may be particularly valuable to explore the relationship between ICT and performance in more detail (Stich et al., 2018, Siegl et al., 2023a).  Considering the theoretical (Demerouti et al., 2001) and empirical

link (Bakker et al., 2004; Taris, 2006) between high work demands, burnout and performance it can be assumed that reducing certain job demands will lead to lower levels of burnout and subsequently better performance (Bakker & Demerouti, 2007). Research has demonstrated a positive association between e-mail availability demands and burnout symptoms such as exhaustion (Belkin et al., 2020; Dettmers, 2017) and a negative relationship between emotional exhaustion to performance (Bakker, et al., 2004; Fritz & Sonnentag, 2005). Thus, it is proposed that a reduction in ICT-demands will improve performance through a reduction in burnout symptoms.

*Hypothesis 10*: A reduction in burnout symptoms will mediate the relationship between changes in ICT-demands and performance.

## 4.2. Methodology

### 4.2.1. Research design

The quasi-experimental design of the study consisted of multiple steps across a 14-month period[4], with the 6-week intervention and data collection phase taking place between November and December 2020 (Figure 4.3). This study involved managers and their teams who were allocated to either the experimental condition (intervention) or a wait-list control group (WLCG). Considering potential attrition, it was aimed to recruit a minimum of 200 participants per condition to satisfy the sample-size requirements (Faul et al., 2009). The group allocation was based on the order in which managers booked their consultation meeting and confirmed participation of their team. Once all spaces in the experimental group were filled, the remaining teams were given January 2021 implementation dates and formed the WLCG.

Quantitative data was collected four times in two-week intervals in both groups: 1) Two weeks prior to the intervention 2) directly after the implementation 3) two weeks - and 4) four weeks post intervention. These time periods were chosen to capture change in outcomes associated with positive and negative affective states which can remain stable for a

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[4] There was a 6-month delay in the implementation of the intervention (initially planned for May 2020) due to the Covid-19 pandemic which commenced in March 2020. Due to the circumstances, the implementation method was changed from in-person to online. Once the operations department regained the capacity to support the intervention (September 2020), a final SLT meeting was held to approve the adjustments.

two-week period (Watson & Levin-Aspenson, 2018). Collecting data at multiple time-points across both conditions simultaneously reduces the bias of immediate intervention effects (e.g. risk of Hawthorne effect/social desirability bias) and allows for comparisons between the waves of change of the experimental group (in which change is expected) and the WLCG (where no change was expected), thus strengthening any causal inferences that can be made about the effectiveness of the intervention (Holman et al., 2010). The intervention follow-up period of four weeks was chosen as this allowed assessments at multiple timepoints spaced two weeks apart.  Assessment over a longer time was not feasible and may have influenced the reliability of the data due to the different working patterns over the Christmas holidays. For example, email volume may not be representative of a typical working week and attrition rates are likely to spike as many participants will not be working during this period. To further reduce the chance of bias, only managers were fully briefed on the specific intervention details at Time 1. While all participating teams and departments were comparable in respect of composition, structure, role responsibilities and qualifications, each participating unit was based at a different geographical location. As the main proportion of their communication occurs within their team, the court personnel and public clients, it was unlikely that change in the experimental group would cause spill-over effects in the control group.
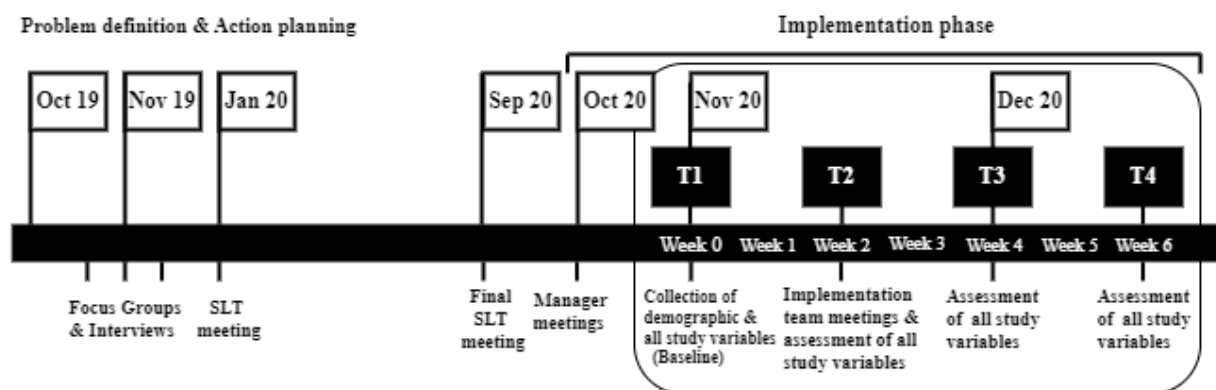


**Figure 4.3**. Timeline of the Intervention.

### 4.2.2. Participants

This study was conducted in a large UK public sector organisation operating within the legal sector. A total of 28 teams comprising of 412 professional employees (managers and staff)

volunteered to take part in this study. The experimental group (EG) consisted of 17 teams ($N$ = 212, 51.5%) and the WLCG of 11 teams ($N$ = 200, 48.5%). Out of the 412 possible respondents, 284 completed the survey at Time 1 (68.9% response rate) and 176 completed all four surveys (42.7 % response rate), resulting in a 38 per cent attrition rate from Time 1 to Time 4 (see Appendix C, 4 for the attrition analysis). The longitudinal sample (N=176) comprised of 139 women (79%), 36 men and 1 participant who identified as third gender, with a mean age of 45.19 years (SD=11.61). Demographic data can be seen in Table 4.3.

**Table 4.3**. Demographic data by group

| Demographic Data | Experimental ($N = 101$) | Wait-List Control ($N = 75$) |
|---|---|---|
| Gender | | |
|    Male | 21 (20.8%) | 15 (20%) |
|    Female | 80 (79.2%) | 59 (78.7%) |
|    3rd Gender | 0 | 1 (1.3%) |
| Age | Mean 45.6 years ($SD = 11.5$) | Mean 44.7 years ($SD = 11.7$) |
|    18 - 25 | 6 (5.9%) | 9 (12%) |
|    26 - 32 | 12 (11.9%) | 5 (6.7%) |
|    33 - 40 | 12 (11.9%) | 10 (13.3%) |
|    41 - 50 | 27 (26.7%) | 24 (32%) |
|    51 - 60 | 40 (39.6%) | 24 (32%) |
|    61 + | 4 (4%) | 3 (4%) |
| Management responsibilities | | |
|    Yes | 41 (40.6%) | 35 (46.7%) |
|    No | 60 (59.4%) | 40 (53.3%) |
| Ethnicity | | |
|    White (UK, Irish, other White) | 91 (90.1%) | 64 (85.3%) |
|    Mixed/multiple ethnic groups | 3 (3%) | 2 (2.6%) |
|    Asian/Asian British | 6 (6%) | 7 (9.3%) |
|    Black/African/Caribbean/Black British | 1 (1%) | 2 (2.6%) |

### 4.2.3. Intervention

Given the lack of intervention research relating to email demands, a participatory multi-step design approach was chosen to minimise the risk of implementing change that has unexpected adverse outcomes. Taking a bottom-up approach and ensuring the intervention is tailored to the needs of the organisation can enhance employee participation in- and commitment towards the intervention, thus facilitating its effectiveness. Therefore, the following three steps were followed in designing the intervention: problem definition (assessment of key problems and risks), action planning (development of solutions, together

with employees) and implementation (implementation of the discussed and approved intervention; Holman & Axtell, 2016; Nielsen et al., 2010).

### 4.2.3.1. *Problem definition and action planning*

During the problem definition and action planning stages five 90-minute focus groups and two 30-minute one-to-one interview were conducted with a small subsample of participants (N = 22), across the different job roles and seniority levels of the organisation. During the focus groups, workers shared insights into email-related problems they faced and highlighted which solutions would be well received, which helped inform the design of the email guidelines. To stimulate discussions, the mind mapping exercise 'Ketso' (https://ketso.com/how-to/uses-applications-of-ketso/) was used. The final version of the guidelines included 12 email rules (Appendix C, 1), which addressed out-of-hours emailing (e.g., limiting email traffic to working hours and days only) and the composure and management of emails during working hours (e.g., think before you send, using a standardised format for subject lines, outlook toolkit).

### 4.2.3.2. *Implementation*

Gaining management support and participation is one of the key facilitators of intervention failure or success, and particularly important for the cultural integration of the guidelines (Kompier & Cooper, 1999; Le Blanc et al., 2007; Kossek, 2016). Therefore, prior to the implementation, the researcher met with all managers via Microsoft Teams to discuss their team's readiness for this intervention, explain the rules in detail, gain their commitment and highlight the importance of role-modelling behaviours and support.

Then, a 1-hour intervention implementation meeting was scheduled with each participating team and their managers via Microsoft Teams. All implementation meetings were scheduled during existing team meetings to ensure the intervention did not cause additional workload for the participants. The meeting consisted of three parts: a) an educational part to raise awareness of the negative impact of email related stressors and to signal the importance of behaviour and culture change, b) the detailed explanation of all email rules which participants were asked to adhere to as strictly as possible and c) a Q&A session for those who had questions or wanted to use this time to discuss any relevant issues with their team.

This implementation method cannot only enhance team member's commitment to participate but also foster positive attitudes towards the intervention (LeBlanc et al., 2007).

Supplemental materials were available at the organisations intranet and included the self-help tool for inbox management and an anonymised 'implementation meeting' recording, for any absent team members.

### 4.2.4. Measures

Demographic variables were assessed once at T1. All longitudinal measures (assessed at T1, T2 T3, and T4) are described below. Unless specifically noted, all responses were measured on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). A full list of survey items can be seen in Appendix B, 2.

*Technostress creators*. Techno-overload and techno-invasion were assessed with the 5-item techno-overload and the 4-item techno-invasion subscales of the technostress creators measure (Ragu-Nathan et al., 2008). The instructions explained that "this technology" referred to work-related emails. Example items are *"I am forced by this technology to do more work than I can handle"* (techno-overload) and "*I feel my personal life is being invaded by this technology*" (techno-invasion). Both scales had high internal reliabilities with Cronbach α's of .87.

*Organisational Expectations for Email Monitoring* were measured using Becker et al.'s (2021) three-item OEEM scale which showed a high internal reliability (α = .85). All items were measured on a 5-point Likert scale and comprised of statements such as "people who are important to me at work expect me to respond to electronic communication away from work."

*Connectivity behaviour.* EMF was measured on a 5-point scale, ranging from 1 (never) to 5 (every few minutes which asked participants to indicate the frequency with which they checked work-related communication during non-worktime (Becker et al, 2021). TOE was assessed by asking participants to indicate the average amount of time they spent dealing with work-related communication during non-work time on a scale of 1 (less than 1 hour) to 4 (more than 3 hours) each day over the past two weeks (Becker et al, 2021). Non-work time was defined as any time beyond ones contracted daily working hours. WFM was assessed by a single-item measure (Schieman & Young, 2010), asking participants how frequently they tried to complete work and home tasks at the same time while being at home, ranging from 1 (never) to 4 (frequently).

*Psychological detachment* was measured using the 4-item psychological detachment subscale from Sonnentag and Fritz's (2007) Recovery Experience Questionnaire. Participants were asked to indicate the extent to which they agreed with statements referring to their free evening, such as "I don't think about work at all", on a scale of 1 (do not agree at all) to 5 (I fully agree). Cronbach α was .85.

*Burnout* was assessed using the Shirom-Melamed Burnout Measure (Melamed et al., 1992; Shirom, 1989), which comprises 14 items across three sub-dimensions: 1) physical fatigue (6-items, e.g. "I feel physically drained"; $\alpha = .95$), 2) cognitive weariness (5 items, e.g., "my thinking process is slow; $\alpha = 96$), and 3) emotional exhaustion (3 items, e.g. "I feel I am not capable of investing emotionally in co-workers and customers"; $\alpha = .94$). . All items were measured on a 7-point Likert Scale from, 1 (*never or almost never*) to 7 (*always or almost always*). This measure was chosen due to its strong conceptual grounding in the COR theory, explaining workers feelings of physical, cognitive and emotional exhaustion as a result of the continuous depletion of their energy coping resources through chronic exposure to occupational stress (Shirom & Melamed, 2006).

*Work-home conflict* was measured using Kreiner's (2006) adapted version of Netemeyer et al., (1996)'s 5-item work-family conflict scale. All items were measured on a five-point Likert scale and included statements such as "the amount of time my job takes up makes it difficult to fulfil home responsibilities". The Cronbach α was .93.

*Performance.* Subjective performance was assessed using one question from the World Health Organization Work Performance Questionnaire (HPQ; Kessler et al., 2003). Participants were asked to score their job performance from 0 (the worst job performance) to 10 (best performance) for the past 28 days.

### 4.2.5. Statistical analysis

SPSS version 25 was used to calculate descriptive statistics, correlation coefficients and internal reliability scores, to test the multivariate assumptions and to conduct an attrition analysis (Appendix B, 2a-d). Mplus version 7.4 (Muthen & Muthen, 2015) was used to test longitudinal measurement invariance (Appendix C, 2d), treatment and mediation effects.

Latent growth curve analysis was conducted to examine the proposed hypotheses as it allows the estimation of inter – and intra-individual variability and patterns of change over time (Curran et al., 2010). Additionally, this method bases its results on latent variables

which significantly reduces potential measurement error (McArdle, 2009). To examine the treatment effects (H1,2,4,6,8) piecewise growth curves with random intercepts, fixed slopes for the first piece (T1-T2) and random slopes for the second piece (T2-T4), which was predicted by group membership (experimental vs. control), were fitted. A breakpoint was set at T2 was chosen as change was expected to occur past this time point but not before. Demographic variables were controlled for and covariances within constructs between intercepts and slopes were examined to further understand the variable impact of the intervention (see supplemental materials 2).

To test for mediation (H 3,5,7,9,10), parallel processes models were fitted, where group membership predicts the second slope and regression paths between construct slopes are specified. This will provide insightful answers to the mechanisms of change during this intervention as it relates the growth in one variable to the growth in another (Lennefer et al., 2020). Indirect effects for the mediators were evaluated using bias corrected 95% confidence intervals. If the indirect path is significant (i.e., CIs do not cross 0 or 1), mediation has been confirmed. To evaluate the goodness-of-fit for each model the following cut-off criteria was used: Comparative Fit Index (CFI) > .90; Root Mean Square Error of Approximation (RMSEA) > .06; Standardised Root Mean Square Residual (SRMR) > .08 (Hu & Bentler 1998).

A summary of the fit indices for all models can be seen in Table 3.1 (Appendix C, 3). Unstandardised ($B$) and standardised ($\beta$) regression coefficients will be provided in a table and throughout the text respectively to interpret change and magnitude of effects. Pseudo $r^2$ will be calculated via the reduction in residual error between models to indicate the change in variance explained for relevant outcome variables.

## 4.3.    Results

An overview of all significant paths predicted in  hypotheses 1 to 9 can be seen in Figure 4.4.
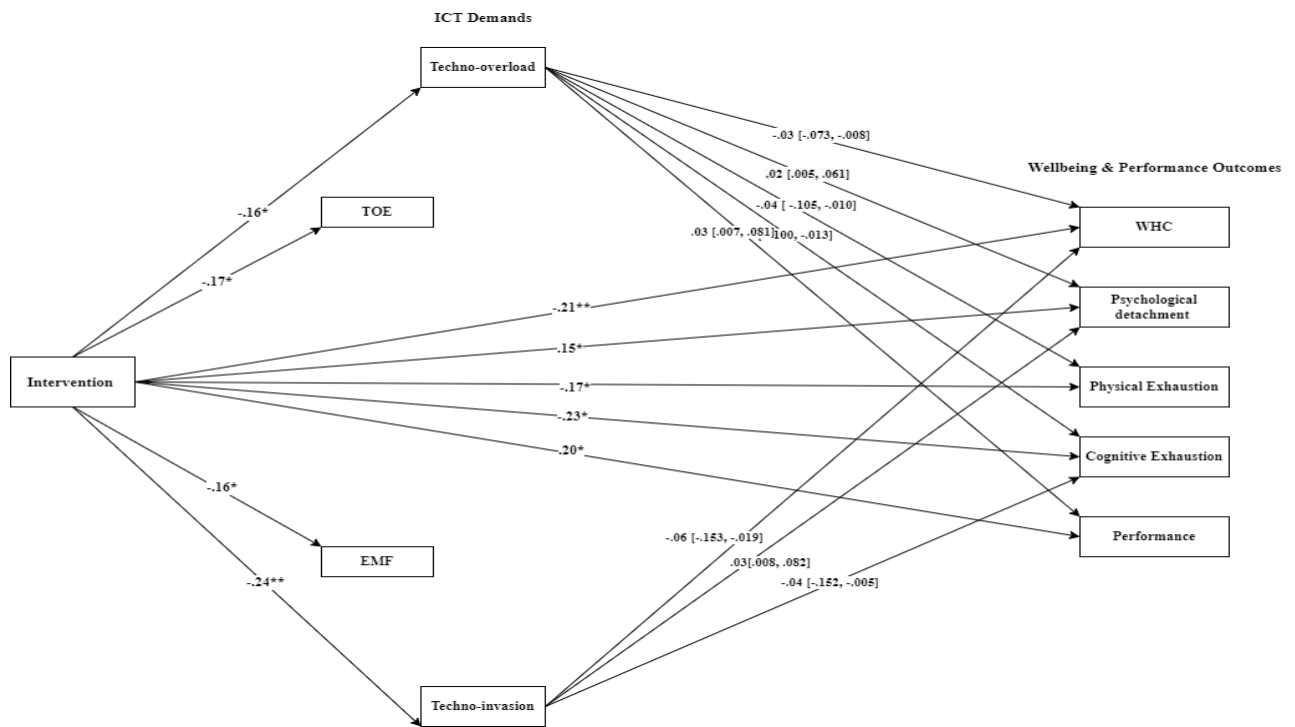
**Figure 4.4** Significant intervention effects on ICT-demands (H1) and Employee Wellbeing and Performance Outcomes (H 2, 4, 6, 8) as well as mediating effects of ICT-demands (H 3, 5, 7, 9).

### 4.3.1. Intervention effects on ICT demands

Regarding Hypothesis 1, the latent growth curve model (LGCM) testing the effects of group allocation on change in ICT-demands (Model 3) showed good fit for the data ($x^2$ (1128, N= 176) = 1803.45, $p < .001$; CFI = .92; RMSEA = .06; SRMR = .04). Significant negative effects of group allocation on techno-overload ($\beta = -.16$, $p < .05$), techno-invasion ($\beta = -.24$, $p < .01$), EMF ($\beta = -.16$, $p < .05$) and TOE ($\beta = -.17$, $p < .05$), were found. These explained 3, 5, 3 and 3 per cent of the variance in slopes respectively and were of medium size. Thus, being part of the EG, instead of the WLCG, resulted in significant reductions in techno-overload, techno-invasion and email monitoring frequency and time spent on emails which supports Hypotheses 1a, b and d and e.

Although all slope effects were negative when predicted by group, suggesting a greater decline in the experimental group, no further significant treatment effects for OEEM (H1c) and WFM (H1f) were found. Table 4.4 shows a summary of all intervention effects and visualisations of the significant effects on ICT demands are shown in Figures 4.5a-d.

**Table 4.4.** Unstandardised Model Results for the Intervention Effects on ICT Demands (H1) and Employee Wellbeing and Performance Outcomes (H3)

| | Model 1 | | | | Model 3 | | | |
|---|---|---|---|---|---|---|---|---|
| | Intercept | | Slope | | Group on Slope | | Intercept with Slope | |
| **Variables** | *B* | SE | *B* | SE | *B* | SE | *B* | SE |
| **Hypothesis 1** | | | | | | | | |
| *ICT Demands* | | | | | | | | |
| EMF | 1.81** | .07 | .06** | .02 | **-.08*** | .04 | -.10** | .03 |
| TOE | 1.72** | .05 | .07* | .03 | -.10* | .05 | -.13** | .04 |
| WFM | 1.98** | .07 | .12* | .06 | -.08 | .06 | -.19* | .04 |
| Techno-overload | 3.41** | .08 | .12** | .02 | **-.11*** | .04 | -.07* | .03 |
| Techno-invasion | 2.15** | .08 | .09** | .02 | **-.14*** | .04 | -.08* | .03 |
| OEEM | 1.88** | .07 | .04 | .02 | -.06 | .05 | - | - |
| | | | | | | | | |
| **Hypothesis 3** | | | | | | | | |
| *Employee Wellbeing and Performance Outcomes* | | | | | | | | |
| Psych Detachment | 3.18** | .08 | .10** | .02 | **.10*** | .05 | -.11** | .03 |
| Physical exhaustion | 4.05** | .12 | .16** | .04 | **-.17*** | .07 | -.10 | .06 |
| Cognitive Weariness | 3.35** | .12 | .20** | .04 | **-.23*** | .07 | -.21** | .07 |
| Emotional Exhaustion | 2.12** | .10 | .14* | .06 | -.07 | .08 | -.06 | .07 |
| Work Home Conflict | 2.27** | .09 | .10** | .02 | **-.13*** | .05 | -.09** | .03 |
| Performance | 7.79** | .11 | .12* | .05 | **.13*** | .06 | -.09 | .06 |

**Note:** Note: N= 176, EMF = Email Monitoring Frequency out of hours; TOE = Time on Emails out of hours; WFM = Work-Family Multitasking; OEEM = Organisational Expectations for Email Monitoring. Full results for model 2 (demographic variables can be seen in Table X in Appendix C, 4, supporting documents 2)
* $p < .05$, ** $p < .01$.
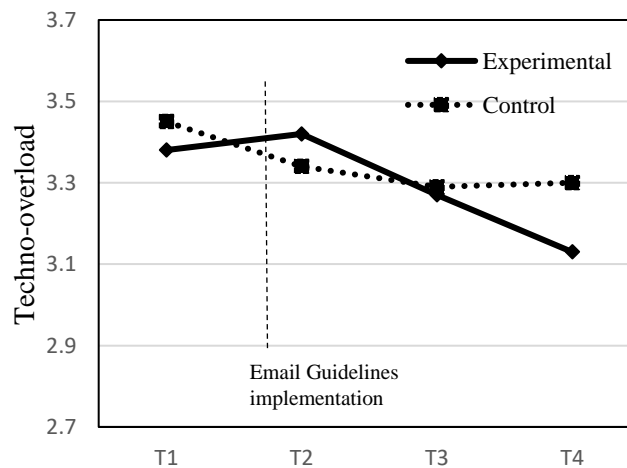


**Figure 4.5a**. Change in mean techno-overload scores
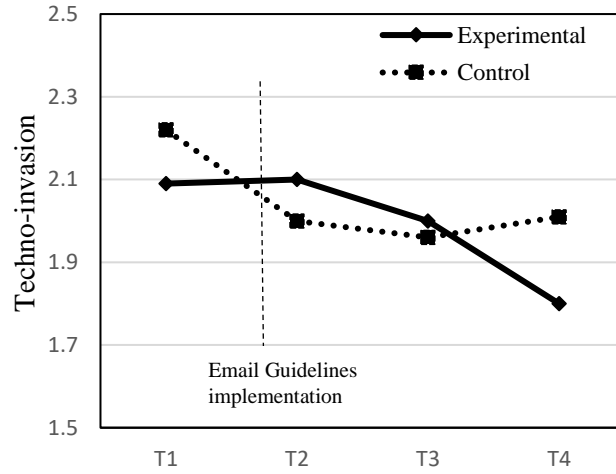
**Figure 4.5b**. Change in mean techno-invasion scores
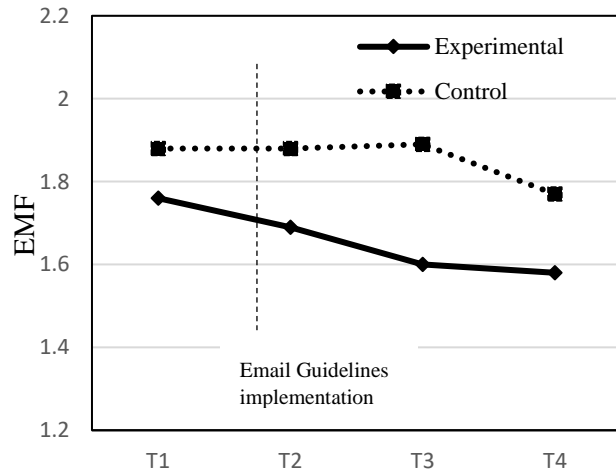


**Figure 4.5c**. Change in mean email monitoring frequency during nonwork time
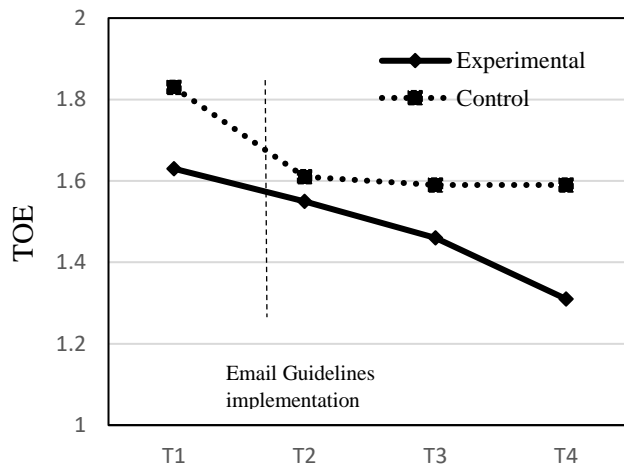


**Figure 4.5d**. Change in mean time spent on emails during nonwork time

### 4.3.2. Intervention effects and mediating effects for employee wellbeing and performance outcomes

The LGCM testing the effect of group allocation on wellbeing and performance outcomes showed good model fit ($x^2$ (1128, N= 176) = 1803.45, $p < .001$; CFI = .92; RMSEA = .06; SRMR = .04). As hypotheses 1 revealed no significant treatment effects for OEEM and WMF no mediation analyses were carried out for these ICT-demands. The mediation models for techno-overload, techno-invasion, EMF, and TOE all showed good fit for the data (Models 4-22, Appendix 3) and a summary of effects can be seen in Table 4.5

*Work-home Conflict*

In support of hypothesis 2, the analysis revealed a significant negative effect of group allocation on WHC ($\beta = -.21$ $p < .01$), indicating that participants in the EG experienced significantly larger improvements in WHC over time than those in the WLCG (Figure 4.6). The effect was of medium size and explained 4 per cent of the variance in the slope of WHC. Hypotheses 3 further analysed if the improvements in ICT-demands mediated the intervention effect on WHC. The results revealed significant indirect effects via techno- and techno-invasion. However, no significant indirect effects for EMF and TOE were found. Thus, the change in ICT-demands of techno-overload and invasion mediated the effects of the intervention on WHC providing support for hypotheses 3a and b while hypotheses 3 c, d, e and f were not supported.

*Psychological detachment*

In support of hypothesis 4, a significant positive effect of group allocation on the slope of psychological detachment was found ($\beta = .15$, $p < .05$), indicating a larger increase in psychological detachment in the EG over time than the WLCG (Figure 4.7). The effect was of medium size and explained 2 per cent of the slope variance. Regarding hypothesis 5, the analysis revealed significant indirect effects through techno-overload and techno-invasion. Again, no significant indirect effects for EMF and TOE were found. Thus, change in techno-overload and invasion mediated the effect of the intervention on psychological detachment and hypotheses 4a and b were supported, while hypotheses 5c, d, e and f were not.

**Table 5.** The Mediating Effect of ICT Demands in the Relationship between Intervention Participation and Employee Wellbeing and Performance Outcomes

| | Wellbeing and Performance Outcomes | | | | | | | | | |
| | WHC | | Psychological Detachment | | Physical Exhaustion | | Cognitive Exhaustion | | Performance | |
| Effects | Estimate (SD) | 95% CI | Estimate (SD) | 95% CI | Estimate (SD) | 95% CI | Estimate (SD) | 95% CI | Estimate (SD) | 95% CI |
|---|---|---|---|---|---|---|---|---|---|---|
| **Techno-overload (M)** | | | | | | | | | | |
| Total effect | | | | | | | | | | |
| Group (X) → Outcome (Y) | -.12* (.05) | [-.206, -.050] | .08 (.05) | [-.001, .166] | -.15* (.07) | [-.270, -.033] | -.19* (.08) | [-.321, -.070] | .13 (.07) | [.015, .247] |
| Total indirect effects | | | | | | | | | | |
| (X) → (M) | -.10* (.05) | [-.179, -.023] | -.10* (.05) | [-.172, -.015] | -.10* (.05) | [-.171, -.016] | -.10* (.05) | [-.175, -.019] | -.10* (.05) | [-.175, -.019] |
| (M) → (Y) | .28** (.11) | [.161, .509] | -.24* (.11) | [-.459, -.122] | .41*(.17) | [.205, .763] | .42* (.16) | [.233, .746] | -.29*(.14) | [-.568, -.121] |
| (X) → (M) → (Y) | **-.03* (.02)** | **[-.073, -.008]** | **.02 (.02)** | **[.005, .061]** | **-.04 (.03)** | **[-.105, -.010]** | **-.04 (.03)** | **[-.100, -.013]** | **.03 (.02)** | **[.007, .081]** |
| **Techno-invasion (M)** | | | | | | | | | | |
| Total effect | | | | | | | | | | |
| Group (X) → Outcome (Y) | -.12* (.05) | [-.204, -.046] | .09 (.05) | [.003, .167] | -.15 (.07) | [-.264, -.027] | -.19* (.08) | [-.319, -.068] | .13 (.07) | [.013, .243] |
| Total indirect effects | | | | | | | | | | |
| (X) → (M) | -.12** (.05) | [-.209, -.050] | -.10 (.05) | [-.188, -.027] | -.11* (.05) | [-.196, -.036] | -.11* (.05) | [-.195, -.033] | -.08 (.05) | [-.170, .004] |
| (M) → (Y) | .47*(.11) | [.249, .945] | -.30 (.18) | [-.578, -.138] | .20 (.29) | [-.045, .656] | .35* (.15) | [.066, 1.044] | -.97 (1.82) | [-12.07, -.148] |
| (X) → (M) → (Y) | **-.06* (.03)** | **[-.153, -.019]** | **.03 (.02)** | **[.008, .082]** | -.02 (.03) | [-.097, .001] | **-.04 (.05)** | **[-.152, -.005]** | .08 (.20) | [.002, 1.025] |
| **EMF (M)** | | | | | | | | | | |
| Total effect | | | | | | | | | | |
| Group (X) → Outcome (Y) | -.12 (.05) | [-.194, -.041] | .07 (.05) | [-.020, .151] | -.15 (.07) | [-.264, -.026] | -.20 (.08) | [-.327, -.078] | .13(.07) | [.016, .246] |
| Total indirect effects | | | | | | | | | | |
| (X) → (M) | -.07 (.04) | [-.147, -.008] | -.05 (.04) | [-.133, .009] | -.06 (.04) | [-.130, .007] | -.06 (.04) | [-.132, .007] | -.06 (.04) | [-.133, .005] |
| (M) → (Y) | .25 (.17) | [-.047, .969] | -.35 (.66) | [-1.372, .022] | .18 (.52) | [-.337, .750] | .35 (.61) | [-.072, 1.175] | -.57 (.76) | [-2.00, -.171] |
| (X) → (M) → (Y) | -.02 (.04) | [-.114, .001] | .02 (.05) | [-.002, .134] | -.01(.03) | [-.092, .006] | -.02 (.05) | [-.127, .002] | .03 (.06) | [.000, .181] |
| **TOE (M)** | | | | | | | | | | |
| Total effect | | | | | | | | | | |
| Group (X) → Outcome (Y) | -.11* (.05) | [-.188, -.036] | .08 (.05) | [-.013, .159] | -.14 (.07) | [.-.258, -.022] | -.19 (.08) | [-.321, -.071] | .13 (.07) | [.015, 245] |
| Total indirect effects | | | | | | | | | | |
| (X) → (M) | -.11* (06) | [-.206, -.027] | -.09 (.06) | [-.188, -.007] | -.10 (.05) | [-.191, -.014} | -.10 (.05) | [-.192, -.014] | -.10 (.05) | [-.191, -.013] |
| (M) → (Y) | -.01 (.52) | [-.616, .308] | -.16 (.53) | [-.817, .093] | -.02 (.66) | [-.649, .460] | -.02 (.75) | [-.640, .457] | -.22 (.76) | [-1.20, 0.132] |
| (X) → (M) →(Y) | .00 (.06) | [-.036, .077] | .02 (.06) | [-.004, .124] | .00 (.07) | [-.041, .081] | .00 (.08) | [-.040, .076] | .02 (.09) | [-.006, .179] |

Note: Note: N= 176, EMF = Email Monitoring Frequency out of hours; TOE = Time on Emails out of hours, * $p < .05$, ** $p < .01$

*Burnout*

In support of hypotheses 6, significant negative effects for group allocation on the slopes of two out of three burnout dimensions were found. Specifically, in comparison to the WLCG, being allocated to the EG resulted in significantly greater reductions in physical exhaustion ($\beta = -.17$, $p < .05$, figure 4.8) and cognitive exhaustion ($\beta = -.23$, $p < .05$) (Figure 4. 9) but not emotional exhaustion ($p > .05$). The results further revealed significant indirect (intervention) effects for physical exhaustion via techno-overload and for cognitive exhaustion via techno-overload and techno-invasion were found. Thus, support for hypotheses 7a and b was found, demonstrating that improvements in techno-overload and invasion mediate the effect of the intervention on burnout (physical and cognitive exhaustion). Hypotheses 7c, d, e and f were not supported.

*Performance*

In support of hypotheses 8, significant positive effects for group allocation on the slope of performance was found ($\beta = .20$, $p < .05$), indicating that there were significantly larger improvements in subjectively self-rated performance over time in the EG when compared to the WLCG (Figure 4.10). Regarding hypotheses 9, the analyses revealed significant indirect effects through techno-overload but not through techno-invasion, EMF or TOE. Thus, in support of hypotheses 9a the effect of the intervention on subjective performance was mediated by changes in techno-overload. No support for the other mediating hypotheses was found.
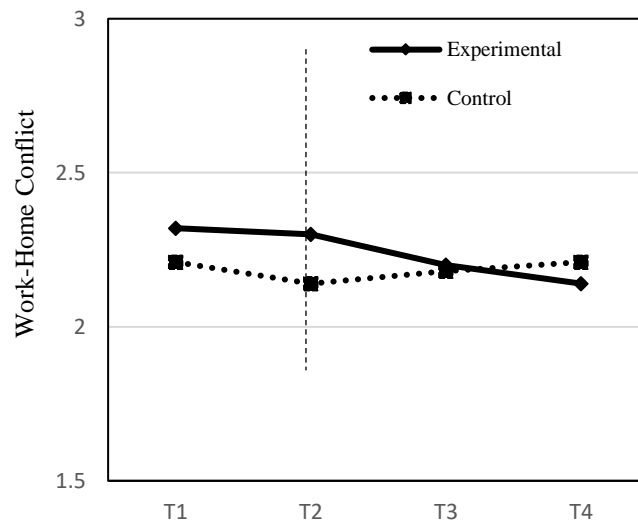


**Figure 4.6.** Change in mean work-home conflict levels
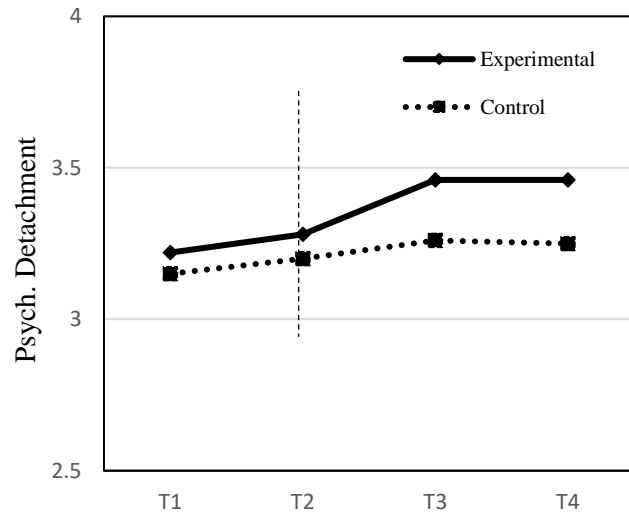
**Figure 4.7**. Change in Psychological detachment levels
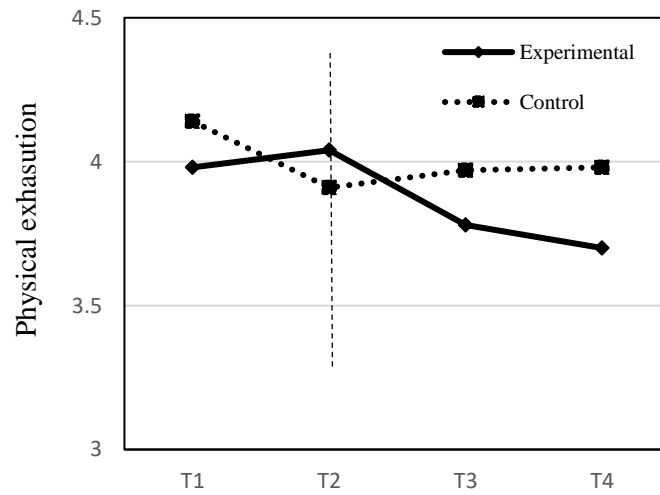


**Figure 4.8**. Change in mean physical exhaustion levels
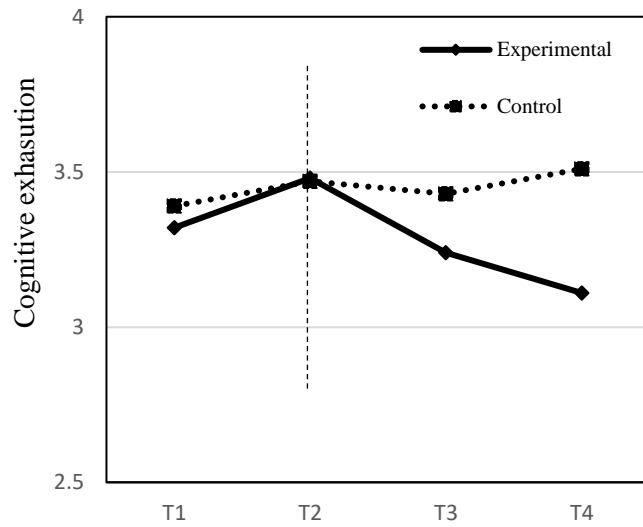
**Figure 4.9**. Change in mean cognitive exhaustion levels
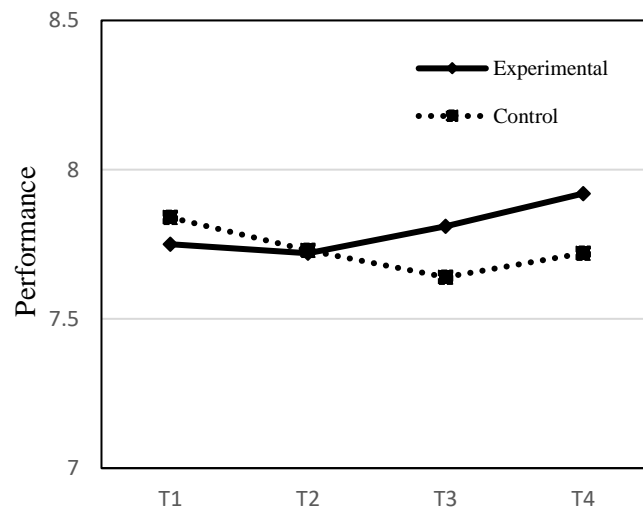


**Figure 4.10.** Change in mean performance scores

Lastly, regarding hypothesis 10 it was tested if a change in burnout symptoms mediated the negative effect of ICT-demands on performance. Based on the current results, ICT-demands of techno-overload, techno-invasion, email monitoring frequency and time spent on email during nonwork time were considered as independent variables and physical and cognitive exhaustion were examined as mediators. Significant indirect effects for techno-overload on performance through physical and cognitive exhaustion were found, suggesting

that the negative effect of techno-overload on performance is mediated by a decrease in burnout symptoms, thus supporting hypothesis 10a. No further significant indirect effects were detected, leaving hypothesis 10 b-f not supported. Results can be seen in Table 4.5 and Figure 11.



total direct: -.31 [ -.654, -.118]
total indirect: -.11 [-.783, -.008]

Physical Exhaustion

.41 [.204, .769]                                    -.28 [-1.563, -.023]

Techno-overload          direct: -.19 [ -.59, .08]          Performance
                         direct: -.17 [ -.50, .01]

.46 [ .264, .792]                                   -.26 [ -1.130, -.086]

Cognitive Exhaustion

total indirect: -.12 [ -.575, -.033]
total direct : -.29 [ -.598, -.116]
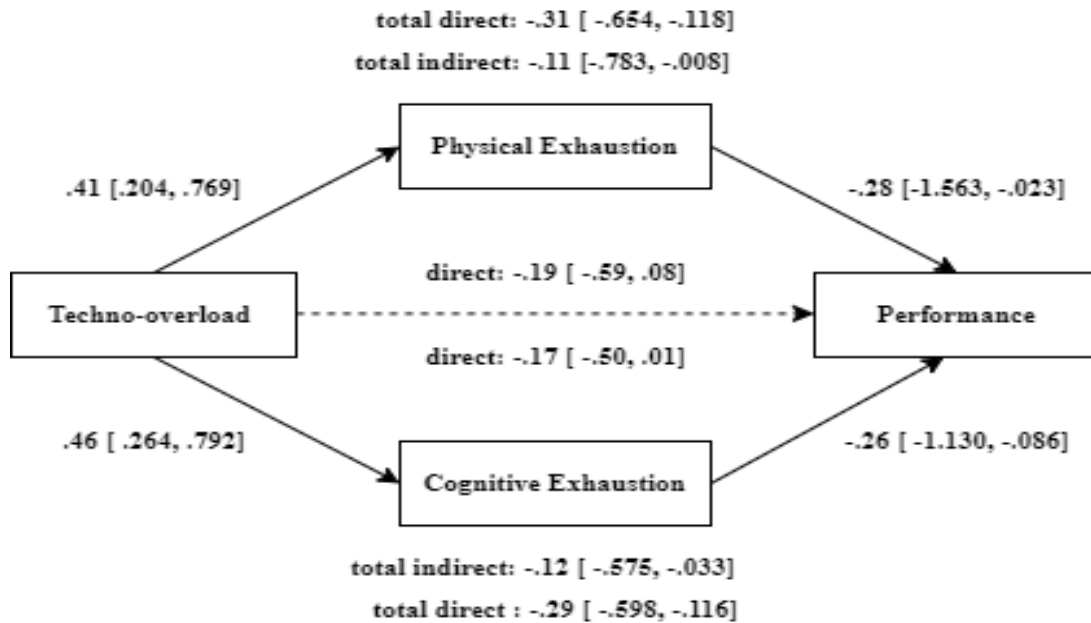
**Figure 4.11.** The mediating effects of physical and cognitive exhaustion in the relationship between ICT-demands and Performance (H10).

## 4.4.   Discussion

The current study aimed to address the lack of rigorous intervention research in the field of work-related ICT, constant connectivity to work and employee health and wellbeing, by conducting a quasi-experimental intervention to examine the impact of new email guidelines on perceived ICT-demands as well as employee wellbeing and performance outcomes.

Consistent with hypotheses 1, the results demonstrated that participants allocated to the EG experienced a significantly larger decrease in perceived ICT-demands than the participants in the WLCG.  This demonstrates that, the intervention was effective in reducing feelings of techno-overload and techno-invasion as well as the frequency with which participants monitored their emails and the overall time spent on emails outside of working hours. Although OEEM and WFM significantly reduced from T1 to T4 in the EG, no

treatment effects were confirmed. Nevertheless, the present results clearly indicate that the implementation of clear email guidelines can lead employees to experience less email-related technostress and to less engagement with emails during non-work time, thus making it an effective method to reduce ICT-demands.

Furthermore, the results showed that participants in the EG experienced significantly greater improvements in WHC, psychological detachment, physical exhaustion and cognitive exhaustion than participants WLCG, confirming Hypotheses 2, 4, and 6. Additional analyses tested whether the reductions in ICT-demands mediated these intervention effects (H 3, 5 & 7). The results showed that reductions in techno-overload alone mediated the effects on physical exhaustion and that reductions in both, techno-overload and techno-invasion, mediated the positive treatment effects on WHC, psychological detachment and cognitive exhaustion. Thus, pinpointing the reduction in techno-stressors as an important mechanism of change in the improvement of employee wellbeing outcomes.

In line with the applied theoretical framework, the conducted analysis allowed us to more closely capture processes associated with gain spirals. Specifically, the use of latent growth curves and parallel process models allowed for the demonstration of how the growth in one variable is related to the growth in another variable (Lennefer et al., 2020). Specifically, we tested whether the techno-stressor slopes/growth curves (modelled as change over time 2,3 and 4) predict the wellbeing and performance slopes/ growth curves (modelled as change over time 2, 3 and 4). This demonstrated that the negative growth in techno-stressors facilitated the positive growth in psychological detachment and performance as well as negative growth in work-home conflict and burnout. A negative growth in poor wellbeing indicators such as the reduction in exhaustion, can reversely indicate a gain in positive wellbeing. Thus, demonstrating how the absence of resource draining demands (i.e., techno stressors) that conflict with work-home processes, facilitate recovery (i.e., improved psychological detachment) and positive gain spirals in wellbeing and performance. Contrary to techno-stressors, the reduction in connectivity behaviour (email monitoring frequency and time spent on emails), did not mediated the intervention effects. Techno-stressors may behave differently to these two demands as these indicate workers situational appraisals of the workload and pressures associated with emails rather than ICT use per se. In line with the assumptions of the transactional model of stress (Lazarus & Folkman 19), situational appraisals may present a more focal driving force for negative wellbeing outcomes. It is possible, that when employees no longer appraise emails as a stressor, the engagement with emails no longer functions as a demand that triggers a stress response. The

observed differences between these stressors and demands is consistent with research showing that connectivity pressure can lead to adverse outcomes independent of subsequent ICT use (Becker et al., 2021; Dettmers et al., 2016; Thörel et al., 2022) and by studies showing that workers with a tendency to use ICT as a resource for work-life integration achieve do not suffer from adverse wellbeing outcomes (Derks et al., 2015; Kossek & Lautsch et al., 2012; Piszczek, 2017; Yeh et al., 2012).

These findings are in line with previous research showing that feelings of overload related to the pace and volume of ICT communication, as well as pressures for constant work-connectivity through ICT, conflict with important recovery processes (e.g., Belkin et al., 2016; Cambier et al., 2019) increase levels WHC (e.g., Gaudioso et al., 2017) and contribute to the development of burnout (e.g., Srivastava et al., 2015). Ultimately, this provides support for the suggestions of prior scholars to implement email policies to mitigate this adverse impact of workplace ICT (Becker et al., 2021; Belkin et al., 2016; Piszcek, 2017) and shows that policies which specifically target sources of email related techno-overload and invasion may be particularly beneficial.

Finally, the effect of the intervention on employee performance was examined (H8) and a significant treatment effect was found, highlighting a greater increase in performance ratings for those who worked under the new email guidelines compared to those who continued 'work as usual'. When examining underlaying mechanisms for this, it was found the treatment effect was mediated by a reduction in techno-overload (H9) and that reductions in burnout symptoms (physical and cognitive exhaustion) mediated the relationship between techno-overload and performance (H10).

This highlights that the current intervention can not only improve short term productivity implications, for example, caused by interruptions, work intensification and role stress (Siegl et al., 2023a) but, in line with the JD-R model (e.g., Bakker & Demerouti, 2007), also shows that efforts to reduce ICT demands (specifically techno-overload) can lead to positive organisational outcomes (improved performance) through reductions in exhaustion. Although workers may feel that being able to work whenever wherever through mobile ICT enhances their productivity (Diaz et al., 2012), studies have linked work-home interference and exhaustion to a lack of concentration and performance at work (Bakker et al., 2004; Bilotta et al., 2021; Demerouti et al., 2007;).

The current results demonstrate that interventions which introduce stricter rules around email management and work connectivity not only reduce feelings of techno-overload and exhaustion but also subsequently significantly improve performance, thus adding to the

much-needed business case for organisational stress and wellbeing interventions (Biron and Karanika-Murray, 2013; Hesketh & Cooper, 2017; Robertson et al., 2011).

### 4.4.1. Strengths and limitations

A particular strength of this study is its quasi-experimental design. Given the nature of the intervention, randomisation was not possible however, potential non-random sampling effects and attrition bias have been addressed and are unlikely to have influenced the present results. A further strength of this study is the use of latent growth curve models for the analysis of data. This method provides reliable estimates of multivariate growth processes without measurement error and has been regarded to have higher statistical power than traditional approaches dealing with the same data (Curran et al., 2010; Muthen & Curran, 1997), thus allowing stronger assumptions of causal inferences to be made.

Nevertheless, this study has limitations that need to be considered when interpreting the results. The onset of the covid-19 pandemic led to a six-month delay in intervention implementation (Figure 4.3) and design changes such as adapting the initial in-person approach to virtual implementation instead. The extent of the external circumstances at this time, characterised by large scales of change and uncertainty, have likely affected the results. For example, pre-pandemic, work was almost entirely carried out at the office and high levels of WFM were a likely indication of an intrusion of work demands into 'home-time' which forced one's attention away from home-tasks. However, throughout the pandemic most participants worked from home, and some had to home-school their children for periods of time, leading them to balance work and home tasks simultaneously while being at home. Considering the large proportion of female participants (Adisa, 2021), this may explain the non-significant treatment effects on WFM. Furthermore, the strain placed on people's mental health (O'Connor et al., 2021; Zacher & Rudolp, 2021) by the pandemic and lockdowns may explain why levels of emotional exhaustion remained largely unchanged.

Nevertheless, it is promising to see that, contrary to previous inconsistent and rather disappointing results of interventions carried out during unstable times (Egan et al., 2007), the current intervention was able achieve positive outcomes. Considering the overwhelming increase in ICT reliance during the pandemic, the introduction of clear rules which enabled enhanced boundary management was a timely and much needed intervention which provides support for the need of person/organisation-intervention fit and readiness for an intervention to be effective (Nielsen & Randall, 2015).

A further limitation is the short time period during which the results of the intervention were followed up. While the growth curves of the EG show a trend towards a linear trajectory from the intervention implementation onwards for most variables, it cannot be said if the intervention led to long term improvements. For example, although the results show that psychological detachment significantly increased in the EG, the trajectory levelled off 4 weeks after the intervention. Given the importance of psychological detachment in the relationship between work demands and the development of worker ill health (Sonnentag et al., 2010), this may impact the longevity of effects. Given the time-constraints of this study it was not possible to follow up beyond the 4 week point however, future research should collect follow up data for 3 - 12 months to further examine this.

The guidelines were not implemented across the whole organisation which may have limited the effectiveness of intervention as workers outside the EG did not adhere to the rules and would not have changed their email behaviour. This could explain the non-significant treatment effects on OEEM. Due to the scope of this study, it was not possible to involve the entire organisation however, the current results provide a promising outlook for the effectiveness of such interventions if rolled out more widely.

The results are limited to a sample of UK public sector employees and future research should explore if these positive results are replicable in other organisational settings, such as private sector firms where international teams operate across time zones. A final limitation is the use of self-report data, which can introduce common method and social desirability biases. To address this, an attempt to add objective measures of email behaviour was made by asking participants to track the numbers of emails sent, received and read through automatic email filters. The results of this analysis (supplemental materials 3) show that while the emails sent, read and received during the workday increased significantly in the WLCG from pre (T1) to post-intervention (T4), no increases occurred in the EG. When examining email volume during non-work time, the numbers of emails sent and received reduced significantly in the EG, while no change was observed in the WLCG. This provides additional support for the improvements in email behaviour through a more objective data source which allows stronger assumptions to be made about the effectiveness of this intervention.

### 4.4.2. Theoretical contributions

The current results provide support for the use of the W-HR model in ICT work-life interventions. Although the model discusses beneficial outcomes (gain spirals) through the

increase in work resources, the current study examined this through the reduction in contextual demands. Results showed that as demands reduced, outcomes improved suggesting that a reduction in contextual work demands, fosters personal resources which in turn leads to improvements in contextual outcomes. Thus, the current findings are in line with the directionality of proposed effects of the W-HR model and contribute to its theoretical implications by creating a case for a gain spiral based on changes in demands.

Furthermore, the mediation results contribute to our theoretical understanding of how workplace ICT impacts on employee WHC, wellbeing and performance outcomes. In Ragu-Nathan et al., (2008)'s techno-stress creators' framework the effects of techno-overload and invasion are based on the transactional model of stress (Lazarus & Folkman, 1984) which deems the impact of stressors and subsequent stress responses on workers subjective appraisal of stressors (demands) and whether they feel able to cope with these or not.

Considering that email volume did not change during the working day but significantly reduced during non-work time in the EG, it appears that this ability to cope is informed by 1) the extent to which one feels satisfied with how they manage their emails throughout the workday and 2) the extent to which one believes that additional emails will be received and need to be actioned during non-work time. As techno-overload and invasion rather than EMF and TOE mediated the treatment effects, it could be said that this subjective coping appraisal is a more influential underlaying mechanism in the relationship between ICT-demands and employee WHC, wellbeing and performance than the physical time workers spend on emails (Gaudioso et al., 2017). It is important to note that although this study focused on the demand's aspect of the WHR model, the email rules in the intervention did not purely focus on reducing demands but some rules also tapped into building resources (e.g. building skills in email management). Whilst this research did not formally assess resources, these findings indicate that alongside a change in demands there is also a parallel adjustment in resources. Future research should examine both, resources and demands capture the interplay between these mechanisms and provide a more comprehensive evaluation of this intervention in line with the WHR model.

Previous research has shown some inconsistencies when examining the effects of time spent working via ICT during non-work time (e.g., Derks et al., 2015) and calls to consider certain boundary conditions such as the level of agreement between individual segmentation preference and group segmentation norms have been made (Yang et al., 2019). In line with this, the current findings demonstrate the importance of workers subjective ability to cope

with ICT-demands and suggest that considering such evaluations alongside the physical aspects of ICT connectivity could aid our understanding in this area.

Finally, the results contribute to our understanding of the relationship between technostress and performance over time by showing potential underlying mechanisms of physical and cognitive exhaustion.

### 4.4.3. Practical implications

There has been much discussion about workers 'right to disconnect' and whether 'banning out of hours emailing' is the way forward to protect workers from adverse outcomes such as burnout (BBC, 2019; Gaudioso et al., 2017; Secunda, 2019; Von Bergen et al., 2019). The current findings support the implementation of stricter rules around email behaviour, especially for messages coming from management during non-work time. However, it is important to note that these results do not stem from a blanket ban to out-of-office emailing but rather a set of rules that formed best practice guidelines which were introduced to teams alongside targeted awareness training and the support of management. Thus, the following practical implications are proposed for organisations who aim to mitigate the negative impact of ICT and constant connectivity.

First, a blanket ban on out of hours emails is not needed to achieve positive results. While workers should be asked to limit email traffic to working hours and days only, there should be flexibility for those who work flexible hours (e.g., flexible working signature).

Second, email interventions should be designed to reduce feelings of techno-overload and invasion as this will be more likely to achieve improvements in WHC, psychological detachment, burnout and performance. For example, simply telling workers not to look at incoming messages is unlikely to have beneficial effects as it will not lead to adaptive coping appraisals and thus neither relief feelings of overload nor invasion. Instead, organisations could target such demands by implementing email rules which enable workers to better prioritise and process incoming messages, reduce the number of unnecessary emails, and set clear expectations around email communication during non-work time. Emphasizing that sending or responding to emails beyond work time is neither expected nor rewarded and that management will not email staff on evenings and weekends may enable adaptive coping responses (Gaudioso et al., 2017) and alleviate anticipatory anxiety associated with emails thus, allowing workers to fully focus on their home roles instead of continuing to address work demands (Becker et al., 2021).

Third, along with previous scholars (e.g., Kossek 2016; Nielsen et al., 2010) it is recommended to pair the introduction of new policies or guidelines with a thorough implementation process. For example, the current results provide evidence for the efficacy of online interventions (i.e., team-based training via MS Teams), which offers a less cost and time-intensive method of implementation. Lastly, interventions should not be targeted at the individual level alone. Communication in its nature does not occur in isolation and implicit pressures to behave in certain ways are driven by the behaviours of managers and colleagues. Thus, interventions should be implemented at the team, department or organisational level to generate a shared commitment to the new email rules.

## 4.5.    Conclusion

This study provides first evidence that an intervention based on the introduction of new email guidelines could effectively reduce ICT-demands as well as improve employee strain and performance outcomes. Mediation analyses revealed that the improvements in WHC, psychological detachment and burnout (cognitive and physical exhaustion) were significantly mediated by a decrease in techno-invasion and techno-overload. Additionally, reductions in techno-overload and subsequently burnout significantly mediated the improvements in performance. These results can inform organisations that are looking for ways to address email-related stress and its adverse consequences and are considering the implementation of email guidelines. Future research should examine the effectiveness of these interventions across different samples and longer timeframes.

# Chapter 5: ARTICLE 3 – Evaluating the Effectiveness of a Team-based Email Stress Intervention on Employee Wellbeing and Performance Outcomes: A Quasi-Experimental Study and Conceptual Replication.

## Abstract

As technological dependence and hyperconnectivity increases globally, understanding and mitigating the negative impact of work-related ICT on employee wellbeing is becoming an increasingly important task. A recent study demonstrated that an intervention based on the introduction of email guidelines in work teams was effective in reducing email-related ICT-demands, which then mediated improvements in employee wellbeing (work-life conflict, psychological detachment, burnout) and performance outcomes (Siegl et al., 2023b). The purpose of the current study was to conceptually replicate the email guidelines intervention to examine its effectiveness in a private sector context. The original quasi-experimental design was maintained where email guidelines were implemented in 16 teams (N=113) who were compared to a waitlist control group (N= 75, 8 teams), and evaluated over four weeks post implementation. Multi-level regression analysis revealed significant reductions in ICT-demands (techno-invasion and email monitoring frequency during non-work time) and burnout (physical and emotional exhaustion) in the experimental group. Furthermore, the reductions in ICT demands were found to mediate improvements in burnout. This study shows although several effects did not replicate, certain positive effects, specifically those on techno-invasion and physical exhaustion could be generalisable to other samples and industries. Inconsistencies between the studies are discussed and directions for future research attention are given. Particularly in the context of the post-replication crisis era of psychological research, the results not only strengthen knowledge in this field, but also contribute to the reliable evidence base needed to develop policy recommendations and effective guidance that can aid the improved management of workplace ICT as well as the wellbeing of workers.

## 5.1.  Introduction

Technological advancement has changed how and where work is done. It has turned the 21st century into a digital era where information communication technology (ICT) permeates almost everything and connects the global world (Cascio & Montealegre, 2016). With the recent covid-19 pandemic, remote and hybrid working have accelerated significantly, and more work is now performed outside the workplace than ever before (OECD, 2021; ONS, 2022). While mobile ICT (e.g., laptops and smartphones) is often celebrated for providing workers with the flexibility to work from anywhere at any time (Joyce, et al., 2010; Adekoya et al. 2022), this also leads to increasingly blurred work-home boundaries (Derks et al., 2016; Chan et al., 2022), work intensification (Kelliher & Anderson, 2010) and pressures to always be connected (Day et al., 2010; Ninaus et al., 2015).

Boundary theory (Ashforth et al., 2000, Clark, 2000) highlights that people's ability to manage the boundary between work and home domains according to their preferences is crucial for their wellbeing. Additionally, the Job-Demands Resources model (JD-R, Demerouti et al., 2001; Bakker & Demerouti, 2007) and the Conservation of Resources (COR) theory (Hobfoll, 2001) emphasise that pro-longed exposure to work demands drains people's resources and triggers stress reactions which, over time,  can create mental and physical health impairments. Accordingly, research has shown that ICT demands are positively associated with work-related stress, work-home conflict, and burnout, as well as negatively associated with recovery and performance (Dettmers et al., 2017; Schlachter et al., 2018; Siegl et al., 2023a; Thoerel et al., 2022). Thus, while ICT is largely seen as a resource, the negative impact of ICT demands is disproportionally larger than the beneficial impact of ICT resources, and organisations are urged to prioritise the management of ICT demands (Ninaus et al., 2021).

To date, research has investigated the antecedents, moderators and outcomes of ICT demands (Berg-Beckhoff et al., 2017, Schlachter et al., 2018;  La Torre et al., 2019; Borle et al., 2021; Thörel et al., 2022; Nastjuk et al., 2023), however, the available evidence on interventions is limited (Stich et al., 2019 ; Siegl et al., 2023a). One particular challenge is the unclear effectiveness of interventions that implement email related changes on the group or organisational level (Siegl 2023a). Although the introduction of email policies, which regulate the hours and days during which employees are electronically available for work, to counteract the adverse impact of ICT demands, have been suggested by multiple scholars

(Gaudioso et al., 2016; Piszcek, 2017; Stich et al., 2019 ; Becker et al., 2020), there is only one study which has examined the impact of such an intervention to date (Siegl et al., 2023b). [5]

The authors implemented new email guidelines in 17 teams of a UK public sector organisation and found significant reductions in ICT demands and improvements in employee wellbeing and performance outcomes. Yet, they acknowledge the need to replicate this intervention in different settings and population (e.g., private, internationally operating firms) to enhance confidence in the generalisability of such findings.

Conceptual replication of empirical research is not only important to attest for generalisation but also for scientific progress through theory building and testing (Tsang & Kwan, 1999; Stroebe & Strack, 2014; Dello Russo & Stoykova, 2015). The recently sparked debate of the replication crisis in psychology research (Pashler & Wagenmakers, 2012; Maxwell et al., 2015) cautions researchers not to make strong assumptions based on the results of one study and emphasises the need for replication (Ledgerwood & Sherman, 2012; Shrout & Rodgers, 2018). We respond to this call  by conducting a conceptual replication of Siegl and colleague's, (2023b) email intervention across a sample of private sector employees working within internationally operating teams.

Our research provides several contributions to the literature: First, from a generalisation perspective, we seek to strengthen the empirical evidence base of group level ICT interventions, specifically for private sector workers. Here, we will examine the impact of email guidelines that regulate when and how participants interact with work-emails.

Secondly, from a theoretical perspective we look to test the underlaying mechanism(s) that drive the effects of the intervention. Siegl et al., (2023b) examined three kinds of ICT demands (techno-stressors, ICT-related pressures, connectivity behaviour) and found that improvements in techno-stressors mediated the positive impact of the intervention on wellbeing and performance outcomes. Replicating and testing these mechanisms in a different setting and a diverse sample is important for building theory with stronger confirmatory power (Schmidt, 2009; Köhler & Cortina, 2021; Klonek et al., 2020).

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[5] Reference for Article 2 (Siegl. S., Clarke, S., Cooper, C.L. (2023b). The Right to Disconnect": An Intervention Study to examine the effect of constant connectivity through work-emails on work-home conflict, recovery, burnout, and performance. *RR at Work & Stress.*

Third, from a practical perspective, additional evidence on the effectiveness of ICT interventions could be useful for organisations considering their implementation. The negative impact of ICT, specifically that of work-related emails, has gained considerable attention in the mainstream media, which may impact managerial practice. However, practitioners may run the risk of following "popular trends" without sufficient evidence for the validity of such ideas (Klonek et al., 2020). Considering the ongoing debate around the impact of workers individual segmentation preferences (Yeh et al., 2012; Butts et al. 2015, Derks et al., 2014, 2016; Piszczek et al., 2017; Gadeyne et al., 2018; Thörel et al., 2020), it remains unclear whether ICT-related changes around workplace connectivity are beneficial for all employees or whether there could be negative outcomes for some (Siegl et al., 2023b). Particularly in international private sector work, as employees with preferences for work-home integration may self-select themselves into roles where work-life balance is not a priority (Steijn, 2008).

Thus, our research helps to assess the effectiveness of previous ICT interventions and thereby contributes to a more empirically informed, theoretically sound, and practically relevant understanding in the work-related ICT and wellbeing field.

### 5.1.1. Background

#### 5.1.1.1. *ICT Demands*

ICT demands have been defined as those physical, social, or organisational aspects of the job, specific to ICT, that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs, for example by blurring work-home boundaries and contributing to constant connectivity (Demerouti et al., 2001. P. 501; Siegl et al., 2023a). Siegl et al., (2023a) created a typology of ICT demands consisting of:

a) 'Techno-stressors', which describe negative technological work environments individuals face due to their interaction with information systems, such as emails (e.g., techno-overload and techno-invasion, Ragu-Nathan et al., 2008). In line with the transactional model of stress (Lazarus, 1966; Lazarus & Folkman, 1984), these trigger a stress response depending on peoples situational coping appraisals and were associated with higher levels of stress (Stadin et al., 2014, Tarafdar et al., 2014), reduced work performance

(Tarafdar et al., 2015; Ioannou & Papazafeiropoulou, 2017), increased work-home conflict (Gaudioso et al., 2017), and burnout (Srivastava et al., 2015, Califf & Brooks, 2020);

b) 'ICT-related pressures and expectations', which encompass demands derived from the injunctive and descriptive norms regarding work availability, for example, workplace telepressure (Barber & Santuzzi, 2015), extended work availability demands (Dettmers, 2017), and organisational expectations for email monitoring (OEEM, Becker et al., 2021).

c) 'ICT-based connectivity behaviour' which looks at the extent and duration of ICT use during non-work time. Siegl et al., (2023a) highlight that the negative impact of ICT connectivity pressure and behaviour is typically based on the principles of boundary theory as well as the Job Demands-Resources model and the COR theory, and accordingly, are negatively associated with work-life balance, psychological detachment, and wellbeing (e.g., burnout). Although both demands follow the same theoretical principles and are highly related, scholars suggest that salient norms for availability can adversely impact wellbeing regardless of physical job contacts (Bamberg et al., 2012; Dettmers et al., 2016; Becker et al., 2020).

### 5.1.1.2.    *Reducing ICT Demands*

A particular issue appears to be the perceived permeability between work and non-work domains which can threaten individual non-work role enactment and creates emotional (e.g., anxiety) and cognitive strain (Allen et al., 2014; Dettmers & Biemelt, 2017; Becker et al., 2021). Adequate recovery from work-related effort-expenditure is important for healthy functioning as it ensures that sufficient resources are available to address future work demands (Meijman & Mulder, 1989; Sonnentag & Fritz, 2007).

In line with this, studies have shown that workers ability to cope with existing ICT demands could be improved through the implementation of micro-boundaries (e.g., setting out of hours email messages on weekends; Rich et al., 2020) and through mindfulness based self-training which enhances perceived boundary control (Rexroth et al., 2017; Altenhammer et al., 2021). Furthermore, training interventions, that help workers manage their email inbox more effectively, can be effective in reducing information overload (Soucek & Moser, 2010).

Although individual level interventions have shown some positive results, researchers have questioned whether enhancing the ability to cope with existing stressors

rather than addressing the organisational source of stress is an effective approach to manage ICT demands (Siegl et al., 2023a, 2023b).

Work environment factors, such as implicit work availability norms, are driven by the attitudes and connectivity behaviours of team members and managers (Adkins & Premeaux, 2014; Palm, et al., 2020) and have a significant impact on perceived ICT demands and subsequent outcomes, such as burnout (Barber & Santuzzi, 2015). Therefore, interventions which are targeted at the group or organisational level (Leblanc et al., 2007) and contain an element of cultural integration (Kossek, 2016) are more effective in this context.

### 5.1.1.3.    *The intervention*

Siegl et al., (2023b) recently conducted a team level ICT demands intervention which comprised of the integration of new email guidelines. The implementation process entailed a 1-hour online meeting which had four components: 1) '*Raising awareness*' (highlighting the relationship between certain email behaviours and negative wellbeing outcomes); 2) '*Email training*' (the main component of the intervention, where the authors introduce each new 'email rule' and explain how and why these should be adhered to); 3) *'Q&A'* (time for the participants to ask questions)' and 4) *'Leadership support'* (a closing statement that shows the support of senior leaders and the commitment of the line manager in adhering to the rules).

The email guidelines draw on previous research that emphasise the use of boundary management tactics (Kossek & Lautsch, 2012; Rich et al., 2020) and inbox management to handle ICT demands more effectively. In line with principles of social identity and social change (Tajfel & Turner, 1979; Bandura, 1986; May & Finch, 2009; May et al., 2009, cf. Kwasnika et al., 2016) the authors suggest that the intervention reduces ICT demands because the team-based format allows for shared learning and the facilitation of new behavioural (social) norms. For example, accepting that emails should only be sent during agreed working hours and days,  should increase group segmentation norms (the extent to which a team sees a strong boundary between work and home domains) and reduce ICT related pressures and connectivity behaviour (Kossek & Lautsch, 2012; Yang et al., 2019).

In addition to minimising the invasive effect of ICT, collectively (instead of individually) engaging in behaviours that reduce the numbers of emails sent and enable the prioritisation of important messages as well as lowering the expectation for immediate

response, should reduce techno-overload (feelings of having to work faster and longer due to ICT). Notably, the guidelines refer to 'contracted hours' instead of standard working hours (e.g., Monday – Friday 9 am – 5 pm) and emphasise that their implementation should not hinder flexible workers in engaging in their agreed working patterns, as long as they can highlight their flexible worker status.

Additionally, if individuals wanted to access their emails during off-job time, they could, but they were required to use a delay send option, so their connectivity behaviour was not visible to others. Thus, the intervention should be effective in lowering ICT demands, as it creates more positive technological work environments and reduces work-home boundary permeability on a team level which then enables individuals to enact their boundary preferences.

The results confirmed significant reductions in techno-stressors (techno-overload, techno-invasion), and connectivity behaviour (email monitoring frequency and time spent on emails after hours) in teams that implemented the guidelines when compared to the control group. To further test the effects of their intervention, the authors draw on the work-home resources model (ten Brummelhus & Bakker, 2012) to predict that a reduction in contextual ICT-demands would improve home- (work-home conflict, psychological detachment) and work (burnout, performance) outcomes. The authors not only found support for the effectiveness of their intervention in improving wellbeing (all except emotional exhaustion) and performance outcomes throughout the 4-week post-implementation evaluation but also demonstrated that reductions in techno-overload and techno-invasion mediated these effects.

These findings present a promising perspective on how to better manage ICT demands however, since the sample was limited to UK public sector workers, it is uncertain how these findings generalise to other populations.

### 5.1.1.4. *Public vs. Private sector*

Public sector firms have been described as more bureaucratic, with public managers being seen as less materialistic and committed than private sector managers (Boyne, 2002). Additionally, civil servants are said to be more motivated by work-family balance (Buelens & Van den Broeck, 2007) while private sector employees are more driven by extrinsic values such as profitability (Van der Wall et al., 2008) and more likely to show workaholic tendencies (Harpaz & Snir, 2003; Borst et al., 2020), which is positively associated with

connectivity behaviour (Molino et al., 2019). Private firms are also, by nature, more likely to operate internationally via global virtual teams which have a significantly greater ICT dependence and face cross-cultural differences in work-leisure orientation (Nurmi et al., 2009).

On the one hand, the desire for work-family balance over extrinsic rewards, may create a greater person-intervention fit and readiness for ICT-change in public sector firms. Studies have shown that whether ICT acts as a resource or a demand can depend on workers segmentation preferences (e.g., Kossek & Lautsch, 2012; Derks et al., 2015; Yang et al., 2019; Thörel et al., 2022). The person-environment fit perspective suggests that individuals' assess situations to determine which align with the expression of their preferred traits and which restrict their behaviour (Kristof-Brown et al., 2005) and subsequently "gravitate toward those situations that foster and encourage the behavioural expression of their traits" (Snyder & Ickes, 1985, p.197; Methot & Le Pine, 2016). In line with this idea, that "people shape their world" (Snyder & Ickes, 1985), individuals may actively choose work environments that align with their preferences for work-home segmentation. For example, workers with lower segmentation preferences may be more likely to self-select themselves into private sector firms and may be more likely to have roles which require international work. In this case, they may use ICT to create a fluid boundary in line with their preferences which could create less receptivity to ICT interventions. In support of this, research showed that workers engage in proactive boundary management choices that influence crossover between work and non-work role domains, such as accepting or declining a job at the same firm that employs their partners or initiating romantic relationships with co-workers (Methot & Le Pine, 2016).

On the other hand, even explicit availability expectations have a negative effect on psychological detachment and wellbeing (Dettmers et al., 2016), and workaholism is predictive of exhaustion (Molino et al., 2019). Thus, there may be an equal or even greater need for ICT-interventions for private sector workers to ensure they get the break they need to recover and remain healthy.  The differences between public and private sector work raise the question whether ICT-interventions will elicit an equally positive response in private sector workers. It is important to better understand if group-level ICT interventions operate consistently across different sectors to evaluate whether these can be suggested as a method to manage ICT demands. To address this need, we will replicate Siegl and colleague's

(2023b) email guidelines intervention and examine its effectiveness in a private sector sample.

### *5.1.1.5. Replication*

A recent crisis in confidence triggered a failure to replicate more than 36 percent of 100 results published in top-tier psychology journals (Open Science Collaboration, 2015) and fraudulent research practice has sparked a debate around the reliability of research findings (Shrout & Rogers, 2018; Maxwell et al., 2015). As a result, it may not be advised to imply strong assumptions from the results of one study without the understanding whether effects can be replicated (Ledgerwood & Sherman, 2012; Shrout & Rodgers, 2018).

There are two main types of replication studies, direct replication, where researchers aim to replicate the exact conditions of the original study to examine if the effects remain the same or have occurred by chance. And conceptual replication where researchers aim to confirm the original hypotheses by using different samples, methods, or measures to generate a better understanding of how generalisable the original findings are (Dello Russo & Stoykova, 2015; Diener & Biswas-Diener, 2016).

The current study falls within the second category. The aim of this study is to test whether the hypothesised effects of the original intervention hold in a sample of private sector workers. Specifically, we will evaluate the effectiveness of an email guidelines intervention in reducing ICT demands and improving wellbeing and performance outcomes using a public sector sample operating in an international capacity. We will further test whether the effects of the intervention are mediated by changes in ICT demands (A summary of hypotheses tested can be seen in Table 5.1 and Figure 5.1).

As our focus was to understand the potential impact of sampling differences all other procedures of the intervention were maintained, including the use of the same authors team and little variation in time (Rosenthal, 1990; Schmidt, 2009). Particularly in the context of the post-replication crisis era of psychological research, the results of the current replication study cannot only strengthen knowledge in this field, but also contribute to the reliable evidence base needed to make policy recommendations and to develop effective guidelines (Bertin et al., 2020) that can aid the management of ICT demands. Considering the growing reliance on ICT and the demand for remote/hybrid working (Messenger, 2018; Vu et al., 2020; Reznik et al., 2022; ONS, 2022; Wigert & Agrawal, 2022), alongside the rising levels

of work-related stress and poor mental health (HSE, 2021), this research will address a

critical gap in knowledge and will have significant theoretical and practical implications.

**Table 5.1.** Hypotheses tested in Siegl et al., (2023b) replicated in a private sector sample

| Hypothesis | |
|---|---|
| 1 | In comparison to the waitlist control group (WLCG), employees in an experimental group (EG) who are subject to the introduction and integration of new email guidelines, will experience a reduction in **ICT-demands** of<br>a) Techno-overload<br>b) Techno-invasion<br>c) OEEM<br>d) E-mail monitoring frequency during non-work time (EMF)<br>e) Time spent on emails during non-work time (TOE)<br>f) Work-family multitasking (WFM) |
| 2 | Compared to the control group, employees in the experimental group will show a reduction in **WHC.** |
| 3 | The intervention effect on WHC will be mediated by a reduction in ICT-demands of a) techno-overload, b) techno-invasion, c) OEEM, d) EMF, e) TOE and f) WFM. |
| 4 | When compared to a control group, employees in the experimental group will experience increases in **psychological detachment.** |
| 5 | The intervention effect on psychological detachment will be mediated by reductions in ICT-demands of a) techno-overload, b) techno-invasion, c) OEEM d) EMF, e) TOE and f) WFM. |
| 6 | When compared to a control group, employees in the experimental group will experience a reduction in **burnout,** measured as (a) physical (b) cognitive and (c) emotional exhaustion. |
| 7 | The intervention effect on burnout will be mediated by a reduction in ICT demands of a) techno-overload, b) techno-invasion, c) OEEM d) EMF, e) TOE and f) WFM |
| 8 | When compared to a control group, employees in the experimental group will experience an increase in **performance.** |
| 9 | The intervention effect on performance will be mediated by a reduction in ICT demands of a) techno-overload, b) techno-invasion, c) OEEM d) EMF, e) TOE and f) WFM. |
| 10 | A reduction in burnout symptoms will mediate the relationship between changes in ICT-demands and performance. |

Note: OEEM = organisational expectations for email monitoring; EMF = email monitoring frequency during nonwork time; TOE = Time spent on emails during nonwork time; WFM = work-family multitasking; WHC = work-home conflict.
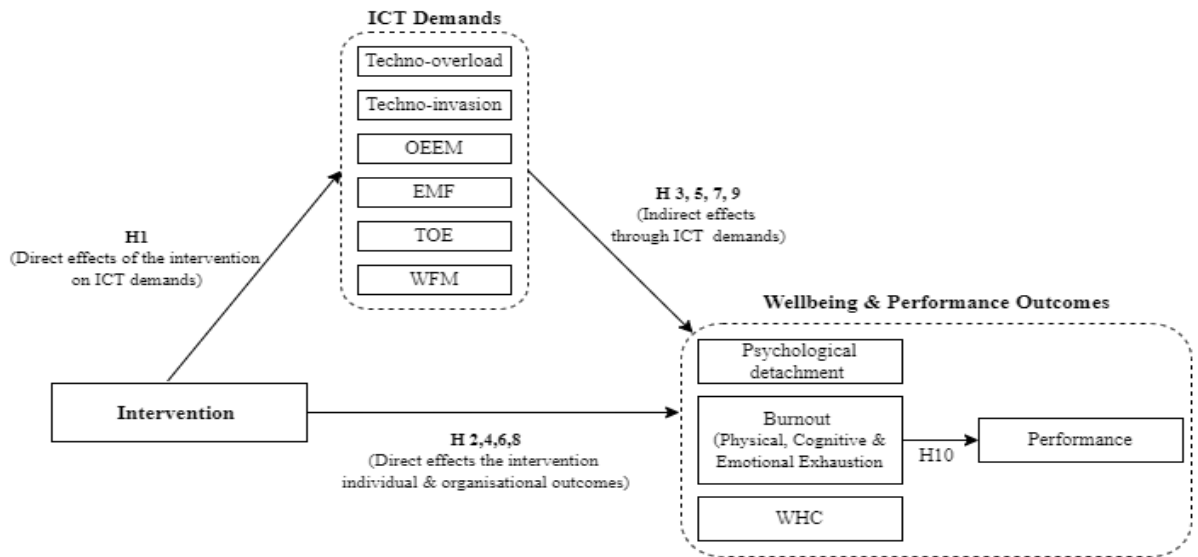
**Figure 5.1**. Hypothesised model of the intervention effects mediated by ICT Demands.

Note: OEEM = organisational expectations for email monitoring; EMF = email monitoring frequency during nonwork time; TOE = Time spent on emails during nonwork time; WFM = work-family multitasking; WHC = work-home conflict.

## 5.2. Methodology

### 5.2.1. Research Design

The quasi-experimental design of the study consisted of multiple steps across a 14-month period[6], with the 6-week intervention and data collection phase taking place between January and March 2021 (Figure 5.2). This study involved managers and their teams who were allocated to either the experimental condition or a wait-list control group. Quantitative data was collected twice across both groups: 1) Two weeks prior to the intervention, and 2) four weeks after implementation of the intervention.

### 5.2.2. Participants

The study was conducted in a large UK private sector firm which operates globally. The sample comprised of 408 professional employees (managers and staff) nested within 24

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[6] There was an 8-month delay in the implementation of the intervention (initially planned for May 2020) due to the Covid-19 pandemic which commenced in March 2020. Due to the circumstances, the implementation method was changed from in-person to online. Once the operations department regained the capacity to support the intervention (October 2020), participating teams were recruited and the implementation phase commenced.

teams. The experimental group consisted of 16 teams (N = 281) and the control group of 8 teams (N = 127). The completion rate at T1 was 70.5 per cent (N=288) and 50 per cent at T2 (N=204), resulting in a 29 per cent attrition rate from baseline to post-intervention assessment (See Appendix D, 2 for attrition analysis). The longitudinal sample (N=204) comprised of 67 women (32.8%), 137 men with a mean age of 42.12 years (SD=11.05).  A summary of demographic information for both groups can be seen in Table 5.2.
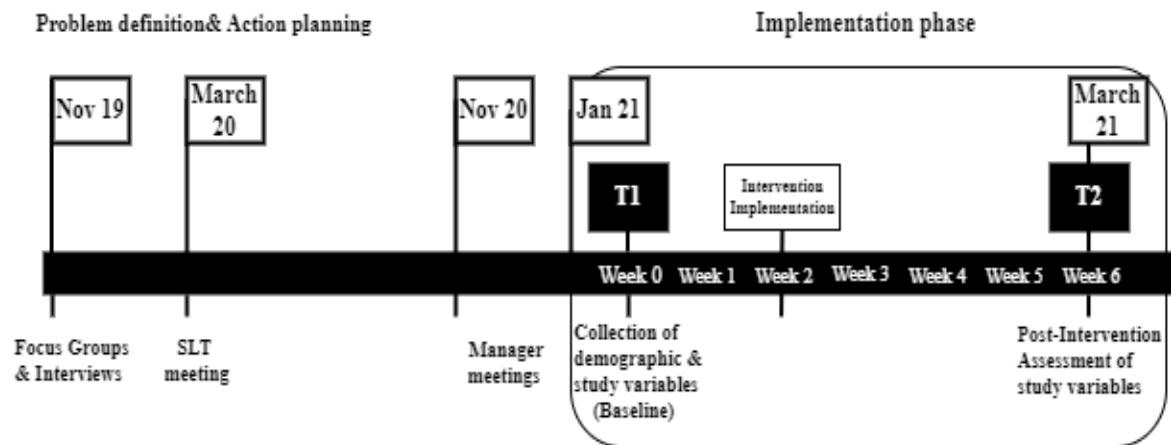


**Figure 5.2.** Timeline of the intervention process

**Table 5.2**. Demographic data by group

| Demographic Data | Experimental ($N = 113$) | Wait-List Control ($N = 91$) |
|---|---|---|
| Gender | | |
|   Male | 81 (71.7%) | 56 (61.5%) |
|   Female | 32 (28.3%) | 35 (38.5%) |
| Age | Mean 43.2 years ($SD = 10.7$) | Mean 40.7 years ($SD = 11.4$) |
|   18 – 25 | 6 (5.3%) | 7 (7.7%) |
|   26 – 32 | 14 (12.4%) | 18 (19.8%) |
|   33 – 40 | 32 (28.3%) | 23 (25.2 %) |
|   41 – 50 | 22 (19.5%) | 22 (24.2%) |
|   51 – 60 | 34 (30.1%) | 16 (17.6%) |
|   61 | 5 (4.4%) | 5 (5.5%) |
| Management responsibilities | | |
|   Yes | 45 (38.9%) | 26 (28.6%) |
|   No | 68 (60.2%) | 65 (71.4%) |
| Working hours | | |
|   Full-time | 105 (92.9%) | 83 (91.2%) |
|   Part-time | 7 (6.2%) | 4 (4.4 %) |
|   Flexible hours | 1 (.9%) | 4 (4.4%) |
| International Team | | |
|   Yes | 78 (69%) | 25 (27.5%) |
|   No | 35 (31%) | 66 (72.5%) |
| Ethnicity | | |

| | | |
|---|---|---|
| White (UK, Irish, other White) | 102 (89.4%) | 75 (82.4%) |
| Mixed/multiple ethnic groups | 0 | 3 (3.3%) |
| Asian/Asian British | 9 (8%) | 8 (8.8%) |
| Black/African/Caribbean/Black British | 3 (2.7%) | 5 (5.5%) |
| Marital Status | | |
| Married | 69 (61.1%) | 60 (65.9%) |
| Single | 30 (26.5%) | 27 (29.7%) |
| Civil Partnership | 8 (7.1%) | 1 (1.1%) |
| Widowed | 0 | 0 |
| Divorced | 6 (5.3%) | 3 (3.3%) |
| Children | | |
| None | 64 (56.6%) | 57 (62.6%) |
| 1 Child | 19 (16.8%) | 16 (17.6%) |
| 2 Children | 22 (19.5%) | 13 (14.3%) |
| 3 + Children | 9 (7.1%) | 5 (5.5%) |

### 5.2.3. Intervention

The intervention design and implementation process mirrored that of Siegl et al., (2023b). Accordingly, it commenced with a problem definition and action planning phase where three 90-minute focus groups were conducted to understand current email practices and issues. This was conducted at similar time points across both studies so that email rules included in the intervention could be developed in response to both organisations focus groups. Furthermore, meetings were held with SLT to discuss the proposed guidelines and with participating managers to gain commitment and support for the integration processes.

The guidelines (Appendix C, 1) remained the same apart from the addition of a subsection specific to participants in international teams. Specifically, rule one asks participants to limit email traffic to working hours and days only. As UK working hours conflicted with the off time of, for example, American team members, participants were asked to not send emails to international workers during their rest time of 7 pm – 10 pm. This was intended to provide adequate time to switch off and engage in family activities without the anticipation of incoming emails while avoiding unreasonable complications for senders. To highlight such hours, participants were provided with the graphic of a clock that indicated the overlap and conflict between working hours. Participants were also given instructions to install multiple electronic clocks on their computer desktop to allow an easy reminder of relevant time zones.

The implementation process consisted of 1-hour online team meetings structured in four parts: 1) an educational piece to raise awareness of the negative impact of email-related

stressors and to signal the importance of behaviour and culture change, 2) the detailed explanation of all email rules which participants were asked to adhere to as strictly as possible, 3) a Q&A session and general discussion, and 4) a closing statement that shows the support of senior leaders and the commitment of the line manager in adhering to the rules.

. Supplemental materials, including the self-help tool for inbox management and a recording of an anonymised 'implementation meeting', were available at the organisation's intranet.

## 5.2.4. Measures

Demographic variables were assessed once at T1. All measures assessed at pre- and post-intervention time (T1 & T2) are described below. Unless specifically noted, all responses were measured on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

*Technostress creators*. Techno-overload and techno-invasion were assessed with the 5-item techno-overload and the 4-item techno-invasion subscales of the technostress creators measure (Ragu-Nathan et al., 2008). Participants were asked to indicate the extent to which they agreed with statements such as "I am forced by this technology to do more work than I can handle" (techno-overload) and "I feel my personal life is being invaded by this technology" (techno-invasion). The instructions explained that "this technology" referred to work-related emails. Both scales had high internal reliabilities with Cronbach α's of .81 and .82, respectively.

*Organisational Expectations for Email Monitoring* were measured using Becker et al.'s (2021) three-item OEEM scale which showed a high internal reliability (α = .86). All items were measured on a 5-point Likert scale and comprised of statements such as "people who are important to me at work expect me to respond to electronic communication away from work."

*Connectivity behaviour.* E-mail monitoring frequency during non-work time (EMF) was measured on a 5-point scale, ranging from 1 (never) to 5 (every few minutes which asked participants to indicate the frequency with which they checked work-related communication during non-worktime (Becker et al, 2021).

Time spent on emails during non-work time (TOE) was assessed by asked participants to indicate the average amount of time they spent dealing with work-related communication during non-work time on a scale of 1 (less than 1 hour) to 4 (more than 3 hours) each day over the past two weeks (Becker et al, 2021). Non-work time was defined as any time beyond ones contracted daily working hours.

WFM was assessed by a single-item measure (Schieman & Young, 2010), asking participants how frequently they tried to complete work and home tasks at the same time while being at home, ranging from 1 (never) to 4 (frequently).

***Work-home conflict*** was measured using Kreiner's (2006) adapted version of Netemeyer et al., (1996)'s 5-item work-family conflict scale. All items were measured on a five-point Likert scale and included statements such as "the amount of time my job takes up makes it difficult to fulfil home responsibilities". The Cronbach α was .95.

***Psychological detachment*** was measured using the 4-item psychological detachment subscale from Sonnentag and Fritz's (2007) Recovery Experience Questionnaire (α = .81). Here, participants were asked to indicate the extent to which they agreed with statements referring to their free evening (non-work time), such as "I don't think about work at all", on a scale of 1 (do not agree at all) to 5 (I fully agree).

***Burnout*** was assessed using the Shirom-Melamed Burnout Measure (Melamed et al., 1992; Shirom, 1989), which comprises 14 items across three sub-dimensions: 1) physical fatigue (6-items, e.g. "I feel physically drained";  α = .93) cognitive weariness (5 items, e.g., "my thinking process is slow" α = 94), and 3) emotional exhaustion (3 items, e.g., "I feel I am not capable of investing emotionally in co-workers and customers"α =.92). All items were be measured on a 7-point Likert Scale from, 1 (*never or almost never*) to 7 (*always or almost always*).

***Performance.*** Subjective performance was assessed using one question from the World Health Organization Work Performance Questionnaire (HPQ; Kessler et al., 2003). Participants were asked to score their job performance from 0 (the worst job performance) to 10 (best performance) for the past 28 days.

### 5.2.5. Data analysis strategy

SPSS version 25 was used to calculate descriptive statistics, correlation coefficients and internal reliability scores, to test for multivariate assumptions (independence, normality, homogeneity of within-treatment variances and sphericity) and to conduct an attrition analysis. Mplus version 7.4 (Muthen & Muthen 2015) was used to examine longitudinal measurement invariance and all proposed hypotheses. The hypotheses were tested using multilevel regression modelling where measurement occasions are defined at level 1 and nested within individuals (level 2).

This approach was preferred over repeated measures MANOVAs as it is a more robust method of analysis especially when dealing with potential violations of homoscedasticity and sphericity. Here, the level one and two variance is correctly partitioned, allowing a more accurate estimation of effect sizes and a reduced chance of type 1 error (Quene´ & van den Bergh, 2004; Bosker & Snijders, 2011). Effect sizes can be evaluated using either standardised beta coefficients (beta) where effects between .1 - .29 are small, effects between .30 - .49 are medium and any effects above .5 are large, or using cohen's d, where .2 presents a small effect, .5 a medium effect and .8 a large effect (Cohen, 1988).

Similarly, to the approach used by Holman et al., (2010) and Le Blanc et al., (2007), a cross-level moderation analysis at level 1 was conducted to test the treatment effects of the intervention (H1, 2, 4, 6, 8). Specifically, dummy variables consisting of the time of measurement and group allocation as well as the interaction term between these two variables were created. Control variables of age, gender and management status were added as level 2 predictors. Treatment effects are demonstrated if the time x group interaction term has a significant effect on a dependent variable as this shows that change over time in the intervention group significantly differed from that of the control group (Holman et al., 2010).

To examine whether the intervention effects were mediated by ICT demands (H3, 5, 7, 9, 10), the mediators were added to the multilevel regression model and indirect (a*b) pathways were specified. Mediation was confirmed if the IV (Time*Group Interaction) became less or non-significant in the presence of a significant mediator and the indirect path was significant (Confidence Intervals do not cross 0 or 1).

## 5.3. Results

The correlations between study variables, descriptive statistics, and t-test results of within and between group differences at time 1 and time 2 can be seen in Appendix D, 1d-e. An overview of all significant paths predicted in hypotheses 1-9 can be seen in Figure 5.3
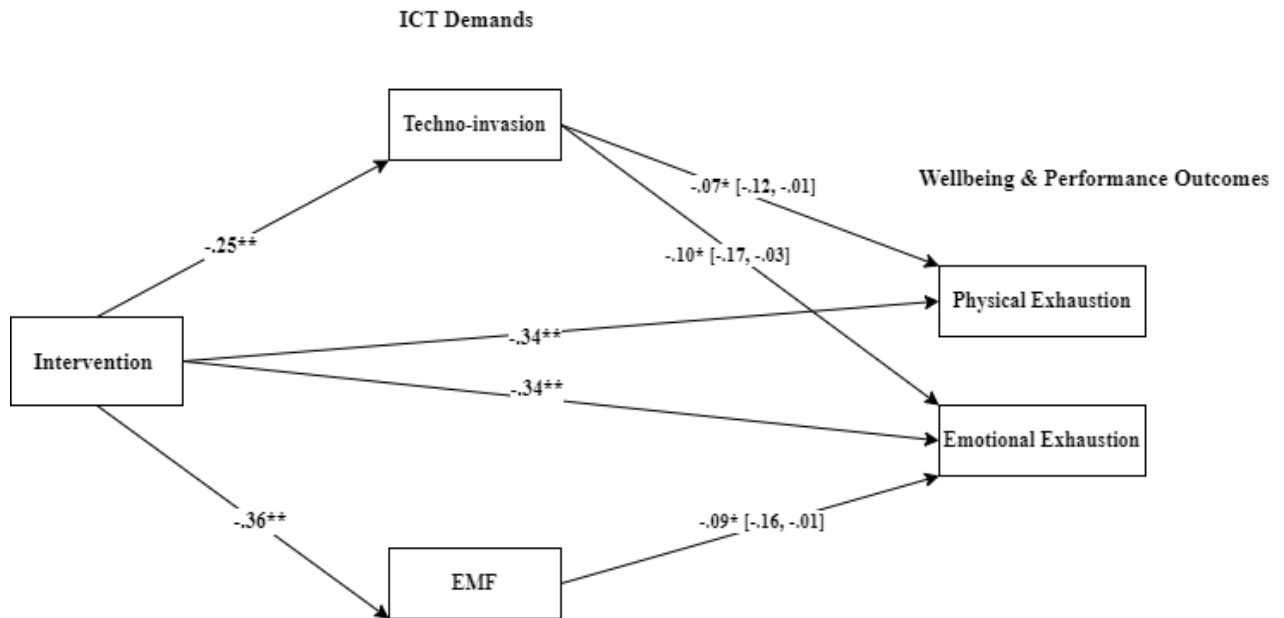


**Figure 5.3.** Significant intervention effects on ICT Demands, Employee Wellbeing Outcomes as well as mediating effects of ICT Demands

### 5.3.1. Intervention effect on ICT demands

Hypothesis 1 stated that the intervention would reduce ICT demands in the experimental group but not the control group. The results revealed that treatment effects were found in two out of six instances (Table 5.3) as indicated by the significant interaction effect for techno-invasion ($\beta = -.62$, p <.01, $\beta = -.62$) and e-mail monitoring frequency during non-work time ($\beta =.55$, p< .01, $\beta =.55$). Both effects were of large size and accounted for 20 and 17 percent of the variance in techno-invasion and e-mail monitoring frequency respectively. Thus, hypothesis H1b and H1d were supported. The significant interaction effects are plotted in Figure 5.4 and 5.5.

Although the remaining ICT demands showed reductions over time in the EG, no significant treatment effect was detected for techno-overload, organisational expectations for

email monitoring, time spent on emails during nonwork time and work-family multitasking. Therefore, hypotheses 1a, c, e, and f, were not supported.

**Table 5.3.** Multilevel models for the effect of the intervention on perceived email stressors

| | Outcome variable | | | | | | | | | | | |
| | EMF | | TOE | | WFM | | Techno-overload | | Techno-invasion | | OEEM | |
| | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
| | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | 1.25** | .34 | 2.24** | .46 | 2.40** | .32 | 3.33** | .27 | 2.17** | .31 | 1.91** | .38 |
| *Controls* | | | | | | | | | | | | |
|   Age | .00 | .01 | .01* | .01 | -.01 | .00 | -.00 | .01 | .00 | .01 | -.00 | .01 |
|   Gender | .16 | .12 | .32* | .14 | -.03 | .10 | .11 | .12 | .06 | .13 | .01 | .15 |
|   Manager | -.38** | .12 | -.32* | .14 | -.14 | .10 | -.12 | .12 | -.51** | .13 | -.61** | .15 |
| *Time and intervention* | | | | | | | | | | | | |
|   Time (pre & post) | .45* | .18 | .09 | .18 | .10 | .18 | .18 | .15 | .24 | .15 | .18 | .19 |
|   Group (EG &WLCG) | .71** | .22 | -.03 | .19 | .06 | .19 | -.14 | .17 | .22 | .19 | .46 | .23 |
|   TxG Interaction term | -.36** | .11 | -.11 | .11 | -.11 | .11 | -.13 | .09 | -.25** | .09 | -.21 | .12 |
| $R^2$ | 19.7% | | 2.3% | | 3.2% | | 4.5% | | 17.3% | | 8.6% | |

*Note:* $B$ = unstandardised $\beta$ coefficients. Gender (male = 2); Manager (1 = yes); EMF = e-mail monitoring frequency during nonwork time; TOE = time spent on emails during nonwork time; WFM = work-family multitasking; OEEM = organisational expectations for email monitoring. *p <.05; ** p < .01.
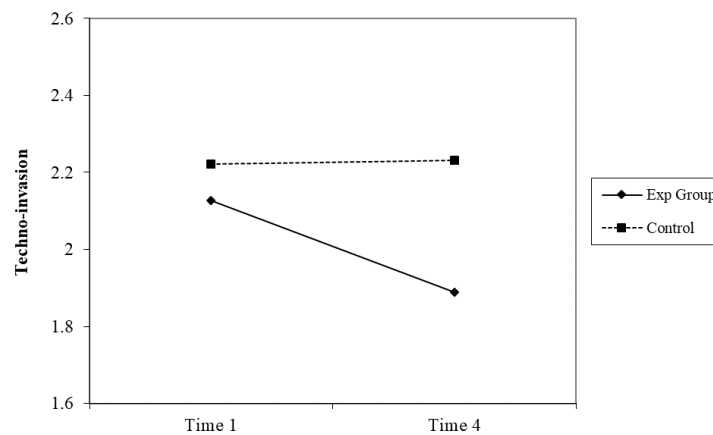


**Figure 5.4.** Change in techno-invasion over time in the experimental vs. control group
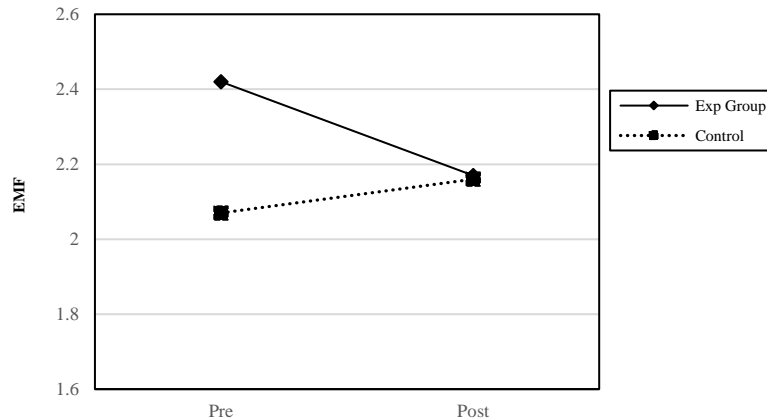
**Figure 5.5.** Change in email monitoring frequency during nonwork time in the experimental vs. control group over time

### 5.3.2. Intervention and mediation effects for employee wellbeing and performance

Table 5.4 shows the multilevel model results for the intervention effects on each employee outcome. The analysis revealed significant treatment effects for two out of three burnout dimensions. Specifically, the intervention was effective in reducing physical exhaustion ($\beta$ = .34, p <.01) and emotional exhaustion ($\beta$ = .34, p <.05), and accounted for an additional 13.4 per cent and 9 per cent of the variance beyond that of the control, time of measurement and group variables. The significant interactions are plotted in Figures 5.6 and 5.7. Although cognitive exhaustion reduced significantly in the experimental group and not in the control group, no significant treatment effects could be detected. Thus, while hypotheses 6 was not fully confirmed, hypotheses 6 a and c were supported.

Next, we tested whether the improvements in burnout were mediated by changes in ICT demands (Table 5.5). Since treatment effects were detected for techno-invasion and e-mail monitoring frequency, these were added to the model to test for mediation. The results revealed that techno-invasion had a significant positive effect on physical exhaustion ($B$ = .28, $p$ < .01, [.12, .43]), indicating that reductions in techno-invasion are predictive of reductions in physical exhaustion. The indirect effect on the intervention on physical exhaustion through techno-invasion was significant ($B$ = -.07, p < .05; [-.12, -.01]), however, the direct effect of the intervention also remained significant. Thus, support for partial mediation was found.

Table 5.4. Multilevel models for the effect of the intervention on employee outcomes

| | Outcome variable | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | WHC | | Psychological Detachment | | Physical Exhaustion | | Cognitive Exhaustion | | Emotional Exhaustion | | Performance | |
| | Model 7 | | Model 8 | | Model 9 | | Model 10 | | Model 11 | | Model 12 | |
| | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE |
| Intercept | 3.29** | .36 | 3.39** | .33 | 4.77** | .47 | 4.48** | .47 | 2.55** | .63 | 6.71** | .56 |
| *Controls* | | | | | | | | | | | | |
| Age | -.01 | .01 | -.00 | .01 | -.04** | .01 | -.03** | .01 | -.02 | .01 | .04** | .01 |
| Gender | .37* | .15 | -.29* | .12 | -.11 | .21 | .04 | .20 | .14 | .21 | .05 | .18 |
| Manager | -.53** | .15 | .13 | .12 | -.06 | .28 | -.13 | .20 | -.18 | .21 | .19 | .18 |
| *Time and intervention* | | | | | | | | | | | | |
| Time of measurement | -.04 | .16 | -.03 | .18 | .19 | .22 | -.15 | .26 | .30 | .29 | .22 | .29 |
| Experimental Group | -.33 | .21 | .27 | .19 | -.49 | .29 | -.65* | .29 | .07 | .37 | .10 | .35 |
| Interaction term | -.03 | .10 | .09 | .10 | -.34** | .13 | -.20 | .15 | -.34* | .17 | .16 | .18 |
| R$^2$ | Baseline: 1% Total 1.2% | | 1.2% 3.2% | | 6.2% 19.6% | | 1% 5% | | 2% 11% | | 6% 7.7% | |

*Note: B* = unstandardised *β* coefficients. Gender (male = 2); Manager (1 = yes); WHC = work-home conflict .
*p <.05; ** p < .01.

Furthermore, a significant positive effect for techno-invasion on emotional exhaustion was found (*B* = .39, *p* < .01, [.24, .54]), indicating that reductions in techno-invasion facilitate reductions in emotional exhaustion. The indirect effect of the intervention on emotional exhaustion through techno-invasion was significant and the direct effect of the intervention became non-significant in the presence of the mediator (techno-invasion) which provides support for full mediation. Thus, reductions in techno-invasion mediated the effects of the intervention on burnout and hypotheses 7b was confirmed.
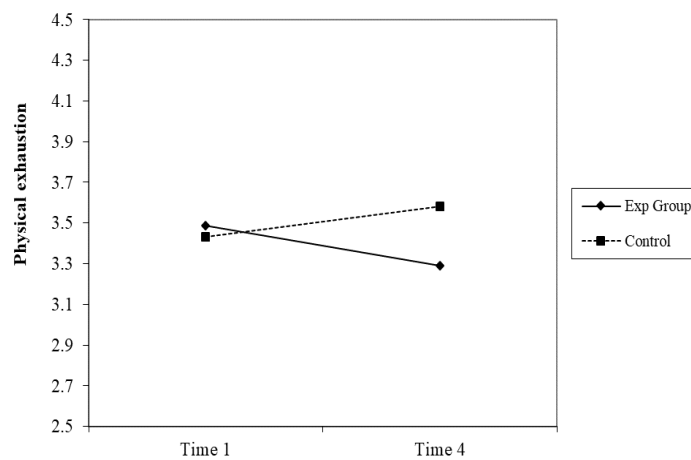


**Figure 5.6** Change in physical exhaustion in the experimental vs. control group over time.
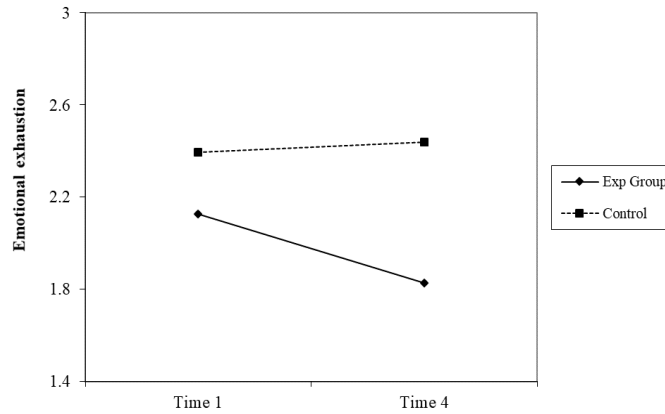
**Figure 5.7** Change in emotional exhaustion in the experimental vs. control group over time.

While no significant direct or indirect effects for e-mail monitoring frequency on physical exhaustion were found, a significant direct effect on emotional exhaustion was detected ($B$ =.25, $p < .05$, [.09, .41]), which suggests that reductions in e-mail monitoring frequency lead to reductions in emotional exhaustion. The indirect effect of the intervention on emotional exhaustion through e-mail monitoring frequency was significant ($B = .09$, $p < .05$, [-.16, -.01]) and the direct effect of the intervention became non-significant in the presence of EMF, thus supporting full mediation and providing support for hypotheses 7d.

Furthermore, while WHC and psychological detachment and performance levels improved in the EG, small improvements were also present in the control group, and no significant treatment effects could be detected. Therefore, hypotheses 2, 4, and 8 were not supported. Due to the non-significant treatment effects, no further mediation tests were conducted leaving hypotheses 3, 5, 9 and 10 not confirmed.

**Table 5.5.** The mediating effect of perceived email stressors

| | DV: Physical Exhaustion | | | | DV: Emotional Exhaustion | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Model 13 | | Model 14 | | Model 15 | | Model 16 | |
| | *B(SE)* | 95%CI | *B (SE)* | 95%CI | *B(SE)* | 95%CI | *B(SE)* | 95%CI |
| *IV:* TxGroup | -.27*(.13) | [.49, -.05] | -.28*(.12) | [-.50, -.06] | -.24 (.17) | [-.53,.04] | -.25 (.17) | [-.54, .04] |
| *M1:* TI | .28**(.09) | [.12, .43] | | | .39** (.09) | [.24, .54] | | |
| Indirect effect | -.07*(.03) | [-.12, -.01] | | | -.10* (.04) | [-.17, -.03] | | |
| *M2:*EMF | | | .16 (.09) | [.01, .32] | | | .25* (.10) | [.09, .41] |
| Indirect effect | | | -.06 (.04) | [-.12, .00] | | | -.09* (.04) | [-.16, -.01] |

*Note:* IV = independent variable; DV = dependent variable; M = mediator; EMF = email monitoring frequency during nonwork time; Control variables are not shown as they are displayed in Table 5.4. *p <.05; ** p < .01.

## 5.4. Discussion

The current study provided a conceptual replication of an ICT intervention by Siegl et al., (2023b) to examine its generalisability across a private sector sample. The recent replication crisis has created a lack of confidence the replicability of experimental research (Shrout & Rogers, 2018. Interventions may fail to replicate due to contextual differences that influence the targeted outcomes, such as their organisational work environment or culture (Randall & Nielsen, 2012), which highlights the importance of evaluating interventions across different contexts and settings before assuming generalisability across samples. The findings of the present study revealed considerable mean difference in organisational expectations of email monitoring between the public sector sample (M(experimental group) = 1.93; M(control group) = 1.81) and the private sector sample (M(experimental group) = 2.59; M(control group) = 2.34). In addition to this, the qualitative focus groups showed that in the private sector sample, participants reported that there was an accepted 24/7 expectation due to global nature of the organisation which created a 'never ending demand' of emails (Appendix A) . Taken together, this suggests that there are, indeed, a stronger 'on culture' and more excessive demands for employees' availability and responsiveness through email in the private sector. This provides evidence for the hypothesized meaningful differences between the two organisational contexts and supports the rational to conduct the current replication study.

During the intervention, rules around emailing times and days were implemented, the importance of disconnecting from work-emails during non-work time was explained and methods for effective inbox as well as work-home boundary management were highlighted. Concurrent with the original study, we found significantly larger decreases in ICT demands of techno-invasion and email monitoring frequency during non-work time in the experimental group in response to the intervention when compared to a control group. This is supported by supplementary analysis of objective email volume in and outside of working hours (Appendix D, 2), which shows that emails read and sent during non-work time significantly reduced in the experimental group but not in the control group which indicates an improved ability to disconnect from incoming emails. Thus, it can be said that the introduction and integration of the current email guidelines was effective in reducing feelings and behaviours associated with technostress and constant work connectivity.

However, contrary to predictions and the findings of Siegl et al., (2023b), no treatment effects for techno-overload and time spent on emails during nonwork time were found. The trend in means would suggest that techno-overload levels remain largely unchanged with minor improvements in the EG, while levels in the control group increase slowly. Hence, although no significant reductions were found over the four-week post intervention assessment period, the intervention may have had a buffering effect. In support of a potential buffering effect, the numbers of emails sent, received, and read during the workday remained largely unchanged in the EG, but increased in the control group (appendix D, 2, supplemental materials 2).

When comparing the mean number of emails received during the day, private sector workers received almost 100 emails more than public sector workers. Additionally, emails sent by managers during non-work time significantly reduced following the intervention however, contrary to public sector findings, no reduction in emails received during non-work time was observed. This suggests that the differing results may be due to differences in email communication patterns. The public sector is more oriented towards internal than external processes (Parker & Bradley, 2000) and private firms are seen as more commercially focused and competitive (Boyne, 2002). Thus, in contrast to public sector workers, who reported that their communication is largely contained within one's team and to public clients (Siegl et al. 2023b), private sector workers may be subjected to more email traffic from outside their participating team, such as commercial departments, collaborating international teams or business customers. Thus, while the email guidelines may be effective in reducing techno-overload on a team level  basis in the public sector, a larger role out may be needed to achieve similar improvements in the private sector. Such a conclusion may also be reached regarding the non-significant treatment effects of organisational expectations for email monitoring (OEEM), as due to the small scale and trial basis role out of the guidelines, perceptions of organisational expectations may not have been directly addressed (Siegl et al., 2023b). Alternatively, whilst this research explored changes in demands, it cannot be discounted that the intervention created a parallel adjustment in resources. Whilst this was not formally assessed, it is possible that the email rules enhanced skills in email management in the public sector sample which facilitated beneficial effects of the intervention. Thus, the different replication results could be due to sample characteristics where the current sample might have already had higher resources in terms of email management skills. Ultimately, although medium and large effect sizes were detected for the intervention effects on techno-

invasion and e-mail monitoring frequency, only the direct effect on techno-invasion was replicated. These inconsistencies highlight the importance of considering differences in organisational work environments and indicate that there may be important boundary conditions that determine who this intervention works for and under which circumstances.

We further examined how the intervention affects employee wellbeing and performance outcomes. Overall,  among all effects, only the mediated effect on physical exhaustion through reductions in techno-invasion was successfully replicated.  Nevertheless, the present results demonstrated significant improvements in burnout, highlighting the interventions effectiveness in reducing physical and emotional exhaustion levels within the current sample. In line with previous research that attributes increases in burnout to ICT demands that facilitate constant connectivity (Srivastava et al., 2015; Dettmers, 2016; Belkin et al., 2020), the intervention effects on burnout were mediated by techno-invasion (physical and emotional exhaustion) and e-mail monitoring frequency during nonwork time (emotional exhaustion only). The improved environmental conditions associated with reduced techno-invasion have likely stalled work demands from invading workers private lives and in line with the work-home resources model, the reduction in sustained exposure to work demands has subsequently enabled workers to adequately replenish their resources which ultimately reduced feelings of physical and emotional exhaustion (Ten Brummelhuis & Bakker, 2012). Indicative of such an effect is  the increase in mean psychological detachment scores over time in the experimental group however, contrary to the original results, no significant treatment effects for psychological detachment or work-home conflict were found.

There are two main differences to the original study regarding the current burnout results. First, while physical exhaustion improved significantly across both studies, Siegl et al., (2023b) found significant reductions in cognitive exhaustion but not emotional exhaustion, whereas the current results show the opposite pattern. Secondly, e-mail monitoring frequency mediated the effects on emotional exhaustion but was not found to be a mediating factor in the original results. Because improvements in techno-overload mediated the intervention effects on burnout in the original study, it is likely that differences stem from the lack of improvement in techno-overload levels. Considering that the current sample had higher baseline levels of e-mail monitoring frequency and techno-invasion and lower starting levels of techno-overload, it is possible that the intervention operated differently due to workers greater need for reduced ICT demands associated with work-home invasion and connectivity. Thus, although this was not formally tested, the current results indicate that the

generalisability of intervention effects might be complex and subject to boundary conditions such as individual or sample characteristics (e.g., pre-existing resources relating the email management skills or preferences for work-home integration) and contextual organisational characteristics (e.g., email communication patters, connectivity norms). Person-intervention and organisation-intervention fit can be an important factor in determining intervention success by enhancing readiness for change (Randall & Nielsen, 2012). Workers may have had pre-existing mechanisms to address techno-overload related to the high numbers of incoming emails, such as effective inbox management skills, which buffered negative effects on cognitive exhaustion. However, addressing ICT demands such as techno-invasion and e-mail monitoring frequency may be more difficult on an individual basis due to the infectious nature of competitive workplace norms. Work environments that operate 24/7 may be more closely linked to feelings of physical and emotional exhaustion due to constant emotional depletion and lack of emotional recovery associated with the pressure to always be available (Belkin et al., 2020) which impacts wellbeing irrespective of the physical time spent on emails during non-work time (Dettmers, 2016; Gaudioso, 2017; Becker, 2021). Thus, the current intervention may be particularly effective in this context as it clarifies expectations around connectivity, requires aligned self-behaviour (no emailing during non-work time unless it is urgent) and realigns team norms in ways that prioritise recovery and transfers boundary control back to individuals (Belkin et al., 2020).

Lastly, contrary to predictions, no treatment effect for performance was found. Although performance ratings increased over time, this increase is observed across both groups and can therefore not be attributed to the intervention. Negative performance implications may be attributed to a lack of effective focus due to techno-overload (Amabile et al., 1996; Tarafdar et al., 2014; Delpechite et al., 2019) and cognitive exhaustion (Demerouti et al., 2007). In line with this, the original study, found that the intervention effects on performance were fully mediated by reductions in techno-overload and subsequent improvements in physical and cognitive exhaustion. Thus, the intervention's ability to improve performance may be limited due to non-significant treatment effects on techno-overload and cognitive exhaustion.

### 5.4.1. Theoretical contributions

This study demonstrates that the effects of this ICT intervention on burnout were mediated by improvements in two ICT demands, namely, techno-invasion and email

monitoring frequency during non-work time. It therefore provides additional support for the utility of implementing the current email guidelines to achieve changes in ICT demands as a means for improving employee wellbeing. Since changes in contextual work demands were associated with changes in employee wellbeing outcomes that can be experienced in the work and home domains (i.e., physical and emotional exhaustion), this study provides further support for the theoretical assumption that gain spirals can result from changes in demands (Siegl et al., 2023b), and the suitability of the work-home resources model (Ten Brummelhuis & Bakker, 2012) as a framework for ICT interventions. Furthermore, ICT demands associated with connectivity pressure and behaviour, such as techno-invasion and email monitoring frequency, typically lead to feelings of low boundary control, which facilitates negative effects on wellbeing (Dettmers, 2016; Mellner, 2016; Piszczek et al., 2017; Park et al., 2020). In line with boundary theory, these findings highlight how creating work environments that enable workers to draw a stronger boundary between work and home domains contribute to improvements in employee wellbeing.

The differences in results between the Siegl et al., (2023b) and the current study suggests that there may have been different pathways through which ICT demands affect employee outcomes. Belkin et al., (2020) suggest that ICT demands can lead to negative individual and organisational outcomes via either an emotional pathway (through emotion depletion) or a behavioural pathway (via lack of work detachment). The significant improvements in physical and emotional exhaustion through techno-invasion and e-mail monitoring frequency suggest that the emotional pathway was the main driver in the current sample. Emotional exhaustion is said to be the main component of burnout and is defined as a chronic state of emotional depletion triggered by ongoing stress (Cropanzano et al., 2003; Hobfoll & Shirom, 2001; Belkin et al., 2020). This supports the premise that the constant emotional activation and the inability to leave work at work derived from normative expectations, depletes resources regardless of the physical time spent on emails or the effort made to separate work and home domains (Belkin et al., (2020) and that this could be tackled by creating more positive emotional environments that buffer emotion depletion and rebuild emotional resources (Bono et al., 2013; Butts et al., 2015). The results of the original study may have been driven by a behavioural pathway where negative wellbeing outcomes were a result of physical and cognitive resource depletion through low detachment rather than emotion depletion (Belkin et al., 2020). Thus, the current study contributes to the understanding of how ICT influences wellbeing outcomes by demonstrating that the same

intervention could improve wellbeing outcomes differently depending on the underlaying pathway that drives negative wellbeing outcomes. The study highlights that generalisability of intervention effects should not be assumed and certain boundary conditions may determine who this intervention works for under which circumstances. For example, whilst this research did not formally assess resources, individual characteristics, such as pre-existing differences in resources between the samples as well as organisational contextual factors may play an important role intervention effectiveness.

Belkin et al., (2020) argue that unlike physical and mental detachment from work, emotional exhaustion is a form of strain where workers may not be consciously aware of the stressors. This suggests workers may experience emotional exhaustion because of high ICT demands but do not realise this as the source of stress. This may be particularly relevant to workers with low segmentation preferences who tend to use ICT more actively during non-work time. Although research suggests that a preference for work-home integration buffers against negative the impact of ICT, the current results would suggest that implementing the current email guidelines intervention to foster more positive emotional work environments that are supportive of stronger work-home boundary creation, should have beneficial effects irrespective of participants segmentation preferences.

### 5.4.2. Practical implications

In the face of the current replication crisis (Shrout & Rogers, 2018; Maxwell et al., 2015), this study makes an important practical contribution by demonstrating how the effects of Siegl and colleague's (2023b) email intervention translate to the private sector and thus, enhancing understanding around it's generalisability. Considering the need for interventions that tackle ICT demands (Ninaus et al., 2021), the positive, yet different, replication results provide a promising perspective for organisations looking to implement stricter rules around email communication. With the short training session of 1 hour and the uncomplicated online delivery method, this intervention offers a cost- and time-efficient option for organisations that want to better manage ICT demands and enhance employee wellbeing.

The difference between the original and current findings provides valuable insight into future intervention strategies. For example, Context-intervention fit is an important factor for interventions success  (Randall & Nielsen, 2012) and may have been higher in the public sector, due to the alignment between intervention level and localised communication patterns. To enhance the C-I-fit and thereby the effectiveness of future private sector ICT

interventions, a larger role out, i.e., on an organisational level, should be considered. Additionally, considering the larger mediating effect of techno-invasion on both physical and emotional exhaustion, the current study highlights the importance of focusing on the improvement of technostress creators associated with constant connectivity demands, by fostering more emotionally supportive ICT-work environments, to reduce employee burnout. While having behavioural strategies to disconnect is important, having an emotional break from work issues appears particularly important for emotional exhaustion. This is in line with studies showing that emotional intelligence of leaders in a virtual workplace moderated the effects of e-leadership skills on employee emotional wellbeing (Chaudhary et al., 2022). The current study highlights that this could be achieved by creating an environment where workers are collectively relieved of the responsibility to monitor and act on incoming emails during non-work time without having to drastically reduce the number of incoming emails. In line with the original study, this emphasizes the need for worker's 'right to disconnect' through the cultural integration of specific emailing rules rather than a blanket ban of out-of-hours emailing. Implementing such rules may create beneficial outcomes even if workers do not articulate emails as a source of stress and could be integrated in a pro-active stress management strategy to shape a positive work-environment sustainable in a post-covid world.

### 5.4.3. Limitations and future work

While this study has numerous strengths, such as its quasi-experimental design, there are important limitations that need to be raised. First, although the study used an experimental and wait-list control group, meaning both groups knew they would come to receive an intervention and be observed accordingly, the impact of a Hawthorne effect cannot be ruled out as treatment was not received by both groups simultaneously. Future research may benefit from using an inert-treatment control group to rule out the potential of a Hawthorne effect (Holman et al., 2010). Such a design may also compare different kinds of email rules to examine whether some are more effective than others. This may help condense the current email guidelines to lower number of rules, thus requiring less perceived change effort and greater adherence while maintaining the same effectiveness.

A further limitation is the inability to randomly assign participants to groups and the non-equivalence of samples at time 1, which may have led to intervention-induced halo effects (Holman et al., 2010). Nevertheless, non-random sampling bias was examined and is unlikely to threaten the validity of the current results (Appendix D, 1b). Additionally, it may

be worth noting that the current sample not only differs from that of the original study by employment sector but was also heavily male dominated, while that of Siegl et al., (2023b) was female-led. While both studies controlled for the effects of gender, it cannot be ruled out that differences in results may be partly due to such sampling differences. Although an initial comparison between the original and current results indicate that the effect of ICT demands on wellbeing in a female-dominated public sector sample may be primarily driven by behavioural pathways and by emotional pathways in male-dominated private sector samples, this assumption remains to be formally tested. Future research may want to examine whether there are boundary conditions for behavioural or emotional pathways, such as personal or work characteristics. This may enable future interventions to increase person-intervention and context-intervention fit and thus enhance the likelihood of intervention success (Randall & Nielsen, 2012).

A further limitation are differences in context during which the current replication study occurred. Although the current study commenced only 1 month after the original study ended, and both occurred during the Covid-19 pandemic, the United Kingdom had since entered a new lockdown phase where workers were subjected to a work-from-home-order and schools closed. Such contextual differences may have further contributed to the differences in results, especially the non-significant treatment effects on work-home conflict and psychological detachment (Vaziri et al., 2020; Žiedelis et al., 2022). Furthermore, Piszczek et al., 2017, found that ICT pressure only impacted emotional exhaustion if subsequent ICT use was associated with reduced boundary control. It is possible, that the context of a work-from-home order drastically reduced workers boundary control and therefore enhanced the effects of ICT demands on emotional exhaustion. Nevertheless, considering the pro-found effects of lockdowns on mental health (Niedzwiedz et al., 2021; Chandola et al., 2022), it is promising to see that the intervention was able to create improvements in burnout levels under these circumstances. Considering that hybrid working is becoming the reality in many sectors and work-related stress and mental health problems remain on the rise (HSE, 2021), the current study offers a method to better manage ICT in the post-pandemic world and future research should explore how the current email guidelines intervention applies to this context.

As in the original study, a limitation is the relatively short follow up timeframe. While it can be said that the beneficial effects of the intervention remain for up to 1 month post implementation, no conclusions can be made about further longevity of effects. Due to this, it

is unclear whether certain outcomes, such as techno-overload, would overtime, demonstrate significant treatment effects. Future research needs use a longer follow up design of up to 6 – 12 months to examine whether the integration of the guidelines can be upheld outside the experimental setting and whether these continue to have positive effects on ICT demands, employee wellbeing and performance outcomes.

Finally, an important limitation to this replication study is the use of the same author team in both experiments. While this means that differences in results are unlikely to stem from differences in intervention delivery, it is unclear whether the intervention can be replicated by other facilitators (Dello Russo & Stoykova, 2015). Experimenter bias is a potential cause for greater success in replications facilitated by the same authors ( Makel et al., 2012) and particularly in training interventions, the impact of the training facilitator on training effectiveness is substantial (Burke & Hutchins, 2008; Towler & Dipboye, 2001; Dello Russo & Stoykova, 2015). Thus, researchers outside of the current author team should replicate and extend the current study to further enhance the generalisability of its effects.

## 5.5.  Conclusion

In conclusion, this study has shown that a change in ICT constant connectivity demands was the mechanism through which an email intervention influenced employee burnout (physical and emotional exhaustion). In congruence with Siegl et al., (2023b) it highlights the importance of addressing technostress creators such as techno-invasion by building more positive technological environments that enable emotional detachment from work issues. Nevertheless, the non-significant replication results highlight the complex role of boundary conditions which impact the generalisability of intervention effects and indicate that there may be different pathways driving the effects of ICT on employee wellbeing (Belkin et al., 2020). In the face of the current replication crisis, the current findings further understandings on which effects of an ICT demands interventions on employee wellbeing can be replicated across contrasting organisational environments. Despite the inconsistent findings, the current results should encourage private organisations to consider the implementation of the email guidelines to better manage ICT connectivity and worker health. Finally, in light of the new hybrid working trends and ongoing mental health crisis, these findings should encourage academics to further explore initiatives to reduce ICT demands to improve wellbeing, and policy makers to promote a "right to disconnect" that is based on the

cultural integration of healthy connectivity norms and emailing rules rather than a blanket ban to emailing.

# Chapter 6: GENERAL DISCUSSION

The integration of ICT into modern work practices had offered immense value, providing newfound resources and many important positive outcomes for employees (Joyce, et al., 2010; Messenger, 2018; Adekoya et al. 2022). While the beneficial effect of ICTs such as emails cannot be discounted, research has emphasised that it simultaneously introduced new demands that can lead to a number of negative wellbeing and performance outcomes. On the one hand, employees can perceive devices (i.e., work mobile phones) as empowering, thereby increasing professionalism, productivity, autonomy and control, on the other hand, mobile ICT can facilitate constant work connectivity, work-life conflict and burnout (Cavazotte et al., 2014; Wright et al., 2014; Stich et al., 2015). This complex interplay of positive and negative demands created by ICT is why it was termed a "double sided sword" (Den-Nagy, 2014; Stich et al., 2015). Given the risk the "dark side" of technology presents to employee health and well-being, it is important to find ways to counteract the negative effects of ICT while maintaining its positive ones (Tarafdar, D'Arcy, Turel, & Gupta, 2015) The aim of this thesis was to explore the conceptual nature and negative outcomes of ICT demands and to identify effective mechanisms to counteract these.

Based on a review of the existing literature, a taxonomy of three overarching ICT demands conceptualisations was developed, demonstrating that research has examined ICT demands as either 1) 'multi-dimensional technostress constructs', 2) 'ICT-related pressures and expectations', and 3) 'ICT-based connectivity behaviour. The negative outcomes associated with each conceptualisation were identified through a systematic review of quantitative research and synthesised using the framework of the work-home resources model. Further, this thesis developed an email-specific ICT intervention which aimed to alleviate ICT demands across each category and associated negative employee outcomes in the work and home domain. The intervention comprised of the implementation of new email guidelines in work-teams and was evaluated in public and private sector firms. This research demonstrates the effectiveness of this intervention in reducing techno-stressors as a means for

improving employee wellbeing (burnout/exhaustion) and discusses differences in intervention outcomes across different work contexts. This final chapter begins by outlining the main overall contributions this thesis makes, before discussing the findings of the three research articles in more detail and highlighting the implications for theory and practice. The chapter closes by discussing the limitations of this thesis and potential avenues for future research.

## 6.1.    Main Thesis Contributions

The three presented articles have each produced important findings worth discussing. However, before diving deeper into this, at this point it may be helpful to outline the key contribution this thesis has made. This will provide a better understanding of how the current findings tie together and why these are important.

### *Article 1*

First, the comprehensive systematic review of dispersed ICT demands research strands led to the development of an ICT demands framework that provides greater conceptual clarity and a more well-rounded understanding of how work-related ICT impacts users. With the vastly growing body of research in this field, and the ever-growing reliance on ICT, taking stock of the empirical research was an important and urgently needed step to inform future research. For this review to take a digestible and coherent shape, a new framework, specifically for ICT demands was needed. While Ragu-Nathan's (2008) framework has advanced the way we conceptualise stressors associated with workplace technology, the drawback of this model is that is not specific to ICT. Technostress creators of techno-insecurity, complexity and uncertainty are relevant concerns now, particularly with the rise in new software systems and AI (Malik et al., 2021), however, these may be less central to stress caused by mobile ICT, such as emails.

Technostress creators of overload and invasion on the other hand are at the heart of the email stress debate. From there, the ICT literature has expanded significantly over the past 15 years. Specifically, the review provides novel insights by demonstrating that technostress research has progressed in its investigation of how technology impacts workers by focusing specifically on pressures for constant work connectivity (ICT-related pressures and expectations) and prolonged ICT use during non-work time (ICT-based connectivity behaviour). These strands are specific to mobile ICT and are conceptualised as extended arms of the techno-invasion and techno-overload stressor respectively in the newly developed ICT

framework. The new framework provides a taxonomy through which the different types of ICT demands (i.e., multidimensional technostress creators, ICT-related pressures and ICT-based connectivity behaviour) can be categorised and reviewed alongside one another. Ultimately, the present framework takes Ragu-Nathan's work further by reflecting the technological developments that occurred since its development 15 years ago and adequately capturing the impact ICT in the home environment.

This is particularly important as the present review of technostress research showed a dominant focus on work outcomes. This is in line with a recent review of the outcomes of technostress which did not reflect any impact on home outcomes such as recovery from work (Borle et al., 2021). This presents an incomplete picture of the impact of ICT demands and highlights the need for a more nuanced ICT framework. This review demonstrated that a more nuanced focus on demands associated with mobile ICT (e.g., techno-invasion/ICT-related pressures and techno-overload/connectivity behaviour) showed significant adverse outcomes in the home environment. This may get lost in the technostress framework as it is considered along the other stressors, particularly if these are aggregated to a technostress factor. This is in line with recent meta-analytic findings which highlight the need for future research to explore the individual effects of the techno-stress creators in non-aggregated state (Nastjuk et al., 2023). Expanding this model and creating a specific ICT demands framework was particularly important as research increasingly focuses on these more nuanced dimensions highlighted by the 21 studies looking at ICT connectivity pressure and 42 studies on connectivity behaviour, over half of which have been conducted in the past 5 years. Thus, while this framework was initially developed to structure the systematic review, it can also function as a novel framework for others to use. This framework captures all the relevant stressors that apply to ICT (such as emails) and offers a better way to look at the existing literature. For future research, this framework offers an opportunity to integrate research into a coherent body of work because it better reflects the existing stressors particularly relevant to modern, mobile ICT.

Additionally, the findings of the systematic review confirm that across the ICT demands literature the most robust evidence exists for the impact on work-home conflict (N=33), burnout and exhaustion (N=27), work-related stress (N=23), recovery (N=19) and performance (N=10). This is in line with recent meta-analytic findings showing while technostress has a detrimental impact on both psychological and behavioural outcomes, the former is more pronounced (Nastjuk et al., 2023). The findings of the present review

compliment this work and take the literature further by providing  nuanced insights into the specific psychological (here attitudinal) and behavioural (here behavioural and production) outcomes associated with technostress that cannot be explored in a meta-analysis and allow for comparisons with additional demands specifically associated with mobile ICT.  Thus, by considering the literature from all angles and applying a framework that integrates both work and home outcomes, this review provides researchers and practitioners with a more holistic understanding of the impact of work-related ICT, which, considering the increasingly blurred lines between work and home, has never been more important (Carnevale & Hatak, 2020).

Ultimately, the present work provides a novel ICT framework that offers substantial value for future research to integrate findings into a more coherent body of literature. In this it can also serve as a building block to bring parsimony to the meaning of measurements in this field. Importantly, by highlighting the shared outcomes of different ICT demands conceptualisations, the present findings can also inform the development of holistic ICT intervention strategies. Specifically, the health impact of poorly managed ICT on burnout is a widely shared concern (Berg-Beckhoff et al., 2017; Dettmers, 2017;  Ninaus et al., 2021) and effective mechanisms to counteract these are urgently needed. The current findings indicate that such strategies need to target different types of ICT demands conceptualisations in combination and at a meaningful level to fully address the source of stress and minimise its impact. This leads straight into the second main contribution of the present work:

*Article 2*

This thesis offers the first exploration of an organisational email-stress intervention that addresses different ICT demands, including techno-overload and constant work connectivity, through the team-level implementation of specific email guidelines. The results revealed that adherence to stricter email rules is effective in reducing ICT demands of techno-overload, techno-invasion, as well as connectivity behaviour in form of email monitoring frequency and time spent on emails during non-work time. Importantly, further investigations revealed that this intervention served as an effective strategy to improve work-home conflict, psychological detachment, burnout, and performance.

As initially highlighted it is important to test whether interventions work due to a change in targeted job characteristics (here ICT demands) to demonstrate that such effects do not occur due to the participation in the intervention per se. The tested mediation model offers meaningful insight into the processes underlying the present intervention and confirms

that the email guidelines were effective in achieving such outcomes because they addressed the stressors they were designed to influence. Specifically, it was found that reductions in techno-overload and techno-invasion were the mechanisms that mediated the beneficial impact on wellbeing and performance outcomes. This provides strong empirical support for the influence of these stressors and the importance of addressing both in interventions when aiming to achieve positive individual and organisational outcomes. By focusing on a reduction on work demands as the mechanism of change rather than an increase in resources, the present findings make important theoretical contributions by testing an often-underexplored pathway in stress theories and interventions. The proposed intervention effects were based on the WHR model, which is rooted in the principles of COR theory, and has a large focus on building resources. Yet, this thesis has highlighted the importance of a reduction in demands which was empirically supported by the findings of the interventions. This advances this theoretical framework by demonstrating that gain spirals can result from reductions in contextual work demands and suggests that, in the context of ICT, this may be a fundamental requirement for sustainable resource recovery and improvements in work-home outcomes. This is in line with COR theory which states that contextual demands that have resource draining effects need to be absent for resource recovery to occur (Hobfoll, 2002). Taking this approach in future research will advance theory by strengthening the evidence base on demand-oriented gain spirals. This can provide additional insights into the conditions under which one may choose to focus on demands or resources and highlight the value of focusing on both theoretical pathways in intervention research.

Interestingly, although connectivity behaviour significantly reduced, no mediation effect was detected, which provides novel insights into the type of mechanisms driving the effectiveness of ICT interventions. These findings can be explained through the perspective of the transactional model of stress, which places an emphasis on workers subjective evaluations of demands and subsequent coping appraisals (Lazarus & Folkman, 1984) and formed the theoretical foundation of the technostress framework (Ragu-Nathan et al., 2008). In the context of ICT, the findings suggest that workers ability to cope is informed by 1) the extent to which one feels satisfied with how they manage their emails throughout the workday and 2) the extent to which one believes that additional emails will be received and need to be actioned during non-work time. As techno-overload and invasion rather than email monitoring frequency and time spent on emails during nonwork time mediated the treatment effects, it could be said that this subjective coping appraisal is a more influential underlaying

mechanism in the relationship between ICT-demands and employee WHC, wellbeing and performance than the physical time workers spend on emails (Gaudioso et al., 2017).

These findings also align the principles of boundary theory (Ashforth et al., 2000; Clark, 2000) which highlights the importance of workers ability to control how they manage the boundary between work and home for their wellbeing. Previous research has shown some inconsistencies when examining the effects of time spent working via ICT during non-work time (e.g., Derks et al., 2015) and calls to consider certain boundary conditions such as the level of agreement between individual segmentation preference and group segmentation norms (Yang et al., 2019). Although this was not directly assessed, the e-mail guidelines have likely increased group segmentation norms as they implemented stricter rules around out of hours communication. Thus, reducing the permeability between work-home boundaries and increasing boundary control (Dettmers, 2017; Kossek & Lautsch, 2012). Future research should include measures of boundary control to further test this assumption. In line with this, the current findings demonstrate the importance of workers subjective appraisals of their technological work environment and suggest that considering such evaluations alongside the physical aspects of ICT connectivity (e.g., email use during non-work time) could aid our understanding in this area.

This can inform future intervention strategies and policy advice in the quest for developing sustainable healthy and productive work environments. In light of the right to disconnect, the present findings offer a first step towards generating an evidence-based approach to managing constant connectivity demands and a valuable guide on how to implement changes that support this movement in a practical way. Ultimately, the findings indicate that making cultural changes and focusing on workers subjective interpretations of how ICT impacts them is a more promising approach than banning out of hours emailing.

*Article 3*

The conceptual replication of the email guidelines intervention demonstrates that the beneficial effects of reducing constant connectivity to work and subsequent alleviation of burnout symptoms can be replicated in a different sector and sample. This strengthens the theoretical underpinning and empirical evidence base of the intervention by showing that the effects on techno-invasion, email monitoring frequency and physical exhaustion did not occur by chance or were an artifact of the participating sample. In turn, this provides greater confidence to policy makers, practitioners and organisations that this is an effective, save and

generalisable strategy for managing ICT demands. At the same time, the majority of effects were not replicated which emphasises the influence that boundary conditions can have on the effectiveness of interventions. Together these results contribute to calls from scholars to create stronger experimental designs when evaluating burnout interventions, to examine the mechanisms through which interventions achieve or not achieve their planned outcomes, and to create a better understand for who these interventions work under what circumstances (Holman et al., 2010; Maricutoiu et al., 2016; Pijpker et al., 2020).

Additionally, the replication uncovered differences between the two intervention studies which provide an insight into how different work settings may shape the impact of ICT demands which raises important future research questions. The intervention effects on techno-overload, time on email, WHC, psychological detachment and cognitive exhaustion of Article 2 (public sector) were not confirmed in the private sector. These differences could have a number of different explanations and require further exploration and research attention. Regarding the impact on ICT demands, it may be that given the higher level of email volume, workers had pre-existing strategies to counteract techno-overload. Issues of constant connectivity are driven by group phenomena and may be more difficult to address on an individual level, thus creating a greater need for interventions to target such stressors in the private sector sample. Additionally, differences in email communication patterns may contribute to these differences. Addressing techno-overload from a team level may not be sufficient if more communication comes from outside the team than within. As techno-overload increased in the control group but remained unchanged in the intervention group, the guidelines may have had a small buffering effect. Perhaps inconsistent findings were an artefact of the study design in this context and future research needs to evaluate whether consistent findings can be achieved if this intervention was rolled out wider and evaluated over a longer period. On the other hand, the email guidelines did not solely target demands but also resources such as email management skills. Whilst this research did not formally assess resources, these findings indicate that alongside a change in demands there is also a parallel adjustment in resources. The sample in the private organization might have already had higher resources in terms of email management skills which may have made participants less susceptible to the changes. Future research should examine whether this serves as a boundary condition for the effectiveness of this intervention.

Regarding the impact on wellbeing and performance outcomes, on the one hand, in the original study, techno-overload mediated the improvement in WHC, psychological

detachment, cognitive exhaustion and performance. Therefore, it may be the lack of overload reduction that has caused these inconsistent intervention effects which further highlights the importance of focusing on additional email demands beyond out-of-hours connectivity. On the other hand, recent work highlights different pathways that underline the impact of ICT on wellbeing which may have contributed to the differences in results (Belkin et al., 2021). The emotional pathway, which is enacted through constant emotional draining may have been more pronounced in the current sample, in comparison to the behavioural pathway which expresses itself through a lack of detachment. Emotional exhaustion is the main component of burnout, but individuals are often unaware of the stressors that contribute to this. For example, if one struggles disconnecting from work, it may be easy to pinpoint reasons for this, such as constant email checking behaviours or worry about an important upcoming meeting. This is in line with recent meta-analytic conclusions that emotional exhaustion is primarily driven by connectivity pressure, rather than behaviour, while detachment is driven by both (Thörel et al., 2022).  However, if one feels emotionally exhausted, it may be more difficult to identify the causes. Particularly in a private sector setting that has high commercial interests and operates internationally, the 24/7 email traffic and constant availability expectations may be particularly draining. Although a person-environment perspective would suggest that individuals choose their workplace in accordance with their preferences, the present findings may suggest that workers may be unaware of hidden emotionally draining stressors of this environment.  This would question the assumptions that low segmentation preferences protect workers from the negative impact of constant connectivity demands. Future research needs to generate a better understanding in the relationship between ICT demands and emotional exhaustion, particularly in an international work setting. Research that explores the psychological impact of working in international teams is scarce and considering some potentially important differences that this thesis has highlighted, this presents a fruitful avenue of future investigation. Here it would also be valuable to explore whether segmentation may have a limit to which they can buffer any negative impact. Although future research is needed to fully verify this, the current results would suggest that stricter email rules and higher segmentation norms may have a positive impact regardless of the nature of work and segmentation preferences.

Overall, the findings of this thesis are particularly relevant in the current context, where the rapid changes in technological work environments brought by the covid-19 pandemic have created even greater uncertainty of how to best manage work-related ICT and

employee wellbeing. Empirical evidence has mounted, showing the profound and disproportionately negative impact ICT can have, and scholars have stressed the need for experimental research that identifies effective interventions to counteract these for years. Considering the growing reliance on ICT and the demand for remote/hybrid working (Messenger, 2018; Vu et al., 2020; Reznik et al., 2022; ONS, 2022; Wigert & Agrawal, 2022), as well as the rising levels of work-related stress and poor mental health, sickness absence and lost productivity (HSE, 2021) this thesis makes significant contributions to the literature by directly addressing this gap. Collectively the empirical studies within this thesis provide an evidence-based intervention that offers an effective strategy to better managing ICT demand, particularly email related techno-overload and -invasion, as a means for improving wellbeing and performance outcomes. This is of substantial value to worker wellbeing, organisation's bottom lines and the wider economy as it offers a theoretically informed and empirically tested intervention targeted at important stressors that continue to increase in relevance in a post-covid world.

## 6.2. Discussion of Findings

This section shows how each article has contributed to the overall research aims and outputs and provides a more detailed discussion of findings.

At its outset, this thesis had two overall research aims:

1. To produce a systematic review of existing ICT demands and their associated negative outcomes.
2. To empirically examine the effectiveness of an email-specific ICT intervention across different samples and settings.

To address these aims, three studies were conducted which were presented as three separate, yet interconnected research articles which answer specific research questions. Taking a comprehensive, interdisciplinary approach to the literature, this thesis first set out to review how work-related ICT demands are assessed across different research strands to advance current understandings of what divergent ICT demands exist (Research Question 1) and what the associated negative outcomes are (Research Question 2). From this, the thesis produced a taxonomy of three overarching categories of ICT demands conceptualisations and a systematic review of the negative attitudinal, behavioural and production outcomes in the work and home domain (Research output 1, Article 1).

Second, this thesis explored how such ICT demands could be addressed to reduce their negative impact on workers. To advance knowledge in this area, a quasi-experimental design was employed to empirically examine the impact of an email-specific ICT intervention on perceived ICT demands (research question 3) as well as employee wellbeing outcomes, in form of work-home conflict, psychological detachment and burnout (research question 4), and performance (research question 5). It was further sought to examine the underlying mediating mechanisms that drive the effects of this intervention (research question 6). Ultimately, this thesis developed a set of specific email guidelines which serve as an effective intervention strategy for reducing ICT demands as a means for improving employee wellbeing and performance (research output 2, Article 2).

Third, it was set out to examine whether the intervention effects remain significant across different samples and settings (research question 7). By conceptually replicating the email intervention, in a multi-national private sector firm, as opposed to the UK public sector setting of the original study, this thesis strengthens the evidence base of the developed email guidelines and demonstrates that the beneficial intervention effects on ICT demands and burnout can be generalised to different samples and settings (research output 3, Article 3).

### 6.2.1. Conceptualisations & Outcomes of ICT Demands

*Conceptual Framework of ICT demands*

The purpose of the first article was to review the conceptualisations and negative impact of work-related ICT demands. Since the publication of Ragu-Nathan et al., (2008) influential technostress creators' framework, research has grown rapidly to the extent where there is a multitude of new constructs, conceptualisations and measures that populate this field. While commendable research progress has been made, research that spans across disciplines with little reference to a unifying framework threatened the development of a coherent understanding of the literature. Thus, to effectively review the negative outcomes of ICT demands, it was important to address the increasingly diversified and pluralistic nature of the technostress literature first. A comprehensive systematic literature review, including 114 quantitative studies has shown that the way ICT demands have been assessed can be grouped into three categories: 1) 'multi-dimensional technostress constructs', 2) 'ICT-related pressures and expectations', and 3) 'ICT-based connectivity behaviour'.

As the label suggests the first category comprised of those studies that apply multi-dimensional technostress measures to assess the negative impact of work-related ICT (N=47), such as Ragu-Nathans et al.'s (2008) 5-dimensional technostress creator scale. Drawing on the transactional model of stress (Lazarus, 1966; Lazarus & Folkman, 1984), each subdimension typically describes a situation in which the use of certain technology presents a stressor. Most central to the use of ICT such as emails, are techno-overload (situations in which individuals have to work faster and longer due to their use of ICT) and techno-invasion (The invasive effect of ICTs in situations where employees can be reached anytime and feel the need to be constantly connected, thus blurring work-related and personal contexts), which are assessed consistently across other multi-dimensional measures using slightly different labels (e.g., Ayyagari et al., 2011; Day et al., 2012).  Additional dimensions within these constructs, perhaps less central to email-related stress, typically assess feelings of insecurity and uncertainty induced by technology, technological complexity, learning requirements and hassles. While some studies examine the individual effects of each stressor, others aggregate these to examine the effects of an overall technostress factor.

Category two relates to the technostress construct in that it presents a research strand that extends from the techno-invasion stressor where researchers use either existing individual subdimensions from this category or develop new unidimensional constructs such as workplace tele-pressure (Barber & Santuzzi, 2015), OEEM (Becker et al., 2021) or extended availability expectations (Dettmers, 2016) to examine the impact of demands specific to 'ICT-related pressures and expectations (N=21). The third category (ICT-based connectivity behaviour) presents a research strand that extends from the techno-overload stressor by examining the impact of demands associated with workers tendencies to work longer due to the use of ICT (N=46). Most studies assess this through unidimensional measures of the frequency and/or extent of ICT use during non-work time (e.g., Boswell & Olson-Buchanan, 2007; Derks & Bakker et al., 2014; Wright et al., 2014) while a small minority considers ICT use during working hours (e.g., email volume/load). Given the predictive nature of ICT connectivity pressures on ICT connectivity behaviour, research often considers these demands alongside one-another. Contrary to the technostress construct, research in categories two and three predominantly apply stress theories that draw on the ongoing presence of work demands and resources (e.g., JDR model, COR theory) and workers ability to manage work-home boundaries (e.g., boundary theory, work-family border

theory). Thus, creating a greater focus on the negative impact ICT demands have in the non-work domain.

The results from this conceptual review highlight the development of technological demands over the past 15 years and a significant shift in research focus on the impact of mobile technology. While Ragu-Nathan's framework has advanced the way we conceptualise stressors associated with workplace technology, the ICT literature has expanded significantly on the techno-invasion and techno-overload stressors, as evidenced by the resultant research taxonomy, showing specific research focus on ICT-pressure and connectivity behaviour. This taxonomy of ICT demands conceptualisations served as a basis for the subsequent systematic review by allowing research on the negative impact of ICT demands to be structured in a digestible and coherent manner.

*Outcomes of ICT Demands*

This paper produced a comprehensive overview of the theoretical underpinnings, measurement, and outcomes of ICT demands structured according to the developed taxonomy (Appendix B). To account for the wide-ranging impact in and outside of the workplace, the review draws on the work-home resources model (Ten Brummelhuis & Bakker, 2012) which distinguishes between attitudinal, behavioural or production (performance) outcomes in the work and the home domain (Cohen & Bailey, 1997), as a framework for integration. The authors suggest that attitudinal outcomes are related to feelings and beliefs that one is valued. For example, job satisfaction, trust in management, organisational commitment, and work-related wellbeing (e.g., engagement and burnout) in the work domain, and family satisfaction, high quality relationships, home-related happiness, and wellbeing (e.g., low levels of stress) in the home domain. Behavioural outcomes include behaviours that indirectly influence more tangible work or home outcomes, for example, absenteeism, turnover, and safety (work domain) and availability for family members and accountability (home domain). Lastly, production outcomes are those essential for "the efficient and effective creation of products and services", such as innovation, quality, and productivity in the work domain, and quality of care for family members, completion of household chores and the achievement of leisure targets in the home domain (Ten Brummelhuis & Bakker. 2012, p. 6).

The review produced a summary of the specific negative outcomes associated with each ICT demands category, their frequency of study and the respective authors (Appendix

B, Table 1). From this, the shared and unique negative outcomes for each conceptualisation were identified (Figure 3.2) and drawing on the work-home processes model (Ten Bummelhuis and Bakker, 2012), short- and long-term effects of each category across both domains were highlighted (Figure 3.3). The results revealed that across categories, ICT demands were associated with negative behavioural outcomes (i.e., increased negative work rumination, workaholism, and attrition) and production outcomes (i.e., reduced recovery from work and performance). However, the most consistent outcomes are of attitudinal nature and include increased negative affect, work-home conflict, exhaustion, burnout, and turnover intentions. In line with the temporal and chronic work-home process model (Hobfoll, 2002; Ten Brummelhuis & Bakker, 2012) this shows that a short-term response to daily experiences of ICT demands is a loss of energy resources (increased negative affect and exhaustion) which can spill into the home domain, creating work-home conflict, for example, due to a lack of availability for family/home commitments. Over time, the chronic exposure to these demands depletes structural resources and activates health impairment processes, leaving workers chronically exhausted and at greater risk of burnout. In the need to protect one's resources, workers contemplate leaving their organisation.

The results further highlight differences regarding the domain in which outcomes are experienced. For example, technostress constructs were more commonly associated with work domain outcomes and form the only category that showed direct performance implications. On the other hand, the negative outcomes of ICT-related pressures were largely allocated to the home domain. This discrepancy may be due to multidimensional technostress constructs which include additional work-domain stressors, such as techno-uncertainty, -insecurity, and - complexity as well as ICT hassles, role-ambiguity, and ineffective communication. Whereas research on ICT-related pressures is focused on the impact of constant connectivity expectations that are pre-dominantly experienced during personal time. The outcomes of connectivity behaviour span across both, the work and home domain, and overlap with the other two ICT demand categories. For example, techno-stressors and connectivity behaviour both show negative work-domain outcomes in form of increased work-related stress and strain as well as reduced job satisfaction and organisational commitment. ICT pressures and connectivity behaviour both create negative home-domain outcomes in form of reduced boundary control, psychological wellbeing, recovery, and sleep which were not found in the technostress category. Additionally, a theme frequently explored by research in category two and three was the impact of segmentation preferences, indicating

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that individuals do not equally suffer from the negative impact of ICT. Multiple studies demonstrate that ICT connectivity pressures and behaviours create greater difficulties psychologically detaching from work and higher levels of work-home conflict, job stress and exhaustion for individuals who prefer to separate work and home lives (segmentors), compared to individuals with a preference for work-life integration (Butts et al. 2015, Derks et al., 2014, 2016; Piszczek et al., 2017; Gadeyne et al., 2018; Yang et al., 2019; Thörel et al., 2020; Yeh et al., 2020).

Overall, this review builds on previous reviews that examine the negative impact of individual conceptualisations (e.g., technostress, La Torre et al., 2019) and acknowledged the limitations of reviewing these in isolation (Schlachter et al., 2018). The findings indicate that ICT demands trigger downward spirals in different ways (i.e., through high levels of technostress, connectivity pressure and/or connectivity behaviour) and have a profound negative impact that is experienced at work as well as at home. The findings confirm that across the ICT demands literature the most robust evidence exists for the impact on work-home conflict (N=33), burnout and exhaustion (N=27), work-related stress (N=23), recovery (N=19) and performance (N=10). While it was not the intention to create a new ICT demands framework at the outset of this study, the developments in technological demands and heterogeneities in outcomes across the different conceptualisations identified in this review highlight the need for a more general ICT framework that can capture both, outcomes in the work and home domain. For example, on the one hand, when using the technostress framework, home outcomes may not be adequately captured. Although techno-invasion is linked to poor home outcomes, such as incomplete recovery, these outcomes were only found in studies which examine this stressor in isolation. Thus, aggregate levels of technostress do not seem to capture this impact. On the other hand, constant work connectivity demands (e.g., availability expectations and ICT use during non-work time) in isolation, may overlook how ICT affects individuals during the workday and not capture performance implications.

Furthermore, the impact of segmentation preferences is a phenomenon that highlights how individual differences may shape how ICT impact users but has yet to be linked to technostress. Additionally, connectivity behaviour is the only demand that has been linked to negative outcomes in spouses which offers a valuable insight into how ICT impacts the immediate social environment of users. Thus, by considering the literature from all angles and applying a framework that integrates both work and home outcomes, this review provides researchers and practitioners with a more holistic understanding of the impact of work-related

ICT, which, considering the increasingly blurred lines between work and home, has never been more important (Carnevale & Hatak, 2020). Ultimately, the current taxonomy of ICT demands conceptualisations, serves two-folds: a) it created an effective framework to review the negative impact of ICT demands in a comprehensive yet digestible and coherent manner, and b) it can function as an ICT demands framework for future research to integrate findings into a more coherent body of literature. Finally, by highlighting the shared outcomes of different ICT demands conceptualisations, the present findings can also inform the development of holistic ICT intervention strategies. The overlap in outcomes implies that interventions may need to address multiple ICT demands in combination with an approach that spans beyond the work domain to effectively reduce the threat these pose on workers' health and wellbeing as well as organisations bottom lines.

## 6.2.2. Effectiveness of ICT Interventions

Considering the mounting evidence outlining the negative impact of ICT, an important unanswered question is how organisations can counteract this. A lack of intervention research in this field has created an urgent need for research that can establish an evidence base for effective strategies to better manage ICT demands. In response to this, Articles 2 and 3 build on the findings of the systematic review (Article 1) by exploring how the negative outcomes of ICT demands can be addressed through an ICT intervention. The aim was to examine whether ICT demands across the identified categories can be effectively reduced through the implementation of email guidelines and whether this can subsequently improve wellbeing and performance outcomes. The effectiveness of this intervention was explored in two separate organisations, one operating in the public sector (Article 2) and one operating in the private sector (Article 3) to explore the generalisability of effects across different samples and settings and address concerns relating to the recent crisis of confidence in psychological intervention research.

### 6.2.2.1. The Email Guidelines Intervention

In the problem definition and action planning stage, a qualitative examination of relevant employee needs was conducted through focus groups using a subgroup of employees across both organisations. Results confirmed that high email volume, a culture driven by pressures of immediate response and availability, and the subsequent inability to switch off

from work were issues those participants faced, and that this was having a negative impact on wellbeing (i.e., feeling overwhelmed, stressed, anxious and exhausted). Recommendations on how to address these challenges were made by each focus group (Appendix A), which were considered alongside the available evidence from the intervention literature regarding email use and boundary management, to form the email guidelines (Appendix C).

The guidelines comprised of 12 rules of preferred email behaviour. The first four address aspects of email invasion and aim to reduce ICT-related pressures and connectivity behaviours. The aim was not to ban out of hours emailing but to signal to workers that this was not a desired workplace behaviour and that there was no expectation to respond to messages beyond working hours. Particularly managers were asked to adhere to the 1st rule (limit email traffic to working hours and days) to role-model this to their staff. A sub-section was added for international teams to consider the time difference to international team members and avoid emailing them between the hours of 7 – 10 pm (for ease, instructions to display multiple clocks on their computer desktop were provided).  It was allowed to access emails and draft messages using the delay send option and to send emails outside of working hours if it was urgent. Flexible working continued as normal, but a flexible working signature needed to be used to highlight the nature of the response pattern. To reduce immediate response pressure, it was encouraged that workers, and particularly those who work part-time, signal their working/non-working days clearly either in their signature or through an out of office response. This also applied to pro-longed periods during which responding was not feasible (e.g., training days).

Rules 5,6,7, 11 and 12 address aspects that contribute to perceived email overload. Rule 5 ("think before you send") addresses the quick and automatic nature of emailing which can create unnecessary email traffic. Here four sub-rules address the number of cc's as well as the nature, medium and timing of communication, to reduce traffic and subsequent techno-overload. Rules 6 and 7 aim to help workers prioritise incoming emails and process messages faster. For example, "for action" could be searched in the last hour of the working day to filter for important messages that may need to be addressed. Although email training was previously highlighted as an effective method to reduce overload (e.g., Soucek & Moser, 2010),  this was not feasible as part of this intervention. Instead, a self-training guide for Outlook was provided to learn useful features and skills and improve inbox management (available upon request). The email hygiene rules (8, 9 and 10) were included in response to

focus group concerns on poor language and the ambiguity of tone in emails which could cause misinterpretation and anxiety (Turnage, 2007; Byron, 2008) .

Article 2 and Article 3 explored the effectiveness of the email guidelines intervention in reducing email specific ICT demands (i.e., techno-overload and techno-invasion, organisational expectations for email monitoring, email monitoring frequency during non-work time and time spent on emails during nonwork time). Based on the three overarching categories established in Article 1, these variables provide an insight into different means through which email stress can manifest. Both articles also examined the interventions effectiveness in improving frequently associated wellbeing outcomes (work-home conflict, psychological detachment, and burnout) and performance, as well as the mediating influence of ICT demands as an underlying mechanism for these effects. Drawing on the work-home resources model, it was expected that the reduction of ICT demands triggers a gain spiral which subsequently improves attitudinal, behavioural and production outcomes in the work and home domain.

Person-intervention- and context-intervention fit contribute to intervention success (Randall & Nielsen, 2012), meaning that while the email guidelines may be effective for certain individuals in one organisation, different results may be found if these are implemented in a different setting or sample. The recent replication crisis in psychological research has demonstrated that generalisability of effects should not be assumed. Thus, while it was the aim to develop an intervention that can be applied by organisations to better manage ICT demands, it is important to consider individual and contextual differences when establishing an appropriate evidence base. Therefore, the email guidelines were implemented and evaluated in two contrasting contexts, first, in a UK public sector organisation (Article 2) and then in an internationally operating, UK private sector firm (Article 3), to examine whether the intervention is effective across different samples and settings.

### 6.2.2.2. *Public Sector*

A number of novel and interesting findings were produced by Article 2. First, it was revealed that participants who received the email guidelines intervention experienced significant reductions in techno-overload and techno-invasion. Thus, demonstrating the interventions effectiveness in creating an environment where workers are not only less likely

to perceive 'that they need to work longer and faster due to their use of emails' but are also less likely to feel that 'their private life as invaded by emails and that they need to be constantly connected'. This indicates that the developed email rules indeed addressed relevant aspects that contributed to the level of techno-overload and invasion. Second, throughout the course of the study, the frequency of email monitoring and the time spent on emails outside working hours reduced significantly for recipients of the intervention.  This shows that the guidelines were effective in creating the desired behaviour change where workers were less likely to engage with work-emails beyond their contracted hours. These results are promising in that they offer an approach to managing email communication that can successfully reduce ICT demands.

Third, the findings of Article 2 revealed significant improvements in wellbeing outcomes. Recipients of the intervention not only showed increased levels psychological detachment but also reductions in work-home conflict, physical exhaustion and cognitive exhaustion when compared to the waitlist control group. Thus, the implementation of email guidelines stopped work demands from interfering with home responsibilities, enabled participants to switch off better after work, and left these feeling less burned out. At the same time, performance ratings improved in the experimental group, highlighting that implementing stricter email rules did not harm work productivity. The fourth and final insights are concerned with the underlaying mechanisms that drive the effects of this intervention. This research revealed that across the examined ICT demands, it was the reduction in techno-overload and techno-invasion that mediated the intervention effects on employee wellbeing outcomes. This confirms that the guidelines were effective due to the predicted sequence of effects where, wellbeing and performance outcomes improve in response to reductions in email-related technostress. It also highlights the relevance of workers situational appraisals of their technological work environment and the importance of such perceptions in shaping how workers feel and behave.

The findings further revealed that reductions in physical and cognitive exhaustion mediated the negative effects of techno-overload on performance. This indicates that intervention-induced reductions in techno-overload, left workers feeling less tired and less physically drained, gave them more energy in the morning and improved their ability to concentrate and focus on work, which subsequently improved performance. Thus, this research provides a first step towards an evidence-base for ICT interventions that not only

improve health and wellbeing by targeting email specific demands, but also produce a return on investment by creating an environment for sustainable, high work performance.


*6.2.2.3.    Private Sector*


When replicated in the private sector, promising, yet slightly different findings were made. In this context, the intervention was effective in improving ICT demands of techno-invasion and email monitoring frequency during non-work time. However, in comparison to the public sector, no change in techno-overload and the time spent on emails was observed. This indicates, that although emails still contribute equally to the workload, recipients of the guidelines felt less affected by this outside of work. It may be that workers still work longer to address unanswered messages left from the working day but beyond this, do not remain vigilant for incoming emails. Thus, creating an environment where workers do not feel the pressure to sacrifice personal time to offer constant work availability. Most effects did not replicate to the private sector which highlights the potential role of boundary conditions and their impact on intervention effectiveness in this context. For example, the inconsistent results may relate to differences in communication patterns between the two samples. Email volume was higher in the private sector and participating teams were more frequently communicating with other departments and external clients not involved in the experiment. Thus, the team-level implementation may present a greater context-intervention fit in the public sector where communication was less widely spread out across and beyond the organisation. An organisation-wide intervention roll-out may have facilitated greater improvements in techno-overload and time spent on emails during nonwork time in the private sector. Further, the findings revealed that the intervention was effective in reducing physical and emotional exhaustion in the experimental group. These effects were both mediated by reductions in techno-invasion and effects on emotional exhaustion were also partly mediated by reductions in email monitoring frequency. Thus, the intervention effectively reduced constant work connectivity through work emails (i.e., email invasion, connectivity pressure and behaviour), and alleviated burnout symptoms across two different organisations, sectors and samples which provides greater confidence in the successful future replication of this intervention regarding these effects.

In contrast to the public sector, no intervention effects could be detected for work-home conflict, psychological detachment, cognitive exhaustion, and performance. This indicates that the adverse impact of emails in the home domain is not solely driven by connectivity pressure and behaviour but also by the workload associated with emails more generally. Therefore, a reduction in both techno-overload and techno-invasion may be required to achieve such improvements. This also underlines that if interventions do not reduce techno-overload, improvements in task focus and worker performance are less likely.

An interesting finding is that emotional exhaustion rather than cognitive exhaustion improved while reductions in physical exhaustion were consistent in both studies. This may be due to different underlying pathways that influence the impact of ICT in the two sectors. Belkin et al., (2020) suggest that ICT demands can lead to negative individual and organisational outcomes via either an emotional pathway (through emotion depletion) or a behavioural pathway (via lack of work detachment). The significant improvements in physical and emotional exhaustion through techno-invasion and EMF suggest that the emotional pathway was the main driver in the current sample. Due to the internationally operating nature of the business, the 24/7 email traffic may be particularly difficult to disconnect from. The ongoing email invasion and a perceived need to keep an eye on incoming messages may lead to chronic emotion depletion. Thus, the intervention may have facilitated greater emotional relief in the private sector sample by creating an environment where workers can emotionally detach from the demands of their organisation's operations. As improvements in cognitive exhaustion were evident in the public sector, this may require the activation of behavioural pathways for which both techno-overload and invasion need to reduce. Ultimately these findings suggest that interventions that address email demands purely in the non-work domain by limiting out of hours emailing, such as the right to disconnect, may achieve improvements in burnout, but may not reach their full potential without addressing the workload stress associated with emails.

The inconsistent results could have a number of different explanations which require further exploration and research attention. For example, while private sector workers experienced a higher email volume, they showed lower levels of techno-overload, which could suggest that they had pre-existing coping strategies to deal with this demand. Whilst this was not formally assessed, it is possible that the email rules enhanced skills in email management in the public sector sample which facilitated beneficial effects of the intervention. Thus, the different replication results could be due to sample characteristics

where the current sample might have already had higher resources in terms of email management skills. Because stressors of constant connectivity are more difficult to address on an individual level, the need for an intervention to address such demands may have been pronounced. Additionally, given the differences in communication pattern, the extent of the intervention roll-out may have been less well suited to address techno-overload in the private sector than in the public sector. Future research needs to examine how differences in communication patterns and work environments such as global virtual teams influence how technostress unfolds.  Research that explores the psychological impact of working in international teams is scarce and the current findings which demonstrate potentially important differences, is important to explore in future research. Interestingly, techno-overload increased in the control group which indicates that the guidelines may have had a small buffering effect. Thus, if evaluated over a longer period, significant differences may have become evident. Future research needs to examine the long-term impact of the email guidelines on ICT demands.  Furthermore, the non-significant intervention effects on techno-overload may have led to the non-significant treatment effects on WHC, psychological detachment, cognitive exhaustion and burnout and performance, as this was an important mediating mechanism identified in Article 2. Alternatively, these differences may be due to different pathways facilitating the impact of ICT on wellbeing (Belkin et al., 2020). The potential presence of such pathways raises the question of how these shape the influence of ICT on wellbeing and what boundary conditions facilitate their activation. Considering the differences in results between article 2 and 3, it may be that the behavioural pathway has a stronger influence on wellbeing because individuals are consciously aware of the stressors that trigger it (i.e., that ongoing exposure to work demands through emails creates a lack of psychological detachment and greater work-home conflict), while the emotional pathway has hidden emotionally draining effects where individuals may not be able to identify the responsible stressors as readily. Nevertheless, as emotional exhaustion is the key component of burnout, targeting this pathway in wellbeing interventions appears of great importance, particularly given its potential long-term health implications. Developing a better understanding of such pathways and considering that ICT demands may trigger both when designing intervention strategies, may provide greater future intervention success.

## 6.3.    Implications for Research and Theory

This thesis set out to review the conceptualisations of ICT demands and their associated adverse outcomes as well as to develop, implement and evaluate an email-specific ICT demands intervention. In this, this thesis makes several important theoretical contributions. First, it advances current understanding of how ICT demands are studied across the vastly growing ICT stress literature by bringing together dispersed elements of research under one overarching taxonomy of ICT demands conceptualisations. This taxonomy highlights that research examines ICT demands as 1) negative situational appraisals of technological work environments (multi-dimensional technostress constructs), 2) injunctive and descriptive norms regarding work availability (ICT-related pressures and expectations) and 3) the duration and extent of ICT use (connectivity behaviour). This review points towards the conceptual similarities between these categories and views research on ICT pressure and behaviour as extended arms of techno-invasion and techno-overload from Ragu-Nathans well-established techno-stress creators' framework. While it was not the primary objective of the systematic review to create a new conceptual framework, the findings have highlighted important implications of the developments of technological demands and the need for a more general ICT stress framework. Because of the shift in technological demands over the past 15 years and the expansion of the literature in this direction, this new ICT demands framework shall not only serve as a structure for the present review but also to aid future research. This work builds on Ragu-Nathan's model to incorporate more nuanced demands specific to mobile ICT and adequately captures the impact of ICT in the home domain. Therefore, this framework captures all the relevant stressors that apply to emails and offers a better way to look at the existing literature. For future research  this is an opportunity to integrate research into a coherent body of work through a framework that better reflects existing stressors as well as those relevant to modern mobile ICT.

Recent research on the jingle-jangle fallacy in work-to non-work balance has highlighted the importance of conceptual, theoretical and measurement clarity for empirical progress in fields with multiple divergent yet highly interconnected research strands (Casper et al., 2018). To address this, this thesis provides a synthesis of the terminology, theory and measurement of each ICT demands category and provides a framework that can be utilised by researchers to integrate findings into a more coherent body of literature. While we do not evaluate the accuracy or validity of the identified  ICT demands constructs and measurements,  providing a clear overview of the existing definitions, differences, and

similarities between these makes a meaningful start to the prevention of jingle jangle fallacies in ICT research.

This thesis makes a second important contribution by presenting the first systematic review that considers the outcomes of all three ICT demands categories under one comprehensive framework. This extends existing work that reviewed individual conceptualisations (e.g., Schlachter et al., 2018; La Torre et al., 2019) and addresses limitations by providing a more complete understanding of the negative impact of work-related ICT. By applying the work-home resources model, this framework highlights specific attitudinal, behavioural and production outcomes of each ICT demand category and the domain in which these are experienced (work or home). While this review identifies over 40 different outcomes, it also highlights that the most robust evidence base across the ICT demands literature exists for the adverse impact on work-home conflict and recovery (home domain) and on work-related stress, exhaustion, burnout, and performance in the work domain. This is in line with recent meta-analytic findings showing that while technostress has a detrimental impact on both psychological and behavioural outcomes, the former is more pronounced (Nastjuk et al., 2023). Meta-analyses and systematic reviews add insights from different levels of specificity, which makes considering these alongside one-another particularly helpful. While the meta-analysis provides a first quantitative insight into the detrimental impact on psychological and behavioural outcomes, the current findings take the literature further as it provides the nuance that cannot be explored in the meta-analysis. It is important to consider the variety and large diversity in outcomes when examining the impact of ICT demands, not only within the technostress framework but also by examining the stressors specific to mobile ICT more closely. Thus, the present review can provide the additional insight into the variety of outcomes associated with technostress and highlight how additional demands that stem from this model align or differ from this. In the same way this can contribute to a recent meta-analysis carried out on availability demands (here ICT connectivity pressure) and availability behaviours (ICT connectivity behaviour) from Thörel and colleagues (2022). Furthermore, this thesis makes an important contribution to the ICT stress literature by demonstrating which outcomes are experienced most consistently across the ICT demands framework and which may be an artefact of a specific conceptualisation. This insight can be valuable for future research as it points towards the most likely source and theoretical underpinning of effects. Specifically, negative affect, work-home conflict, burnout, exhaustion, and turnover intentions are associated with all three ICT demands

categories, which implies that the source of stress can manifest in different ways and may need to be addressed from different angles.

Third, this thesis advances understandings on how these adverse outcomes can be effectively addressed by demonstrating that the implementation of email guidelines forms an effective strategy for ICT interventions. The results contribute to research that shows that email practices impact on employee wellbeing and support the suggestions of scholars to implement stricter rules around out of hours emailing (i.e. Belkin et al., 2016; Gaudioso et al., 2016; Piszcek, 2017; Becker et al., 2021). This research extends existing intervention research by conducting the first empirical examination of an intervention that specifically addresses ICT demands beyond the individual level. The findings support the hypotheses and show how different team environments can influence individual levels of work-home conflict, psychological detachment, burnout symptoms, and performance. This contributes to research that emphasises the role of team norms when considering the impact of ICT and the importance of cultural integration of work-life interventions (Kreiner, 2006; Kossek & Lautsch, 2012; Kossek, 2016). The experimental multi-wave design and use of a wait-list control group furthers existing research by strengthening the evidence base for the causal effects of perceived ICT demands on burnout. The findings support the use of the W-HR model for ICT interventions and extend the implications of the model by highlighting the creation of gain spirals in response to reductions in work demands. While a health impairment pathway of high demands is referred to in many stress theories, only the beneficial impact of increasing resources is frequently examined. Thus, these findings make important theoretical contributions by providing evidence for this mechanism in the stress process. This further supports the assumption that addressing ICT demands, is an important requirement when aiming to improve wellbeing outcomes. Further, although significant reductions were evident in both technostress creators (techno-overload and techno-invasion) and connectivity behaviour (EMF and TOE), only techno-stressors consistently mediated the intervention effects. This indicates that workers situational appraisals of the workload and pressures associated with emails are a more focal driving force of their negative impact than the actual engagement with emails during non-work time, which is in line with the assumptions of the transactional model of stress (Lazarus & Folkman 19). This is supported by research showing that connectivity pressure can lead to adverse outcomes independent of subsequent ICT use (Becker et al., 2021; Dettmers et al., 2016; Thörel et al., 2022). Nevertheless, email monitoring frequency was found to partly mediate the effects of the

intervention on emotional exhaustion in Article 3 which demonstrates that if techno-overload cannot be reduced, connectivity behaviour may play a more salient role.

Fourth, this thesis advances knowledge by conceptually replicating the email guidelines intervention in a different sample and setting. This provides further empirical support for the intervention and shines a light on the generalisability of effects. Specifically, the effects on techno-invasion, EMF and physical exhaustion were replicated in the private sector. Interestingly, while cognitive exhaustion only improved significantly in Article 2 (public sector), emotional exhaustion significantly improved only in Article 3 (private sector). This demonstrates that the same intervention, conducted by the same researchers was effective in reducing ICT demands associated with constant work connectivity and subsequently improving burnout symptoms, within two different samples and sectors. The private sector firm operated in a profit driven context with international teams working across time-zones (i.e., UK, America, Singapore, and Germany) where 24 hours email traffic is not unusual. This work environment differed considerably from the public sector context where teams operated locally within public service administration. The consistent reduction in ICT demands and subsequent improvements in employee wellbeing in both public and private work settings strengthens the support for the hypothesised effects and theoretical model underlaying this intervention and the utility of implementing it.

These results are in line with boundary theory and support previous research that highlight the importance of boundary control for wellbeing (Dettmers, 2016; Mellner, 2016; Piszczek et al., 2017; Park et al., 2020) by showing that interventions that create work environments supportive of stronger work-home boundary creation reduce symptoms of burnout. The findings of this research also indirectly add to the debate on the role of segmentation preferences (Derks et al., 2016; Yang et al., 2019; Althammer et al., 2021). The person-environment fit perspective suggests that workers in the private sector firm may have lower segmentation preferences due to the 24/7 email traffic that implies lower segmentation norms of their chosen workplace. Previous research highlights that low segmentation preferences buffer against the adverse impact of ICT use during non-work time, such as work-home conflict. Thus, the non-significant replication on work-home conflict may be associated with differences in segmentation preferences. Nevertheless, as no negative impact on wellbeing and performance outcomes was detected (in fact, means increased throughout the course of the study), it can be assumed that the intervention did not threaten participants boundary management preferences or working habits important for their performance. This is

in line with a recent intervention research showing that segmenters and integraters benefit from work-life balance interventions (Althammer et al., 2021). Belkin et al., (2020) argue that emotional exhaustion is a form of strain where workers can be consciously unaware of the stressors. This may be particularly relevant to segmenters who tend to use ICT more actively during non-work time. These may suffer from emotional exhaustion but fail to realise that ICT demands contribute to this. In line with the current findings, this suggests that individuals should benefit from the implementation of the current email guidelines irrespective of their segmentation preferences.

The results of Article 3 are in line with research showing that inconsistent results in intervention research are not uncommon (Nielsen & Randall, 2013). The initial results highlighted that the reduction in techno-overload was an important mediating mechanism underlaying the intervention effects on work-home conflict, psychological detachment, cognitive exhaustion, and performance. The non-significant replication of this effect points towards to importance of techno-overload in driving these outcomes. This provides novel insights into the relationship between techno-overload and recovery processes from work as a relationship with psychological detachment has not previously been established (Article 1). Thus, while much research focuses on connectivity pressures and out of hours emailing, the workload associated with emails more general may be a critical aspect of ICT management that could be overlooked in the right-to-disconnect debate. The difference in outcomes between the two interventions supports suggestions that there may be different pathways underlaying the effect of ICT demands on employee wellbeing (Belkin et al., 2020). Building on this, these findings suggest that the effects of techno-overload may be driven by a behavioural pathway (via lack of work detachment) while an emotional pathway is more likely to drive the effects of techno-invasion and constant work connectivity (through emotion depletion). This supports the premise that the constant emotional activation and the inability to leave work at work derived from normative expectations, depletes resources regardless of the physical time spent on emails or the effort made to separate work and home domains (Belkin et al., 2020; Thörel et al., 2022). In line with this, the present findings support suggestions to address this by creating more positive emotional environments that buffer emotion depletion and rebuild emotional resources (Bono et al., 2013; Butts et al., 2015). Thus, the current thesis contributes to the understanding of how ICT influences wellbeing outcomes by demonstrating that the same intervention could improve wellbeing outcomes differently depending on the underlaying pathway that drives the effects of the

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targeted ICT demands. The results further imply that for ICT interventions to achieve consistent outcomes, demands that activate both emotional and behavioural pathways need to be addressed. In line with context-intervention fit perspective, these results highlight that the appropriate level of intervention implementation may differ depending on the email communication network of the organisation. While a team-level approach led to effective results in the public sector where communication was largely team-centric. Inconsistencies, particularly regarding the effects on techno-overload may have stemmed from the wide communication network of private sector participants who frequently communicated with other departments, international colleagues and external clients who were not subject to the new guidelines.

Fifth and finally, this thesis makes an important contribution to research conducted in a post-covid world. Home working and connectivity behaviours have gained significance for many people over the past two years and as such, the negative as well as the positive implications may be shifting in meaningful ways.  If nothing else, the 'drivers' for working from home have changed as well as the individuals' demands for work flexibility, which interact with organisational needs/demands. While it is difficult to predict the extent to which work-home boundaries will be challenged, one can speculate that at least a fair amount of what we know about work-nonwork balances may evolve quite rapidly in the next few years.  Therefore, it is extremely important for researchers to take stock of what has been done in order to advance our future research. The findings of  this thesis advance knowledge by taking this stock on the research conducted over the past 15 years, that examines how ICT, and particularly constant connectivity demands,  impact individuals at work and at home. Thus, allowing research to build on this to examine the specific impact of the pandemic and post-pandemic changes.  The experimental research of this thesis was conducted in the context of the pandemic and mass home working and therefore provides a starting point for post-pandemic intervention research that aims to explore how the demands for ongoing home-working and sustainable work practices can be balanced to allow for the maintenance of healthy work-home boundaries and worker wellbeing.


## 6.4.    Implications for Practice

The outputs of this thesis produce novel insights into the nature of ICT demands to inform practice on how to better manage work emails and the implications for workplace wellbeing. Thus, this research makes 3 key practical contributions related to a) the identification of specific ICT demands that threaten work and home outcomes, b) the development of strategies that counteract the negative impact of ICT demands and c) the implementation of ICT demands interventions.

First, the thesis makes valuable practical contributions by providing a taxonomy of ICT demands conceptualisations and an integrated framework of the associated negative outcomes which can be utilised by researchers, practitioners and organisations to identify ICT demands that may threaten attitudinal, behavioural or production outcomes of workers. A particular strength of this work is that it ties together dispersed strands of ICT research to provide practitioners with detailed information on how the negative impact of  ICT demands manifest in the work and home domain. Ultimately this serves as a 1-stop summary of the empirical research which enables the efficient development of evidence-based recommendations that are grounded in a comprehensive understanding of this field.  For example, Article 1 shows that work-home conflict and burnout are not only driven by connectivity behaviour but also by demands that are less explicitly observable such as techno-stressors and ICT pressures. Thus, being able to consider and compare the results of different ICT demands alongside one another can help organisations to avoid blind spots when designing relevant interventions. At the same time, it raises awareness of negative outcomes that may be less commonly researched in relation to ICT such as implications for innovation (Tarafdar et al., 2011, 2014, 2015; Chandra et al., 2019), and performance (Ioannou & Papazafeiropoulou, 2017; Delpechitre et al., 2019; Li & Wang, 2020) or may be more distal outcomes where an obvious link is not easily made such as absenteeism, attrition, and turnover intentions (Barber & Santuzzi, 2015; Belkin et al., 2020; Califf & Brooks, 2020; Califf et al., 2020) that can unfold over time if ICT are not managed well. Highlighting outcomes that link to important bottom-line outcomes can raise the relevant importance organisations place on the investment into targeted initiatives. Therefore, the findings of this research contribute to the business case for ICT interventions to develop work environments that are sustainable from a workplace health, productivity, and retention perspective.

Second, this thesis has developed an intervention strategy effective in managing email-specific ICT demands as a means for improving wellbeing outcomes. The significant intervention effects for burnout offer a promising perspective on how to address the rising

levels of work-related stress and poor mental health in the context of the hyper-connected post-covid world. Practitioners and organisations may apply the developed email guidelines to better manage email communication and connectivity expectations. If implemented appropriately, the current findings provide confidence that this email guidelines intervention can not only alleviate symptoms of burnout but may also reduce work-home conflict and improve psychological detachment and work performance. Thus, offering an attractive strategy for policy makers to address the socio-economic impact of poorly managed work demands with the long-term aim to create sustainable, healthy, and high performing work environments. Particularly, demonstrating that the intervention effects on burnout can be replicated across diverse samples and settings contributes to the reliable evidence base needed to make policy recommendations. In line with this, this thesis makes specific implications for the right to disconnect legislation. On the one hand it is the first empirical examination of an intervention that aims to reduce out of hours emailing from an organisational perspective and supports that stricter emailing rules can reduce connectivity pressure and symptoms of burnout. On the other hand, while this research highlights the importance of targeting techno-invasion as a mean for reducing burnout, it also stresses that it may be equally important to address techno-overload. The present research highlights that a reduction in the work overload associated with emails plays a critical role in the improvement of work-home conflict, psychological detachment, cognitive exhaustion and performance which suggests that focusing solely on banning out of hours emailing may not be sufficient to achieve the desired intervention success organisations and policy makers may strive towards. Thus, when developing interventions that aim to counteract the negative impact of poorly managed ICT such as emails, targeting both techno-overload (situations where workers feel that they need to work faster and longer due to use of emails) and techno-invasion (situations where workers private lives are invaded by work demands and they face expectations of constant availability) should be central to this strategy. The present email guidelines offer a first step towards an evidence-based approach for this and offer a novel approach to dealing with workplace stressors that will only increase in prevalence in this post-covid world.

The third and final practical contribution of this thesis relates to the implementation of email interventions. The current research provides support for the implementation of email guidelines at the team level. Considering that email communication is, in its nature, an interpersonal activity and that the detrimental effects of ICT-pressures and expectations are driven by injunctive and descriptive norms around work availability, the cultural integration

of new rules and norms within a group environment is an essential part of this intervention. Prior scholars have noted that employees do not exist within a vacuum but are affected by wider meso-and macro-level influences (Martin et al., 2016) and that such social and organizational factors play a much larger role in the development of burnout than individual factors do (Maslach et al., 2001; Schaufeli & Buunk, 2002 cf. Le Blanc et al., 2007, p. 214). Therefore, practitioners, organisations and policy makers should implement interventions at the team-level, ideally organisation-wide, and plan a thorough integration strategy (i.e., team training to raise awareness of the negative impact of email stressors and a thorough explanation of the new email rules and expectations) to maximise intervention success. Particularly in organisations where email traffic is not largely contained within one's team and line management, an organisation-wide implementation may improve emailing behaviours associated with techno-overload and warrant more consistent and promising results. Lastly, the present research highlights a legislative ban on out of hours emailing is not necessary to reduce ICT demands and improve employee wellbeing. Instead, a set of rules that outlines best practice email behaviour, where emailing beyond working hours is discouraged, yet workers can access their inbox and work flexibly in accordance with their needs, can be sufficient if implemented appropriately (i.e., at the appropriate level, with relevant training, and role modelled by line managers).

## 6.5. Limitations

While the specific limitations for each study are outlined in their respective discussion chapters, a number of additional overarching limitations will be outlined here. These limitations relate to issues of measurement and intervention design.

The first main limitation lies with the amount of different terminology and measurement used in ICT research. This thesis outlined the potential threat of jingle jangle fallacies, where one may falsely assume that two distinct constructs are the same because they use the same label (jingle fallacy), or that two similar constructs are distinct because they have different labels (jangle fallacy). A particular strength of Article 1 is the comprehensive scope which allowed dispersed strands of ICT research to be unified under one overarching taxonomy and associated negative outcomes to be reviewed within one framework. However, the review

does not address the quality of measurement. Although this research makes a good first step, by providing clarity regarding the similarities and differences of the overarching conceptual nature of ICT demands research and generating an overview of the sub-constructs allocated to each category, it cannot fully solve the issue of the jingle jangle fallacy without reviewing the accuracy and validity of the applied measures in more detail. Many of the included studies share only little information regarding the development and validation process of their applied measures, which may indicate a lack of systematic measure development practices. This makes it difficult to evaluate potential threats to internal, external, statistical-conclusion, and construct validity (Flake & Fried, 2022) and is a concern because the conclusions drawn about ICT demands are contingent on these measures being construct valid. However, this is a recognised challenge in general scale development and social science research and not an isolated incident in the ICT stress literature (Hughes, 2018, Flake & Fried, 2022).

Nevertheless, it is important to mention that the results of the empirical part of this thesis are based on measures which have followed a detailed development and validation process (Ragu-Nathan et al., 2008) and are well established reliable measures commonly used within their field (Kreiner, 2006; Shirom & Melamed, 2006; Sonnentag & Fritz, 2007). Single item measures were used to evaluate connectivity behaviour and subjective performance. While this can limit the internal reliability of such indicators, measurement invariance analysis confirmed that the measures were stable over the repeated data collection points. To strengthen the behavioural data, email volume was assessed in and outside of working hours to serve as an objective indicator that can be interpreted alongside the existing measures. Future research should consider using objective measures of performance or other ratings to further examine this relationship (Nastjuk et al., 2023).

An additional concern worth noting is that it has been difficult to draw a boundary between the developed ICT demands categories in Article 1 due to the conceptual overlap between specific sub-constructs. In light of the jingle jangle problem, this is important to acknowledge because although the categories are discussed separately, it would be false to view these as strictly distinct entities. For example, while constructs allocated to the ICT-pressures category are unidimensional (e.g., Barber & Santuzzi, 2015; Dettmers, 2016; Becker et al., 2020), this type of demand is also assessed in multi-dimensional technostress measures through techno-invasion, response expectations, 24/7 availability (Day et al., 2012), ICT-induced invasion of privacy and work-home conflict (Ayyagari et al., 2011). Unless studies have used these specific sub-dimensions in isolation, outcomes that derived from

these measures have been allocated to separate categories. This shows that research findings are becoming increasingly difficult to disentangle and that a more parsimonious approach to studying these phenomena is needed. Although article 1 identified the similarities between the constructs allocated to each ICT demands category (e.g., all studies in the ICT pressures category focus on "the availability for work during non-work time and a need to respond to work messages which is either implicitly derived through workplace norms or explicitly through formal policies") there is still heterogeneity between subconstructs allocated to the same category. For example, some see it as an individual pressure and pre-occupation with quick responding  (Barber & Santuzzi, 2015), others describe it as an organisational expectation (e.g., Becker et al., 2021; Dettmers, 2017; Piszeck, 2017) or as situational pressure created by the characteristics of ICT interactions (Ragu-Nathan et al., 2008; Day et al., 2012). Similarly, while some view outcomes from a person-environment fit perspective (e.g., Ragu-Nathan et al., 2008; Ayyagari et al., 2011), others focus on the role of demands and resources (Belkin et al., 2020; Hu et al., 2019) or that of work-home boundary formation (Dettmers et al., 2016; Park et al., 2020). Considering the vastly developing and still relatively new research field of ICT demands, particularly when it comes to connectivity pressures and behaviour,  it is not unusual that constructs lack precise and coherent definitions (Macey & Schneider, 2008). However, as this can create ambiguity regarding the unique contributions of each category and subconstruct, the endeavour of bringing conceptual clarity as well as theoretical and measurement precision to this field should receive specific attention in future research.

A major strength of this thesis is its longitudinal, multi-wave, multi-sample and -sector, participative, quasi-experimental intervention design. Scholars have repeatedly stressed the need for longitudinal experimental designs to elevate research in this field and deepen our understanding of the structural and causal nature of effects (Nastjuk et al., 2023). Nevertheless, there are limitations concerning the present design that need to be considered. For example, it was not possible to randomly allocate participants to the experimental and wait-list control groups. This can increase the risk of bias due to confounding variables which limits the validity of the present findings and the ability to draw firm causal conclusions (Miller et al., 2020). For example, in Article 2, both groups are closely matched in sample size, demographic information and baseline variable scores (see tables 4.3 and 5.2). However, in Article 3, discrepancies can be observed between the compositions of the two groups, particularly regarding the baseline scores in techno-overload, work-home conflict, and

cognitive exhaustion. This may have biased the results and contributed to the inconsistencies between the two intervention studies. Nevertheless, the difficulty of developing an RCT design in organisational intervention research is largely acknowledged (Montano et al., 2020). Some even suggest that it may be inappropriate if psychological and social processes play an important role in the intervention (Nielsen & Randall, 2012), which would be applicable for the present research considering the nature of the demands and outcomes associated with emails. Furthermore, no active control condition was used, and participants were not blinded to the treatment which limits the causal inferences that can be drawn from the intervention effects as demand characteristics may have influenced the results (Holman et al., 2010; Vonderlin et al., 2021). Nevertheless, the guidelines were developed in accordance with participants needs and the scope of this work did not allow further experimental evaluations. Yet, the robust design and promising findings offer fruitful avenues for future research to further explore this.

Several additional limitations that are worth re-iterating are the impact of the covid-19 pandemic, the restricted roll-out of the guidelines, the relatively short evaluation period and the absence of individual differences measures. The interventions were carried out during extraordinary physically and mentally challenging times. While it cannot be evaluated whether the pandemic has had an impact on the present findings, it is difficult to imagine that it has not. On the one hand, the outbreak of the pandemic significantly delayed the implementation of the intervention which created a long gap to the needs analysis. On the other hand, one can argue that the participating organisations continued to see value in the intervention because it was particularly relevant to the stressors their workforce faced at the time (i.e. the introduction of specific email rules that help manage high volumes of messages and build stronger work-home boundaries may have been of great need at a time where mass home working was introduced to the participants for the first time). It is promising to see that the intervention was effective under conditions where work-home conflict and wellbeing was threatened by contextual influences, which underlines the relevance of this intervention in a post-covid context. Finally, the focus of this research is limited to a view on demands which only partly captures the potential mechanisms at play. It is important to recognise that ICT such as email can act as resource (e.g., Day et al., 2010), and provide a wide range of beneficial outcomes. Mobile ICT provides employees with remote access to the workplace, improved international collaboration, and quick and efficient communication channels which creates greater autonomy, work-life balance and performance (Gajendran & Harrison, 2007;

Messenger, 2017; Stich et al., 2018). Additionally, recent research argues that ICT can enable job crafting to increase resources that help workers tackle job demands and improve wellbeing (Tarafdar & Saunders, 2022) and foster practices that enhance workplace inclusion (Tarafdar et al., 2023). Therefore, studying demands without measuring positive outcomes could unitedly curtail the benefits of email use and paint a negatively skewed picture. The work-home resources model has resources at its centre and although this research advances the demands element of this model, future research would benefit from studying these in combination to fully capture the complex and interconnected mechanisms at play which would provide an insight into both, the beneficial and adverse outcomes.

## 6.6.  Future Research

Although suggestions for future research have been offered for each study individually in the respective articles, particularly important avenues of research will be outlined throughout this section. Future research needs to build on the findings of Article 1 and address its limitations by thoroughly reviewing the identified themes and measurements within each ICT demands category (particular focus may be placed on ICT-pressures and connectivity behaviour as the extended arms of techno-invasion and techno-overload). Nastjuk et al., (2023) have recently conducted the first meta-analysis of technostress and its impact on psychological and behavioural outcomes. The current results can be applied to further this research by looking at specific rather than aggregated levels of outcomes that are shared between categories and are frequently examined (i.e.,  work-home conflict, burnout and exhaustion). Such work should document substantive differences in measuring ICT demands and use a meta-analytic approach to examine whether such differences affect conclusions about the outcomes of each category (Casper et al., 2018). Ultimately, future research in this field should work towards a parsimonious conceptual model with an associated bank of good measures that can lead to new interdisciplinary studies that build a cumulative tradition of literature.

To further strengthen the research design of interventions, randomised designs would be the gold standard. However, if this is not feasible, future research should use matched controls, for example through propensity score weighting, to reduce bias and enhance the validity of findings (e.g., Morgan, 2018; Vonderlin et al., 2021). Further, the use of an active control group would strengthen the causal claims made and could shine light into an

unanswered question regarding the relevant effectiveness of each of the 12 email rules that formed the guidelines. While the guidelines were developed in accordance with participants needs, the rules may not be equally relevant to techno-invasion and overload (e.g., hygiene rules). Additionally, retaining twelve rules may be difficult which can have implications for practicality and subsequent adherence.

There are two ways for future research to address this, either by providing the groups with subsections of the guidelines (i.e., those related to techno-overload vs. those related to techno-invasion and connectivity behaviour) or by providing one group with the full guidelines and one group with a set of rules that is considered less central to the hypothesised effects (i.e., hygiene rules). This would allow for a comparison between the different email rules and narrow down the active ingredients of the intervention. Ultimately this could help modify the rules to create a more compact and operational version of the guidelines while maintaining their beneficial effects. Additionally, the inconsistencies between the two intervention studies raise important questions that can direct future research. For example, research needs to examine how differences in communication patterns and work environments such as working in international teams influence how technostress unfolds. To strengthen the evidence base for email interventions, future research should employ an organisation-wide design and a longer follow up period to evaluate the sustainability of effects if implemented on a larger scale. The present findings provide an insight into the generalisability of effects to diverse samples, yet it does not directly assess the influence of individual differences. Research shows that it is likely that individual differences, such as segmentation preferences, impact on how individuals react to constant connectivity demands and ICT interventions. (e.g., Yang et al., 2019; Thörel et al., 2020; Yeh et al., 2020).Therefore, future research should include measures of segmentation preferences in their intervention design to develop firmer insights into how changes in segmentation norms influence integrators or examine the potential moderating effects of such differences.

Looking into the future, how and where work is conducted is shifting significantly. As many workers choose to continue working from home for at least parts of the week (Davis et al., 2022), the drivers and threats associated with ICT are likely to change (Carnevale & Hatak, 2020). The greater need for flexibility as well as new stressors and negative aspects of connective technologies, such as 'visibility behaviours' (e.g., Leonardi & Treem, 2020) may present important research avenues to consider. Thus, researchers and practitioners should build on the empirical evidence that this thesis has created and continue to explore the

effectiveness of ICT interventions in a post-covid world as well as consider how the changing needs of workers may interact with organisational demands and resources. For example, while the present thesis examined the impact specific to emails, the way communication is conducted in a technological environment is shifting and understanding how modern communication technologies such as instant messaging tools and virtual meeting spaces impact levels of technostress and wellbeing is an important future research endeavour (Hill et al., 2022).

An important element to consider in future research is the role of boundary conditions in the effectiveness of interventions. The extent to which an intervention is effective is likely to vary depending on a number of individual and organisational factors (Nielsen et al., 2021). While the inconsistent results between the two interventions highlight some potential boundary conditions that point towards who may be more likely to benefit from the email guidelines, specific moderators of intervention effectiveness were not assessed. Person-intervention fit is seen as an important determinant of intervention success which highlights the need for the intervention to align with individual participant needs (Randall & Nielsen 2012; Nielsen, 2013). An example of a relevant individual-level moderator are Segmentation preferences, which indicate an individual's preference for work-home integration. Studies have repeatedly shown that segmentation preferences influence the impact that ICT use has on wellbeing outcomes, in a way where individuals with lower preferences for work-home segmentation are less likely experience negative effects due to the use of ICT (Derks et al., 2015; Kossek & Lautsch et al., 2012; Piszczek, 2017; Yeh et al., 2012). Thus, integrators may react differently to the email rules than individuals with preferences for work-home segmentation. Future research could explore this as an individual-level moderator of the effectiveness of ICT interventions. Additionally, the present findings highlight that the context in which the intervention is implemented may shape its effectiveness. A lack of environment-intervention fit is often attributed to the failure of complex organisational interventions (Randall & Nielsen, 2012). Differences in email communication patterns between the two organisations (e.g., high volume of 24/7 email traffic in the private sector) and the associated organisational segmentation norms may play an important role here which could be explored as organisational-level moderators in future ICT interventions.

Additionally, this research explores the impact of constant work connectivity on employee wellbeing and performance in a context of global virtual teams. The findings suggest that emotional pathways may be driving the negative impact of ICT demands

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however, there is little research on the psychological impact of working in this context (Gilson et al., 2015; Glazer & Kozusznik, 2012; Jimenez et al., 2017). This raises the question whether the emotionally draining nature of 24/7 email traffic, that often characterises such work environments is a hidden stressor that unconsciously impacts workers despite a perceived person-environment fit. As teams become increasingly dispersed and remote working is becoming a new normal for many, the effects of working in a global virtual environment need to be better understood. Considering the importance of team norms in shaping connectivity expectations and behaviours, it is important to explore how team structures change in a virtual environment, whether this influences how workers perceive and respond to ICT demands (Hill et al., 2022) and what type of leadership skills are needed to manage the new technological demands of virtual working (Chaudhary et al., 2022).

## 6.7.    Conclusion

It is undeniable that some form of ICT infiltrates almost every aspect of modern life. Understanding the negative impacts of work-related ICT is important for individuals and organisations alike, and subsequently studies exploring this have risen exponentially in recent years. While substantial research progress has been made, the rapid increase in technostress and wider ICT literature has brought challenges in that it lacks coherency and conceptual clarity, making it difficult to gain a holistic understanding of what is known to date. Although mobile ICT offer valuable resources, evidence suggests that the negative health impact of poorly managed ICT far outweigh such benefits. The detrimental effect on employee health and wellbeing presents a great area of concern particularly as the reliance on ICT is ever increasing, yet experimental research that explores effective intervention strategies has largely been absent. The current thesis addressed these main challenges by building on Ragu-Nathan et al., (2008) technostress model to develop a new ICT framework that comprises a comprehensive taxonomy of ICT demands conceptualisations and then reviewing associated negative attitudinal, behavioural and production outcomes. This offers conceptual clarity and provides a more nuanced look at how different ICT demands impact workers in the work and home domain. This has the potential to serve as a framework to integrate findings into a more coherent body of literature and as a building block to bring parsimony to the meaning and measurements in this field.

This thesis also makes substantial contributions to research by providing the first exploration of an organisational email-stress intervention that addresses aspects of overload and constant work connectivity, through the team-level implementation of email guidelines. Having evaluated this approach across different samples and sectors, collectively the empirical studies within this thesis provide an evidence-based intervention that offers an effective strategy to better managing ICT demands (particularly techno-overload and -invasion), as a means for improving wellbeing and performance outcomes. This is of substantial value to worker wellbeing, organisation's bottom lines and the wider economy as it offers a theoretically informed and empirically tested intervention targeted at important stressors that continue to increase in relevance in a post-covid world. Particularly in light of increasing numbers of work-related stress and poor mental health, these findings highlight the importance of including modern stressors such as ICT demands in policy advice and organisational approaches aimed at reducing stress and burnout. Future research may build on the present findings and continue to explore the effectiveness of ICT interventions in the vastly changing virtual and technologically omni-present environment while considering how the changing needs of workers may interact with organisational demands and resources.

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# APPENDIX

## Appendix A – Focus Group Feedback Reports

### *Organisation 1 (public sector)*

**Feedback Report**

**How are work-related emails affecting you? A qualitative investigation of email-related technostress and implications for organisational interventions.**

**Overview**

This project investigates E-mail communication in organisations and its impact on employees in terms of their wellbeing, work-family balance, recovery experience and performance. E-mails are more and more often described as stressors which can have a significant negative impact if received excessively (Barber & Santuzzi, 2015; Becker, Belkin, Conroy & Tuskey, 2019; Derks, ten Brummelhuis, Zecic & Bakker, 2014; Stich, Tarafdar & Cooper, 2018; Wright, Abendschein, Wombacher, O'Connor, Hoffman, Dempsey, ... Shelton, 2014). However, little is known about how to manage E-mail communication more effectively without losing its benefits. The aim is to gain a better understanding of the key issues associated with work-related E-mails inside and outside of working hours. From this, we would also like to gain a better understanding of what the organisation can do, from an employee perspective, to reduce any negative effects emails may cause. Ultimately, the results of this project will inform the development of new a new E-mail policy or guidelines which will be implemented by the participating department.

**Methodology**

During the month of November 2019 four 90-minute Focus Groups were conducted with 22 employees across different levels of the ████████████████████. During the Focus Groups a mind mapping exercise called "Ketso" (https://ketso.com/how-to/uses-applications-of-ketso/) was used to facilitate the discussion among participants.

**Results**

The results are structured under relevant subheadings that describe a key theme of discussion mentioned across groups. First the issues associated with emails are reported and then Policy suggestions are given.

Volume

In every Focus Group, every single participant raised that the high numbers and excessive volume of incoming E-mails are a problem. It was discussed that they "feel like it (incoming E-mails) never stops", that "they cannot clear their inbox" and they therefore "don't feel on top of their work". An example of how this is experienced by one participant can be seen below:

> *"I think because there are so many emails, you know, your brain doesn't get...you don't get adequate time to sort of, you know, pause between emails so you are constantly reading, you know, constantly responding, constantly monitoring and you don't get a break. And for me it's the sheer volume of it. (...) Yeah. So I can start work at seven thirty and, you know, I'll be at my desk non-stop from seven thirty till one o'clock just dealing with emails, and even then I'm not on top of it all." (F, FC4).*

The participants further explained that this constant overload leads to an inability to prioritise and discriminate between incoming work, to missing or losing E-mails, and because they feel like they have to rush through them, mistakes are more likely to happen (which can create

"legal risks"). On top of that, all participants reported that it is highly distracting and affects their productivity negatively. It was described how it leads them to regularly re-prioritise and multitask, how the build-up during the day and during OOO periods leads to older work being overlooked and how they do not manage to process all their incoming work due to the time-demand it takes to manage their E-mails.

In general, participants feel overloaded by the high amount of incoming E-mails and ascribe this to E-mails being overused, to being cc'ed into E-mails that are not relevant to them (often associated to "reply all" function or the senders need to "cover themselves" - *"Oh, if I just cc the lawyer, they will magically interpret that I want advice on X, Y and Z" F1, FC3.*), to too many unnecessary "thank you" and "okay" E-mails, and to an oversharing culture.

Pressure (expectations of immediacy/culture)

In the focus groups participants described that they face an expectation to respond immediately and that such expectations are too high and unrealistic. They experience pressure due to peoples believe that their request will be dealt with as soon as it comes in and a lack of consideration. Example:

> *"People don't understand the pressures on me. Because I get emails from so many people. That is stressful, because people don't understand that I'm not just sitting there going, oh…" (F1, FC3)*

The pressure to reply was reported to stem from the internal culture, from clients and from oneself. For example, participants explain how what is said does not match the internal norms regarding the expectations to finishing work. Furthermore, the created pressure creates an unnecessary urgency and fast paced environment, which can leave participants little time to reflect, stressed and anxious about making mistakes. Additionally, it was explained that the weight of such expectations can lead participants to feel the need to constantly check their E-mails. Example:

> *"Yes, you're right about the culture, there's a culture of on the face of it, saying, oh, you should only be working your normal hours plus maybe a tiny bit more, you shouldn't have to work at the weekends, you shouldn't have to do this, but as you say, there's also an expectation that you're going to get it cleared." (F3, FC1)*

> *"I think it's pressure, but I think it's also about being…people feel insecure about it, that you feel you…there's pressure on you to be……on all the time and available all the time; and if you're not, I think you're a gold-plated exception to this, I'm pretty impressed." (F, FC2)*

Lastly, it was said that E-mails are used as an audit trail and are seen as a method of forwarding responsibility to someone else (you cannot say "no" to receiving an E-mail).

Cannot switch off (expectation to stay connected to work all the time):

The issues discussed in the previous section extend into this one. Below is an example of how the volume and expectation to keep on top of all E-mails invades peoples off-work time:

*I think maybe mine is similar to that in that I've written 24-hour expectation. And then basically said in my experience it starts off as a method of control that you impose by trying to get ahead. You kind of think, right, I'm just going to just check them now before I go into the office or whatever. But then that sets a precedent and then it's set an expectation that you will then answer them and then you become in a situation where you've lost all control, and it's just like enough, you know." (F3, FC3).*

*"(...) part of the reason for the stress is that they can be sent out of hours and you're having to keep stay on top of your inbox. Like I can get 30 emails between 5 pm and 8 am, and it's like..." (F4, FC3).* [The conversation continues to mention how senders do not think about the consequences, only about getting it off their desk and onto somebody else's]

*"I find this as a working mum as well, that I find that my peer group seem to think I should always be switched on, and that it's terribly rude if mums are doing a call out for somebody to help drive the kids to music or gymnastics or what have you, and you don't respond. So I find the pressures are incredibly difficult, to be always on is hard work. (F, FC2)*

Participants explain how there is a very low boundary for sending E-mails outside of office hours and how they feel an expectation to read and respond to E-mails when they are not working. Some describe that they feel like they are always "on call" as it is so easy to reach them. Hence, they describe how organisational and personal pressures interfere with their work-life balance and with their ability to detach from work during time off. A poorly managed increased reliance on flexible working, poor leadership practices and a lack of shared expectations/rules/policy are named in associated with this issue.

Health:

The above reported problems have often been mentioned in combination with adverse consequences which over time can impact their psychosocial and physical health. More specifically, participants described how an "out of control inbox is very stressful", how it leads them to feel overwhelmed and exhausted. An example of how E-mail stress is seen as constant can be seen below:

*"I wonder whether the numbers, this whole basis of volume just adds to this sense of being very stressed and overloaded, it's your recalibration point of 700, it feels as though you were constantly, instead of starting at a neutral level, you're already on a platform of stress and you just go higher and higher up a level of stress." (F, FC2)*

Furthermore, E-mails were said to make work feel relentless causing participants to fear taking a break and regret going on holiday, diminishing their ability to recover from work. They also reported how a fear of missing urgent work, making mistakes or not knowing what may be waiting in their inbox for them leads to anxiety, constant E-mail checking and worrying.

F: *"...it's impossible to manage or recover after any time away.*
F1: *Oh, yes.*
M: *Yes. Yes. And so, you feel like you wish you hadn't gone anyway.*
F2: *Yeah.*
F3: *Yes." (FC2)*

*"And personally, I think I do suffer from an anxiety syndrome if I don't check my emails. I think there might be something lurking in there, that for the sake of just a few seconds... Mine is definitely anxiety driven, it's not out of a sense of, I think this is a good place to be in, it's more of a..." (F, FC2)*

*"(...) the anxiety of sending emails to the wrong person and that creates a huge amount of anxiety for me." (M1, FC4)*

Lastly, there were some reports of physical health problems such as sore eyes, neck strain, backpain and headaches from looking at the screen.

Other:

Lastly, there have been problems raised which could not be grouped under higher-order themes as they were not as consistent. Nevertheless, some may still be important. During some Focus Groups participants discussed how E-mails lead to less verbal communication which reduced connectivity and social bonds at work. Generally poor email skills such as inefficient use of subject lines, reply all, or long, hard to sift through messages, were a frequent point of discussion. Additionally, poor language, the ease for misinterpretation and behaviours such as "passive aggressive copying in" and "talking behind ones back" were mentioned as E-mail related problems. Ineffective systems, processes and IT software were discussed. As mentioned before, a lack of shared expectations through an internal policy were raised as problems and poor leadership and management practices were named as underlaying reasons for many of the issues discussed above.

**E-mail Policy Recommendations**

After discussing the negative impact E-mails had, all participants of the Focus Groups were asked to come up with ideas that they believe would make an effective internal E-mail policy. The ideas were themed into those which address the "E-mail overload" issue and those which address the consequential "E-mail invasion" aspect. Those suggestions address many of the above raised issues and could have a positive impact on workers.

E-mail overload

- Encourage the use of other instant ICT for simple questions (i.e. Skype) and increase F2F conversations especially if you work in the same team on the same floor

- Standardised format for subject lines (i.e. for info/action + response expected & deadline).

- Shared general information (weekly newsletter) instead of separate emails from different senders.

- Stop "Thank you" & "Cheers" E-mails (It is not rude)

- Raise Awareness: "Think before you send" (could a phone call/F2F conversation be better? Do you have to send it now? Does it really need to go to all these people?)

- No Email day

- Use "Expiry" tool which automatically deletes E-mails that are only relevant until a certain time/day.

- Turn off notifications

- Create an understanding for the time it takes to deal with E-mails

- Limit the amount of people that can be copied into an E-mail

E-mail invasion

- Limit E-mail traffic to working hours unless it is urgent (i.e. do not show E-mails in inbox outside of business hours - VW approach)

- Set clear expectations when and when not to send/reply to E-mails (i.e. automatic OOO on weekends & holidays, maybe even on week nights) - internally and with external clients

- Use Flexible Working Signature (i.e. "while it suits me to email now, I don't expect a response")

- Use delayed send

- Good Examples from Management (no E-mails sent from Managers to staff outside of office hours unless it is urgent).

- Awareness training – Negative impact of E-mails

- Allow time to respond (i.e. a 48-hour turnaround policy)

- Include trigger "are you sure" when sending E-mails out of hours (I am unsure how we would implement this).

*Organisation 2 (private sector)*

**████████Feedback Report**

**How are work-related emails affecting you? A qualitative investigation of email-related technostress and implications for organisational interventions.**

**Overview**

This project investigates E-mail communication in organisations and its impact on employees in terms of their wellbeing, work-family balance, recovery experience and performance. E-mails are more and more often described as stressors which can have a significant negative impact if received excessively (Barber & Santuzzi, 2015; Becker, Belkin, Conroy & Tuskey, 2019; Derks, ten Brummelhuis, Zecic & Bakker, 2014; Stich, Tarafdar & Cooper, 2018; Wright, Abendschein, Wombacher, O'Connor, Hoffman, Dempsey, … Shelton, 2014). However, little is known about how to manage E-mail communication more effectively without losing its benefits. The aim is to gain a better understanding of the key issues associated with work-related E-mails inside and outside of working hours. From this, we would also like to gain a better understanding of what the organisation can do, from an employee perspective, to reduce any negative effects emails may cause. Ultimately, the results of this project will inform the development of new a new E-mail policy or guidelines which will be implemented by the participating department.

**Methodology**

During the Month of November 2019 three 90-minute Focus Groups were conducted with 14 employees across different levels of ████████. During the Focus Groups a mind mapping exercise called "Ketso" (https://ketso.com/how-to/uses-applications-of-ketso/) was used to facilitate the discussion among participants.

**Results**

The results are structured under relevant subheadings that describe a key theme of discussion mentioned across groups. First the issues associated with emails are reported and then Policy suggestions are given.

Volume

In every Focus Group, every single participant raised that the high numbers and excessive volume of incoming E-mails is a problem. It was discussed that they "feel like it (incoming E-mails) never ends", that "they cannot clear their inbox" and they therefore "don't feel on top of their work". An example of how this is experienced by participants can be seen below:

> *"To the point where now openly speaking I'll have 800, 900 emails I've not opened, which reflects how many emails I've actually received, so thousands every month. And I just haven't read them, because I just don't have enough time" (M; FC2).*

> *"it can be overwhelming in the same thing. You can get days when you get too much." (M1, FC1)*

> *"My first one is just too many of them. And the pressure to keep on top." (M1, FC3)*

The participants further explained that this constant overload leads to an inability to prioritise and discriminate between incoming work, to missing or losing e-mails. On top of that, all participants reported that it is highly distracting and affects their productivity negatively. It was described how it leads them to regularly re-prioritise and multitask, how the build-up during the day and during OOO periods leads to older work being overlooked and how they do not manage to process all their incoming work due to the time-demand it takes to manage their E-mails.

> "I've got here impacts focus on other tasks. Because when you're doing something what happens is you go straight onto your email, and then you stop reading your email and you forget what you're on. And it takes you twice as long or three times as long to do anything because you get your email popping up". (M, FC2).

> "I've got constant battle to manage and distraction from other work". (F, FC2)

In general, participants feel overloaded by the high amount of incoming E-mails and ascribe this to E-mails being overused, to being cc'ed into E-mails that are not relevant to them (often associated to "reply all" function or the senders need to "cover themselves") and to the reduced headcount leaving more work for less staff. Lastly, the high amount of irrelevant E-mails was described as demoralising by several participants which could further impact on their productivity, job engagement/satisfaction and wellbeing.

Pressure (culture)

In the Focus groups participants described a reactive company culture which is created by organisational pressures that drive work. Furthermore, they face expectations to respond immediately which are too high and unrealistic. They experience pressure due to peoples (managers, co-workers, clients) expectations they will deal with their request as soon as it comes in and if they don't it shows a lack of commitment. Due to a "need to please" participants will succumb this. Example:

> "So the volume related bits. I've got on here, expectations of others that I'm suddenly doing what they're asked me to in an email. So literally that, straight onto your shoulders. So off theirs onto yours, and there's no... It's still with me, even if I say I'll look at that next week. It's suddenly straight on your shoulders as soon as you read it. So the accountability clicks into you. No matter how urgent. It's that feeling." (M1, FC3)

> "F: So I wrote one about need to please, and I think that's wanting to send the email the last at night so you can see how late somebody...
>
> M: Prove you were there, yeah. Need to please, I like that.
>
> F: But I do think...but it is, I am that sort of person. I want to be there to be helpful to everybody. So if I get an email at seven o'clock at night, I'll respond. Unless I can't do

*it, generally. I want my manager to think I'm doing a good job, so I'll respond all the time.*

*I: And that creates maybe a little bit of competitiveness and then…*

*F: Yeah, I think it does.*

*I: …another person responds and then you…*

*F: That goes onto my don't know when to stop. So it's like you do it, but because you've then done it in the past, it's then an expectation oh, if I do email "(F)" at eight o'clock, she'll respond." (FC2)*

Furthermore, participants explain how they believe that having a full inbox is seen as a sign of poor performance and how they would be "embarrassed" if someone saw it. This leads them to feel anxious, disorganised and bad about their own work. Additionally, participants described how there is no choice as it is just the "accepted norm" here (feeling pressure, being available, working longer). Frequently mentioned in association with pressure was an "internal blame culture". Here participants described how E-mails are used as an audit trail to "get out of jail free" and how it is an easy way to pass on responsibility to someone else without their acceptance. They further explain how it is their culture to say, "I emailed/copied you in" (but don't call/follow up) and "not to fix a process but rather to look for a scapegoat".

*"Oh, and then the other one I thought was blame culture. We do like a scapegoat. So someone has…rather than fixing things and making them better and saying oh okay, something didn't go right. So we'd like to suggest an improvement and help you make it better and how could we do it, it's like who did that and why?" (F1, FC3)*

*"What they do is…someone will turn around and say you said this. And they'll just email it to you in amongst a big email, and you're on a call with someone, say oh well, such and such is looking at that, I emailed three weeks ago. And they don't think about chasing it or doing anything to help you. They just go no, it's your problem mate. It's not my problem, they just pass it on. It's a way of passing the baton. I don't know, just email it onto someone else. Oh, it's their problem now. Rather than actually getting on the phone and discussing it." (M, FC2)*

Cannot switch off (expectation to stay connected to work all the time):

The issues discussed in the previous sections extend into this one. On the one hand participants describe how dealing with the volume of E-mails cannot be fitted into the normal working day and that the pressure and implied productivity links lead them to extend their working day. On the other hand, participants feel an expectation to read E-mails out of office hours and to respond during vacation times. They explained that there is a 24/7 expectation, (although in many cases somewhat accepted due to the global nature of their work) leading them to feel like there is no escape, facilitating constant E-mail checking and worrying when at home. They can see colleagues working late and that they feel pressure to reply/do the same due to the time E-mails are sent to them. Examples of how this is experienced can be seen below:

*"(...) are really bad for Saturday morning working, really bad, all of them work Saturday morning. So you get a whole load of emails over the weekend. So I had to log in on a Sunday evening..." (M1, FC1)*

*F2: "Yeah, I have that, 24 hours hard to manage and stressful all in the same...because you come in on a morning now because you're a global organisation, or at the moment I'm finding that people are working really long, late hours. So even if I log off at 10 o'clock I'll come in and I've had 10 emails between 10 and midnight, and I'm, like, oh God, even more now. Yeah, it's quite hard.*

*I: So do you feel you work longer because of that as well?*

*F2: Absolutely, yeah.*

*M1: Do you not feel you've got to respond to emails that are done that late at night?*

*F2: Yeah, I do, I do feel like I've got to respond, yeah. And I also get, this needs to be done by tomorrow at 8. So I'm thinking...and, you know, so I've got to log on then, that's when..." (FC1)*

*M: "I've got three of those I think. More required from fewer staff, shadow leader and bad work life balance.*

*F: So I've got shadow of leader too.*

*I: Shadow...so you're saying the leader is having poor email behaviour?*

*M: Yeah.*

*F: Yeah.*

*I: So what kind of... What do they do?*

*F: So they email at 11 o'clock at night. So then you feel that you should respond."*
*(FC2)*

E-mails further facilitate relationship conflict and a lack of recovery while on holiday as seen by the example below:

*F1: "My husband threatened to throw my BlackBerry in the sea once, because I was sat on the sunbed reading emails and he just said..." That's enough you're supposed to be switching off from work, and if you don't put that in the safe, I'm going to throw*

*it in the...*" *And I was, like, right, okay. But I needed telling because I don't switch off.*

*M1: Yeah, exactly.*

*F2: And it runs away with time. Because I always think, just one more and then before you know it, it's an hour later and you're engrossed in...*" *(FC1)*

"*Well it's not so much I say I'm going to work for two hours now. It's just continually... My kids or one of my children will be talking to me or my eighteen-month-old daughter will be saying some of her first words. And I'm there just responding to an email. I've got to get this one out because it's from the US and they're still at work and they want an answer before the end of their working day.*" *(M2, FC3)*

Participants reported further that the ability to have access to their E-mails at home made them feel the need to check those constantly and that they often feel like they are "never off their phone" because of that. Hence, they describe how organisational and personal pressures interfere with their work-life balance and with their ability to detach from work during time off. A lack of shared expectation, unclear accountabilities and poor leadership practices were named as underlaying reasons for many of the issues discussed above.

Health:

The above reported problems have often been mentioned in combination with adverse consequences which over time can impact their psychosocial and physical health. Participants in the focus group acknowledged that it either has an impact on their mental health or that they can see why it could affect it. More specifically, participants described how an "never ending inbox is very stressful", how it leads them to feel overwhelmed and out of control. Furthermore, E-mails were said to make work seem relentless causing participants to feel like they cannot relax. It was also explained that because they receive more emails than they can deal with, they often cannot wrap up what they need to do during the day which causes them to worry about unfinished (and additional incoming) work during and after their shift has ended. To counteract this, participants continue working late from home, on the weekends and on holidays which inhibits important recovery mechanisms. E-mails are experienced as particularly stressful when returning from holiday, again counteracting any recovery experience they may have had. An example of how this is experienced can be seen below"

"*So the stress of having so many, then the impact that can have on an individual. It's about the need to read everything all the time. (...) I've got mental health after holidays. When you come back it's stressful and overwhelming*" *(M, FC2).*

Poor language (misinterpretation)

During each Focus Group, participants discussed the negative impact of poor language and the ease of misinterpretation in E-mails. For example, it was mentioned that E-mails can easily cause offence due to their "tone of voice" either because this is intended by "keyboard warriors" or because the font, colour, length of response or tone is misunderstood. Participants explained that E-mails can sound sarcastic or detrimental and that the use of language can be demoralising or cause a reaction. If such E-mails come from internal it can also negatively impact on working relationships (whether it was intended or not). For example, participants said that E-mails can be used as a weapon, are used by some teams to show bad performance and are "arse covering". Example:

> "So I've just put just used by some teams to show bad performance. So it's interesting, I've put specifically the product cost team at the moment. That team is struggling, it's a new team, and it's been a disastrous year. And they just...almost like a league table of where other STUs have gone wrong. But they never actually... And they put the world and his wife on it. But when they cock it up it's just sent to a very small audience." (F, FC3).

Other:

Lastly, there have been problems raised which could not be grouped under higher-order themes as they were not as consistent. Nevertheless, some may still be important. During some Focus Groups participants discussed how E-mails lead to less verbal communication which reduced connectivity and social bonds at work. An uncertainty whether E-mails were read, cyber security/GDPR risks and the ease of making mistakes were also criticised. Lastly, unclear accountabilities and a lack of training and common expectations through an internal policy were raised as problems.

**E-mail Policy Suggestions**
After discussing the negative impact E-mails had, all participants of the Focus Groups were asked to come up with ideas that they believe would make an effective internal E-mail policy. The ideas were themed into those which address the "E-mail overload" issue and those which address the consequential "E-mail invasion" aspect. Those suggestions address many of the above raised issues and could have a positive impact on workers.

E-mail overload

- Encourage the use of other instant ICT for simple questions (i.e. Yammer, whatsapp) and increase F2F conversations especially if you work in the same team on the same floor

- Standardised format for subject lines (i.e. for info/action + response expected & deadline).

- Shared general information (weekly newsletter) instead of separate emails from different senders.

- Stop "Thank you" & "Cheers" E-mails (It is not rude)

- Raise Awareness: "Think before you send" (could a phone call/F2F conversation be better? Do you have to send it now? Does it really need to go to all these people?)

- Log a receive/send ratio (and time of use) and manage more effectively.

- Use "Expiry" tool which automatically deletes E-mails that are only relevant until a certain time/day (This came from another company but seemed like a good idea)

- Email training/tips on how to manage them more effectively

- Turn off notifications

- Create an understanding for the time it takes to deal with E-mails

- Limit the amount of people that can be copied into an E-mail (rules around cc)


E-mail invasion

- Limit E-mail traffic to working hours unless it is urgent

- Set clear expectations when and when not to send/reply to E-mails (i.e. automatic OOO on weekends & holidays, maybe even on week nights)

- Use Flexible Working Signature (i.e. "while it suits me to email now, I don't expect a response")

- Better E-mail management when on holiday (only contact via phone call)

- Use delayed send

- Good Examples from Management (no E-mails from Managers outside of office hours unless it is urgent).

- Awareness training – Negative impact of E-mails

- Include trigger "are you sure" when sending E-mails out of hours (I am unsure how we would implement this).

# Appendix B – Article 1 appendices

*Table 1.* Studies Assessing the Negative Impact of Work-related ICT Demands.

| ICT Demand Conceptualisation | Author | Methodology, Sample, Country | Theory | Measure | Outcome Variable | Finding | NOS Score |
|---|---|---|---|---|---|---|---|
| **Multidimensional Techno-stressors** | Sarabadani, Compeau & Carter (2020) | Cross-sectional survey, 188 full-time employees who frequently use technology at work, USA | Transaction-based Model of stress (Lazarus & Folkman, 1984)<br><br>Appraisal Theory of Emotions (Beaudry & Pinsonneault, Lazarus, 1991, Lazarus & Folkman, 1984) – same as TMSC?? | Technostress creators scale (Tarafdar et al., 2007/Ragu-Nathan et al., 2008) | Emotional responses (direct) | Techno-overload is positively associated with loss emotion (i.e. anger, frustration, disgust, dissatisfaction, disappointment and annoyed)<br><br>Techno-complexity is positively associated with deterrence emotions (i.e. anxiety, fear, worry and distress).<br><br>(contrary to predictions),Techno-uncertainty is negatively associated with achievement emotions (i.e. happiness, satisfaction, pleasure, relief and enjoyment). | 5 |
| | Zhao, Xia & Huang (2020) | Cross-sectional survey, 513 full-time employees who use ICT at work , China | Transaction-based Model of stress (Lazarus & Folkman, 1984) | Technostress creators scale (Tarafdar et al., 2007) | Appraisal outcomes (direct)<br><br>Coping strategies (indirect) ICT-enabled productivity (indirect) | Techno-overload and techno-uncertainty are positively associated with challenge appraisal outcomes.<br>This in turn has a significant positive effect on employee productivity and an indirect effect on employee productivity via instrumental support seeing (problem-focused coping).<br><br>Techno-uncertainty, techno-complexity and techno-insecurity are positively associated with hindrance appraisal outcomes.<br>This in turn has a significant negative effect on employee productivity and an indirect effect on employee productivity via venting (emotion-focused coping). | 7 |

| | | | | | Conrary to preductions: Techno-complexity and techno-insecurity are negatively associated with challenge appraisal outcome<br><br>No sig. effect for techno-invasion | |
|---|---|---|---|---|---|---|
| Cho, Kim, Chin, & Ahmad (2020). | Diary study, 98 employees across multiple sectors, N.A. | Stressor–strain model (Kahn & Byosiere, 1992)<br><br>Boundary theory (Ashforth et al., 2000; Clark, 2000) | ICT Demands scale (Day et al., 2012) – response expectations, poor communication, hassles, extended availability. | Work-family conflict (direct) Negative affect (direct) | ICT hassles and extended availability had significant positive effects on WFC.<br><br>Response expectations and poor communicatiom showed significant positive relationships with negative affect. | |
| Li & Wang (2020) | Cross-sectional survey, 312 University teachers, China | N.A. | 4 dimensional Technostress creators measure (Ragu-Nathan et al., 2008) – no techno invasion | Work performance (direct) | Techno-complexity and techno-insecurity have a negative relationship with work performance.<br><br>Contrary to predictions, techno-overload was positively related to work performance | 5 |
| Califf & Brooks (2020) | Cross-sectional survey, 416 K-12 teachers, USA | Stressor-Strain Theory (Cooper et al., 2001; Podsakoff et al., 2007; Schaubroeck et al., 1989)<br><br>Person-Environment Fit theory (Cooper et al., 2001; Edwards et al., 2000) | Technostress creators scale (Tarafdar et al., 2007) | Burnout (direct)<br><br>Turnover intentions (distal) | Techno-insecurity, techno-invasion, techno-overload have a signigicant positively relationship with burnout.<br><br>In turn, burnout has a signigicant positive effect on turnover intentions. | 7 |
| Güğerçin (2020) | Cross-sectional survey, 252 mainly white collar workers in the manufacturing industry, N.A. | Neutralisation Theory (D'Arcy et al., 2014; Gilboa et al., 2008; Rodell & Judge, 2009) | Techno-overload, techno-invasion, techno-complexity (Tarafdar et al., 2007) | Minor cyberslacking (a.k.a. cyberloafing, is defined as the voluntary use ofthe internet, e-mail, and mobile technology during work hours for personal purposes) | Only techno-invasion has a significant positive effect on minor cyberslacking | 5 |

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|---|---|---|---|---|---|---|
| Molino, Ingusci, Signore, Manuti, Giancaspro, Russo, ... & Cortese (2020) | Cross-sectional survey, 749 workers across different occupational sectors, Italy | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966)<br><br>Person-Environment Fit theory (Cooper et al., 2001; Edwards et al., 2000) | Techno-overload, Techno-invasion, Techno-complexity (Ragu-Nathan et al., 2008) – Italian version | Work-family conflict (direct) Behavioural stress (direct,indirect) | Techno-invasion has a positive relationship with work-family conflict and an indirect prositive relationship with behavioural stress, which is fully mediated through WFC.<br><br>Techno-overload and Techno-complexity have direct positive relationships with behavioural stress. | 6 |
| Califf, Sarker & Sarker (2020) | Cross-sectional survey, 402 nurses, USA | Stressor-Strain Theory (Cooper et al., 2001; Podsakoff et al., 2007; Schaubroeck et al., 1989)<br><br>Person-Environment Fit theory (Cooper et al., 2001; Edwards et al., 2000) | 4 dimensional Technostress creators measure (Ragu-Nathan et al., 2008) – no techno invasion<br><br>Techno-distress - adapted from the Kessler Psychological Distress Scale (Kessler et al. 2003)<br><br>Technology characteristics Ayyagari et al. (2011) | Techno-distress(direct) Attrition (distal) Job Satisfaction (distal) Turnover Intention (distal) | Techno-overload and techno-insecurity have a positive relationship with Techno-distress.<br><br>Techno-distress has a negative relationship with job satisfaction (paper says is saying yes in table but NS in text) and turnover intention. | 5 |
| Zainun, Johari & Adnan (2019) | Cross-sectional survey, 225 administrative workers in higher education insitutions, Malaysia | Social Exchange Theory (Cropanzano & Mitchell, 2005) | Technostress creators scale (Tarafdar et al., 2007) | Commitment to change | Techno-invasion and techno-insecurity have a significant negative relationship with commitment to change. | 5 |
| Hauk, Goritz & Krumm (2019) | Longitudinal survey, 631 professionals from German-speaking countries | Transactional theory of stress (Lazarus & Folkman, 1987) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Technology-related strain (direct, indirect) | Technostress has a significant positive effect on technology-related strain, which is partly mediated by coping strategies (active coping, social coping and behavioral disengagement) | 6 |

| Authors | Method/Sample | Theory | Technostress Measure | Outcomes | Findings | Quality |
|---|---|---|---|---|---|---|
| Chandra, Shirish & Srivastava (2019) | Cross-sectional survey, 164 participants including senior managers from leading buisness schools and senior executives from large corporations | Control Theory (Spector, 1998) Conservation of Resources (COR) theory (Hobfoll, 1989) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | ICT-enabled innovation (direct) | Techno-overload, techno-invasion, and techno-complexity had a significant curvilinear relationship with ICT-enabled employee innovation | 7 |
| Pirkkalainen, Salo, Tarafdar & Makkonen (2019) | Cross-sectional survey, 846 IT using full-time employees, USA | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966) Coping theory (Carver, Scheier & Weintraub, 1989; Folkman, 1984) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | It-enabled productivity | Technostress creators have a significant negative relationship with IT- enabled productivity | 7 |
| Weinert, Maier, Laumer & Weitzel (2019) | Cross-sectional survey, 110 participants (mainly workers??), N.A. | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966) | Full Technostress measure (Ayyagari et al., 2011) | Emotional exhaustion (direct) Reacting coping/mental disengagement (indirect) | Technostress had a significant positive effect on emotional exhaustion which has a positive effect on reactive coping. | 5 |
| Delpechitre, Black, & Farrish, (2018) | Cross-sectional survey, 218 salespeople from one lare organiation, USA | JDR model (Bakker & Demerouti, 2007) | Technology overload (information overload, communication overload & system feature overload ; Karr-Wisniewski & Lu, 2010) | Role ambiguity (direct) Role conflict (direct) Effort invested to use use technology (direct) Administrative performance (direct) Outcome performance (direct) | Technology overload (all three dimension) has a positive relationship with role ambiguity and role conflict and a negative relationship with outcome performance. Information overload and communication overload have a positive relationship with ones effort invested in using technology. Information overload and communication overloadwere have a negative relationship with administration performance. | 8 |

| Issa & Bahli (2018) | Cross-sectional survey, 215 employees from varius publicly listed firms on the NYSE, USA | Stimulus – organism – response model (Struempfer, 1986 – extension of Lazarus's TMSC)<br><br>Triphasic stresss model, appraisal theory of emotion, activation theory (?) | Techno-overload, uncertainty and complexity (Ragu-Nathan et al., 2008) | Techno-exhaustion/strain (direct)<br><br>Discontinuous usage intentions (distal/indirect) | Technostressors have a U-shaped relationship with technoexhaustion. Specifically, if technostressors increase, technoexhaustion will decrease to a certain point and beyond this. they will show a positive relationship with technoexhaustion.<br><br>Techno-exhaustion in turn has a positive relationship with discontinuous usage intentions | 7 |
|---|---|---|---|---|---|---|
| Mahapatra & Pati (2018) | Cross-sectional survey, 163 exceecutive education participants, India | JD-R model (Demerouti et al, 2001) | Full Technostress creators measure (Ragu-Nathan et al., 2008) – referenced wrong in paper | Burnout (direct) | Techno-invasion and techno-insecurity have a significant positive effect on burnout.<br><br>When testing for mediation, Techno-complexity reported a significant association with burnout.<br>Techno-insecurity fully mediated the relationship between techno-complexity and burnout.<br>Techno-invasion partially mediated the relationship between techno-complexity and burnout. | 6 |
| Kim & Park, (2018) | Cross-sectional survey, 190 participants, Korea | Person- Environment Fit Model of stress (Edwards & Cooper1988) | Technostress as techno-overload, insecurity and invasion (Kim & Park, 2018) – questions look like Ragu-Nathan (2008) but do not reference it. | Techno-strain (direct) | Technostress has a positive effect on strain | 5 |
| Turel & Gaudioso (2018) | Cross-sectional survey, Study 1 - 175 full time employees working for a state gov organization, USA Study 2 - 178 employees from 3 | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Distress (direct)<br>Work exhaustion (indirect/distal) | Technostress has a signficicant positive effect on distress.<br>Technostress has a significant indirect effect on work-exhaustion mediated by distress.<br><br>Addition: positive leadership climate buffers this effect and competitive | 7 |

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|---|---|---|---|---|---|---|
| | small IT service firms, Italy | | | | climate increasesthe effect (even beyong TS). | |
| Yin, Ou, Davison & Wu (2018) | Cross-sectional survey, 178 employees using MICT's for work, China | Coping Theory / cognitive load theory? TMSC? (Lazarus, 1993; Folkman et al., 1986) | (MICT) Information overload (adapted from Eppler & Mengis, 2004) | Job satisfaction (direct) | Information overload has a significant negative effect on job satisfaction. | 6 |
| Pirkkalainen, Salo, Makkonen & Tarafdar (2017) | Cross-sectional survey, 1091 IT users from various industries, N.A | Coping model of user adaptation (Beaudry & Pinsonneault; 2005) Transaction- based Model of stress (Cooper et al., 2001; Lazarus & Folkman, 1984, Lazarus 1966) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Strain | Technostress has a siginficant positive effect on strain | 7 |
| Ioannou & Papazafeiropoulou (2017) | Cross-sectional survey, 440 participants, N/A | Transaction- based Model of stress (Lazarus & Folkman, 1984,Cooper et al., 2001) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | End-user satisfaction (direct) End-user performance (direct) | Technostress has a significant negative relationship with end-user satisfaction and end-user performance. | 7 |
| Gaudioso, Turel, & Galimberti (2017) | Cross-sectional survey, 242 employees of a large organisation, USA | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966) Stress dynamics model (Lazarus, 1993a, 1993b, 1996). | Techno-invasion and Techno-overload (Ragu-Nathan et al., 2008) | Work-family conflict (direct) Job distress (direct) Work exhaustion (distal) | Techno-invasion has a direct positive relationship with work- family conflict. Techno-overload has a direct positive relationship with job distress. The effects of techno-invasion and techno- overload on work exhaustion are mediated by WFC and job distress (and adaptive/maladaptice coping strategies related to work technology). | 7 |

| Authors | Method/Sample | Theory | Independent Variables | Dependent Variables | Findings | Score |
|---|---|---|---|---|---|---|
| Mahmud, Ramayah & Kurnia (2017) | Cross-sectional suvrey, 222 employees working wits IS across several manufacturing industries, Bangladesh | N.A. | ICT-induced Work-home conflict, work overload, role ambiguity (Ayyagari et al., 2011) | Techno-exhaustion/strain (direct) | ICT-induced Work-home conflict, work overload, role ambiguity have a sig positive effect on strain. | 6 |
| Suh, & Lee (2017) | Cross-sectional survey, 258 teleworkers from global IT companies, South Korea | Job characteristics theory (Oldham and Hackman, 2005) Stressor-strain model, (Frese and Zapf, 1988) | ICT-induced Invasion of privacy, Work overload, Role ambiguity (Ayyagari et al., 2011) | Techno-Strain (direct) Job satisfaction (direct) | ICT-induced invasion of privacy, work overload and role ambiguity have a sig positive effect on strain and a sig negative effect on job satisfaction | 6 |
| Stadin,Nordin, Brostrom, Magnusson Hanson, Westerlund & Fransson (2016) | Cross-sectional survey (data from the 2014 Swedish Longitudinal Occupational Survey of Health), 14757 employed adults, Sweden | Demands-control (job strain) model, (Karasek and Theorell 1990). Effort-reward imbalance (ERI) model - (Siegrist, 1996) | ICT Demands (Stadin et al., 2016) | Work-related stress (job strain and effort reward impalance) (direct) Suboptimal self-rated health (distal) | ICT demands have a sig positive relationship with work-related stress. In turn, this has a sig positive relationship with suboptimal self-rated heath | 7 |
| Harris, Harris, Carlson & Carlson (2015) | Cross-sectional survey, 219 full-time workers, USA | Conservation of Resources (COR) Theory (Hobfoll, 1989) | Technology overload (information overload, communication overload & system feature overload ; Karr-Wisniewski & Lu, 2010) | Work-life conflict (direct) | Information overload, communication overload and system feature overload have a positive relationship with work-life conflict. | 7 |
| Harahap & Effiyanti (2015) | Cross-sectional survey 152 vocational school teachers, Indonesia | Person- Environment Fit Model of stress (Edwards & Cooper1988) Social Cognitive Theory (Bandura, 2001) | ICT-induced work overload and job insecurity (Ayyagari et al., 2011) | Technostress conceptualised as computer anxiety, strain and negative affectivity (direct) | ICT-induced work overload and job insecurity have a sig positive effect on technostress. | 5 |

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|---|---|---|---|---|---|---|
| Gaudioso, Turel, Galimberti, (2015) | Cross-sectional survey, 242 employees of a large organisation, USA | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966) | Techno-overload & Techno-invasion (Ragu-Nathan et al., 2008) | Work-family conflict (direct) Job stress(direct) ICT coping strategies (distal) Work exhaustion (distal) | Techno-invasion has a significant positive effect on work-family conflict. Techno-overload has a significant positive effect on job stress. In turn, work-family conflict and job stress have a significant positive effect on maladaptive coping strategies which significantly increase work-exhaustion. | 6 |
| Jena (2015) | Cross-sectional survey, 216 Academics, India | N.A. | Technostress creators measure (Ragu-Nathan et al., 2008) – only used one item per subdimension?? | Job satisfaction (direct) Organisational commitment (direct) Negative affectivty (direct) Technology-enabled performance (direct) | Technostress has a negative relationship with job satisfaction, orgnisaitonal commitment and technology-enabled performance. Technostress has a positive effect on negative affectivity | 5 |
| Srivastava, Chandra, Shirish, 2015 | Cross-sectional survey, 152 senior managers and executives from different firms, N.A. | Transaction- based Model of stress (Lazarus & Folkman, 1984) | Technostress creators measure (Ragu-Nathan et al., 2008) | Burnout | Technostress creators have a significant positive effect on burnout | 6 |
| Kim, Lee, Yun & Im, 2015 | Cross-sectional survey, 210 employees, Korea | N.A. | 4 mobile enterprise stressors (adapted techno-stress creators from Tarafdar et al., 2007) – no unertainty | Work exhaustion | Only mobile-enterprise invasion has a significant impact on work exhaustion | 7 |
| Tarafdar, Pullins & Ragu-Nathan (2015) – same as 2014? | Cross-sectional survey, 237 institutional sales professionals, N.A. | Technostressor effects: Role Theory (Rizzo, House, & Lirtzman, 1970) Moderator effect: Social Cognitive Theory, (Bandura, 1982) | 4 dimensional Technostress creators measure (Ragu-Nathan et al., 2008) – no techno uncertainty | Sales Performance (direct) Technology-enabled innovation (direct) | Technostress has a negative relationship with Sales Performance and Technology enabled innovation | 7 |

| Maier, Laumer & Eckhardt (2015) | Cross-sectional survey, 206 full-time employees who use IT daily, N.A. | Stressor–strain–outcome model (Koeske & Koeske 1993) | Full Technostress measure (Ayyagari et al., 2011) + 2 items from techno-insecurity (Ragu-Nathan et al., 2008) | Work-home conflict (direct) Work overload (direct) Techno-exhaustion (direct) Work-exhaustion (indirect) Job satisfaction (distal) Turnover intentions (distal) Organisational commitment (distal) | All Technostressors (exepct techno-induced invasion of privacy) have a significant positive effect on techno-exhaustion. In turn, Techno-exhaustion has significant positive effect on work exhaustion and turnover intentions and a sig. negative effect on job satisfaction and organisational commitment. Work exhaustion fully mediates the reltionships between techno-exhaustion and job-satisfaction, turnover intentions and organisational commitment. Techno-induced work-home conflict, work overload and role ambiguity have a sig. positive effect on work overload which in turn positively predicts work exhaustions. Techno-induced job insecurity, invasion of privacy and work-home conflict have a positive effect on overall work-home conflict which in turn positively predicys work exhaustion. | 6 |
|---|---|---|---|---|---|---|
| Hung, Kuanchin & Lin (2014) | Cross-sectional suvrey, 601 work-related mobile phone users, N.A. | N.A. | Communication overload - no items or referene provided but oriented at Techno-overload. (Hung et al., 2014) | ICT-enabled productivity | Communication overload has a negative relationship with ICT-enabled productivity | 5 |
| Ahmad, Amin & Ismail (2014) | Cross-sectional survey, 282 librariams from higher learning institutions, Malaysia | N.A. | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Organisational commitment (direct) | Contrary to predictions, techno-overload and techno-uncertainty have significant positive relationships with organisational commitment. | 5 |

| Fuglseth & Sorebo (2014) | Cross-sectional suvrey, 2016 employees of a medium-sized government administration, Norway | Transactional model of stress (Lazarus, 1991 | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Employee satisfaction with ICT use (direct)<br>Intention to extent the use of ICT (distal) | Technostress has a sinigicant negative effect on employee's satisfaction with ICT use, which mediated the effect of Technostress on Intention to extent the use of ICT. | 7 |
|---|---|---|---|---|---|---|
| Fieseler, Grubenmann, Meckel & Mueller (2014) | Cross-sectional survey, 491 professionals from 25 different European countries | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966) | 4 dimensional Technostress creators measure (Ragu-Nathan et al., 2008) – no techno uncertainty | ICT strain (direct)<br>Work exhaustion (direct & distal)<br>Job satisfaction (distal) | Techno-overload and Techno-complexity have a positive effect on ICT strain.<br><br>ICT strain in turn had a positive effect on Work exhaustion which subsequently decreased job satisfaction.<br><br>Hence, techno-overload and techno-complexity affected work exhaustion and job satisfaction indirectly (quoted from autors) | 5 |
| Reinke & Chamorro-Premuzic (2014) | Cross-sectional survey, 201 participants (all workers apart 5% students), mainly living in: US, UK, Canada & Germany. | JD-R model (Demerouti et al., 2001) | Email overload (adapted from Dabbish & Kraut, 2006) | Burnout | Email overload has sig positive effect on burnout. | 7 |
| Tarafdar, Pullins & Ragu-Nathan, (2014). | Cross-sectional survey, 237 institutional sales professionals, N.A. | Technostressor effects: Role Theory (Rizzo, House, & Lirtzman, 1970)<br><br>Moderator effect: Social Cognitive Theory, (Bandura, 1982) | 4 dimensional Technostress creators measure (Ragu-Nathan et al., 2008) – no techno uncertainty | Role Stress (direct)<br>Technology-enabled innovation (direct)<br>Technology-enabled performance (distal) | Technostress has a positive relationship with role stress and a negative relationship with technology-enabled innovation.<br><br>Both outcomes subsequently reduce technology enabled perfromance, hence they found two separate pathways through which technostress creators negatively impact technology- enabled performance – by increasing role stress and by decreasing technology-enabled innovation. | 5 |

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|---|---|---|---|---|---|---|
| Day, Paquet, Scott & Hambley (2012) | Cross-sectional survey, 258 employees aross various occupations, N.A. | Transactional model of stress (Lazarus and Folkman, 1984)<br><br>Job-demands-resource model (Demerouti et al., 2001). | ICT demands scale (Day et al., 2012) | Strain (direct)<br>Perceived ICT stress (direct)<br>Burnout – exhaustion (direct)<br>Burnout – cynicism (direct)<br>Burnout – professional efficacy (direct) | ICT demands had a sig positive effect on strain, perceived ICT stress, exhaustion, cynicism and professional efficacy | 7 |
| Yun, Kettinger & Lee (2012) | Cross-sectional survey, 300 employees who use MICT for work, Korea | Boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996) | Work overload due to Office-Home Smartphone use (OHS - Yun et al., 2012) | Work-life conflict (direct)<br>Job stress (distal)<br>User resistance to OHS | Work Overload due to OHS has a positive relationship with work-life conflict.<br><br>In turn, work-life conflict positively predicts job stress and user resistance to OHS. | 6 |
| Ayyagari, Grover & Purvis (2011) | Cross-sectional survey, 661 full-time employees who work with information systems, USA | Person- Environment Fit (Edwards 1991) | Full Technostress measure (Ayyagari et al., 2011) | ICT-related strain (direct) | ICT-related work overload, role ambiguity, work-home conflict and job insecurity are positively related to ICT related strain<br><br>(Contrary to predictions invasion of privacy did not significantly relate to strain). | 6 |
| Tarafdar, Tu., Ragu-Nathan & Ragu-Nathan (2011) | Cross-selctional survey, 233 employees from two US public service organisations, US | Transaction- based Model of stress (McGrath 1976, Lazarus 1966) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Job Satisfaction (direct)<br>Organisational Commitment (direct)<br>Employee Innovation (direct)<br>Employee Prodictivity (direct)<br>End User Satisfaction (direct)<br><br>Role Conflict (direct)<br>Role Overload (direct) | Technostress has a <u>negative</u> effect on:<br>Job Satisfaction<br>Organisational Commitment (p=.05)<br>Employee Innovation<br>Employee Prodictivity<br>End User Satisfaction<br><br>Technostress has a <u>positive</u> effect on:<br>Role Conflict<br>Role Overload | 5 |
| Tarafdar, Tu & Ragu-Nathan (2010) | Cross-selctional survey, 233 employees from two US public service organisations, US | Transactional Model (McGrath 1976, Lazarus 1966) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | End-User Productivity (direct)<br>End-User Satisfaction (direct) | Technostress has a negative effect on end-user productivity and end-user satisfaction | 5 |

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|---|---|---|---|---|---|---|
| | Wang & Shu (2008) | Cross-sectional survey, 285 employees, China | N.A. | Full Technostress creators measure (Ragu-Nathan et al., 2008) – references it as 2002 in paper?? | Role conflict (direct) Role overload (direct) | Technostress has a positive relationship with role conflict and role overload. | 7 |
| | Ragu-Nathan, Tarafdar., Ragu-Nathan & Tu (2008) | Cross-sectional survey, 608 employees spread across 5 organisations, N.A. | Transaction- based Model (McGrath 1976, Lazarus 1966) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Job Satisfaction (direct) | Technostress has a negative effect on Job Satisfaction | 5 |
| | Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan (2007) | Cross-selctional survey, 233 employees from two US public service organisations, US | Sociotechnical theory(Trist & Bamforth,1951) and Role theory (Gross & McEachern 1996) | Full Technostress creators measure (Ragu-Nathan et al., 2008) | Role-stress (direct) ICT-enabled task productivity (direct) | Technostress has a positive relationship with role stress and a negative relationship with productivity. | 5 |
| **ICT-related pressures and expectations** | Büchler, ter Hoeven, & van Zoonen (2020) | Cross-sectional survey, 274 employees from an automotive firm and 387 employees from an technology firm, N.A. | Boundary Theory (Ashforth et al., 2000) | Constant Connectivity (Büchler et al., 2020) | Psychological detachment (direct) Well-being (indirect) | Constant connectivity has a negative relationship with psychological detachment. The negative relationship between constant connectivity and well-being is mediated by psychological detachment | 7 |
| | Belkin, Becker & Conroy (2020) | Cross-sectional survey, 563 full time workers across various industries, USA | Job demands–resources model (Bakker & Demerouti, 2007; Demerouti, et al., 2001) Conservation of Resources (COR) Theory (Hobfoll, 1989) | Organisational Expectations for email monitoring – OEEM (Becker et al., 2019) | Time spent on emails after hours (direct) Psychological detachment (direct) Emotional exhaustion (direct, indirect) Work-life balance (direct, indirect) Turnover intentions (indirect) | OEEM has a positive relationship with time spent on emails after hours and emotional exhaustion. OEEM has a negative relationship with psychological detachment and work-life blance. The positive relationship between OEEM and emotional exhaustion is partially mediated by psychological detachment. | 7 |

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| | | | | | The negative relationship between OEEM and work-life balance is mediated by psychological detachment and emotional exhaustion. This mediation is a serial mediation.<br><br>OEEM has a sig indirect relationship with turnover intentions, mediated by psychological detachment and emotional exhaustion (serial mediation). | |
| Lutz, Schneider & Vorderer (2020) | Experimental study, 337 emplyees across various sectors, Germany | Work-family boarder theory (Clarke et al., 2000)<br><br>Transactional model of stress (Lazarus and Folkman, 1984) | Inconsistent work-related pressure to be available in the private domain | Negative affect (direct) | Participants in the high setting-inconsistent pressure condition had higher levels of negative affect when receiving work-related messages at home compared to those in the low setting inconsistent pressure condition. | 6 |
| Park, Liu, Headrick, 2020 | Weekly diary study, 546 elementary school teachers, USA | Boundary theory (Ashforth et al., 2000; Clark, 2000); JD-R (Bakker & Demerouti, 2007) | Availability Expectations (subdimension from Day et al.,2012's ICT Demands Scale) | Negative work rumination (direct)<br>Negative affect (direct)<br>Insomnia (direct) | ICT Demands (availability expections) were positively related to negayive work rumination, negative affect and insomnia. | 8 |
| Kao, Chi, Thomas, Lee & Wang, 2020 | 2-wave survey, 186 full-time employees, Taiwan | Effort-recovery model (Meijman & Mulder, 1998) | Availability Expectations (subdimension from Day et al.,2012's ICT Demands Scale)<br><br>Workplace telepressure (Barber & Santuzzi, 2015) | Burnout (direcr)<br>Work-family conflict (direct) | ICT availability demands were positively related to burnout and work-family conflict.<br>ICT availability demands were positively related to workplace telepressure which mediated the effects on burnout and performance. | 8 |
| Cambier & Vlerick (2020) | Diary study? 55 employees, Belgium | N.A. | Workplace telepressure (Barber & Santuzzi, 2015) | Objective e-mail reply quantity | Worplace telepressure has a positive effect on objective email reply quantity | 6 |

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|---|---|---|---|---|---|---|---|
| Was initially in 1st conceptualisation | Wu, Wang, Mei & Liu (2020) | Cross-sectional suvrey, 374 managers and general staff working in the manufacturing and IT industry, China | Transaction- based Model of stress (Lazarus & Folkman, 1984, Lazarus 1966)<br><br>Conservation of Resources (COR) theory (Hobfoll, 1989) | Techno-invasion (Tarafdar et al., 2007) | Job anxiety (direct) | Techno-invasion has a significant positive effect on job anxiety | 7 |
| | Barber, Conlin & Santuzzi (2019) | Time-lagged cross-sectional survey, 409 employees across various occupations, USA | Personal resource allocation framework (Grawitch et al., 2010)<br><br>Resource drain perspective (Edwards & Rothbard, 2000) | Workplace telepressure (Barber & Santuzzi, 2015) | Study 1<br>Work-life blanace satisation (direct)<br>Psychological detachment (direct)<br>Relaxation experiences (direct)<br><br>Study 2<br>Work-life balance effectiveness (direct)<br>Work-family conflict (direct)<br>Work-family enrichment (direct) | Study 1<br>Workplac telepressure ha a negative relationship with work-life balance satisfaction, psychological detachment and relaxation experiences.<br><br>Study 2<br>Workplace telepressure has a negative relationship with wor-life effectiveness and work-family enrichthment and a positive relationshipwith work-family conflict. | 7 |
| | Palm, Seubert, & Glaser (2019) | Time-lagged cross-sectional survey, 748 working adults, Austria and Germany | Boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996)<br><br>Reasoned Action Approach (RAA; Fishbein & Ajzen, 2010) | Injunctive norms (Höge, 201) (expectation from employer to be available and do more out of hours)<br><br>Descriptive norms (behaviour from colleagues) | Work-to-nonwork integration behavior | Injuctive norms and descriptive norms have a positive relationship with work-to-nonwork integration behavior | 7 |
| | Becker, Belkin, Conroy & Tuskey (2019) | Study 1<br>Daily diary study, 182 working adults, USA<br><br>Study 2<br>Cross-sectional survey,138 working | Job demands–resources model (Bakker & Demerouti, 2007; Demerouti, et al., 2001) | Organisational Expectations for email monitoring – OEEM (Becker et al., 2019) | Study 1<br>E-anxiety (direct)<br>Employee health (indirect)<br>Employee relationship quality (indirect)<br><br>Study 2<br>E-anxiety (direct) | Study 1<br>OEEM has a positive relationship with e-anxiety and a negative relationship with employee health and relationship quality.<br><br>The negative relationship between OEEM and health and OEEM and | 7 |

| | Author | Study | Model | Variables | Outcomes | Findings | |
|---|---|---|---|---|---|---|---|
| | | adults and significan others, USA | | | Health Relationship quality | relationship quality are both mediated by e-anxiety. | |
| | | Study 3: Time-lagged cross-sectional study, 162 full time workers who use email out of hours, N.A. | | | Significant other e-anxiety Significant other health Significant other relationship quality | Study 2 All results from study 1 were replicated apart from those for employee health. | |
| | | | | | Study 3 E-anxiety (direct) Relationship satisfaction (direct) Health (indirect) General anxiety (indirect) | OEEM has apositive relationshuip with significat other e-anxiety, which is mediated by employee e-anxiety | |
| | | | | | | The negatve relationship between OEEm and significant other health and relationship quality is mediated by employee and significant other e-anxiety. | |
| | | | | | | Study 3 OEEM positively predicts e-anxiety and has a sig negative relationship with relationship satisfaction. The negative effect of OEEM on health is mediated by e-anxiety. OEEM has an indirect positive effect on general anxiety through e-anxiety. | |
| Also fits in 3rd conceptualisatiom | Cambier, Derks & Vlerick (2019) | 5-day diary study, 80 employees, Netherlands | Effort-recovery model (Meijman & Mulder, 1998) | Workplace telepressure (Barber & Santuzzi, 2015) Daily work-related smartphone use during off hours (Derks & Bakker, 2014) – mediator | Psychological detachment (indirect) | Workplace telepressure has a positive relationship with daily work-related smartphoe use during off hours wich in turn has a negative relationship with psychological detachment. | 7 |
| | Hu, Santuzzi & Barber (2019) | Cross-sectional survey, 233 full-time workers, N.A. | Effort-recovery model (Meijman & Mulder, 1998) Job demands–resources model (Bakker & Demerouti, 2007; Demerouti, et al., 2001) | Workplace telepressure (Barber & Santuzzi, 2015) | Burnout –physical fatigue (direct, indirect) Burnout – cognitive weariness (direct) Burnout – emotional exhaustion (direct) Sleep quality (direct, indirect) Sleep quantity (indirect) | Workplace telepressure has a significant positive relationship with all three burnout dimensions (physical fatigue, cognitive weariness & emotional exhaustion) and poor sleep quality. Workplace telepressure has a negative relationship with psychological | 5 |

| | | | | Psychological detachment (direct) Boundary crossing behaviour (direct) | detachment and boundary crossing behaviours. The relationship between workplace telepressure and physical fatigue, sleep quality and slepe quantity was was mediated through boundary crossing. | |
|---|---|---|---|---|---|---|
| Dettmers & Biemelt (2018) | Cross-sectional survey, 310 emploees, N.A. | Effort-reward imbalance (ERI) model (Siegrist, 1996) Work-home border theory (Ashforth et al., 2000; Clark, 2000) | Extendet availability demands (Dettmers, 2016) | Emotional exhaustion (direct) Cognitive irritation (direct) | Extended availability requirements have a sig positive relationship with emotional exhaustion and cognitive irritation. | 7 |
| Van Laethem, Van Vianen & Derks (2018) | Daily diary study, 116 employees, Netherlands | Effort-recovery model (Meijman & Mulder, 1998) Allostatic load theory (McEwen, 1998) Job demands–resources model (Bakker & Demerouti, 2007; Demerouti, et al., 2001) | Workplace telepressure (Barber & Santuzzi, 2015) Daily work-related smartphone use during off hours (Derks & Bakker, 2014) - mediator | Psychological detachment (indirect) | Workplace telepressure has a positive relationship with daily work-related smartphoe use during off hours wich in turn has a negatuve relationship with psychological detachment. | 7 |
| Kim & Hollensbe (2018) | Time-lagged cross sectional study, 267 employees from a information technology company, USA | Boundary theory - (Ashforth et al., 2000; Clark 2000; Pleck 1977) | Technology-related pressure (Harris, Marett & Harris, 2011) | Home boundary permeability (direct) Work-to-home conflict (indirect) | Technology-related pressure positively predicts hme boundary permeability. In turn, home boundary permeability has a positive relationship with work-to-home conflict. | 7 |
| Piszczek (2017) | Cross-sectional survey, 163 full-time workers (HR alumni), USA | Boundary theory (Nippert-Eng, 1996) Job demands–resources model (Bakker & Demerouti, 2007; Demerouti, et al., 2001) | After-hours electronic communication expectations (Fender, 2010; adapted Piszeck, 2017) | Work-family technology use (direct) Boundary control (direct) Emotional exhaustion (direct) | After-hours electronic communication expectations have a positive relationship with work-family technology use and emotional exhaustion. After-hours electronic communication expectations have a negative relationship with boundary control | 6 |

| Study | Method/Sample | Theory | Key Construct | Outcomes | Findings | Quality |
|---|---|---|---|---|---|---|
| Dettmers (2017) | Logitudinal survey, 416 full time workers, predominantly within the service industry, Germany | Work–home boundary theory (Ashforth, Kreiner, & Fugate, 2000; Hall & Richter, 1988; Nippert-Eng, 1996) | Extendet availability demands (Dettmers, 2016) | Emotional exhaustion (direct & indirect) Recovery - psychological detachment (direct) Work-family conflict (direct) | Higher levels of extended availability requirements at T1, lead to higher levels of WFC and lower levels of psychological detachment at T2 and higher levels of emotional exhaustion at T3.  Indirect effects of extended availability requirements through WFC and psychological detachment on emotional exhaustion were significant. | 7 |
| Dettmers, Bamberg & Seffzek (2016) | Cross-sectional survey, 346 employees from various industries, Germany | Boundary Theory - (Ashforth et al., 2000) | Extendet availability demands - availability requirements and frequency of job contacts (Dettmers et al., 2016) | Emotional exhaustion (direct) Psychological detachment (direct) Control over off-job time (direct) | Availability requirements have a positive effect on emotional exhaustion and a negative effect on psychological detachment and control over off-job time.  Frequency of job contacts showed a sig positive inrmeental effect on detachment and control. | 6 |
| Dettmers, Vahle-Hinz, Bamberg, Friedrich & Keller (2016a) | Dialy diary study,132 working adults, Germany? | Work-family border theory (Clark, 2000; Kossek et al., 2012) | Day-level extended work availability (i.e.weeks with on-call duty; Dettmers et al., 2016) | Start of day mood (arousal, calmness, valence) (direct)  Cortisol awakening response (direct)  Recovery experience (control, psychological detachment) (direct) | Eztended work availability has a negative relationship with all start of dat arousal, calmness, valence and with control and psychological detachment.  Extended work availability has a positive relationship with the cortisol awakening response. | 7 |
| Barber & Santuzzi (2015) | Cross-sectional survey, 303 full-time workers, USA, | Job-demands-resource model ( Bakker & Demerouti, 2007; Demerouti et al., 2001)  Effort-recovery model (MeijmN & Mulder, 1998) | Workplace telepressure (Barber & Santuzzi, 2015) | Burnout, Absenteeism, Psychological detachment email behaviour, Sleep quality | Workplace telepressure has a positive effect on cognitive and physical burnout, absenteeism and e-mail response frequency.  Workplace telepressure has a negative effect on psychological detachment, sleep quality and e-mail response times.  In study 1, techno-overload predicts workplace telepressure ? | 5 |

| | Adkins & Premeaux (2014) | Cross-sectional survey, 290 employees of two Universities, N.A. | Boundary theory (Ashforth, Kreiner, & Fugate, 2000)<br><br>Work-family border theory (Clark, 2000) | Requirement to be connect to work after regular hours (adapted from Vankatesh & Davis, 2000). | Work connectivity behaviour after hours (direct) | The requirement to be connected to work after hours had a positive effect on work connectivity behaviour after hours. | 7 |
|---|---|---|---|---|---|---|---|
| **ICT-based Commectivity Behaviour** | Tams, Ahuja Thatcher & Grover (2020) | Cross-sectional survey, 601 knowledge workers, N.A. | Work-demand control model (Karasek, 1979) | Perceived interruption oberload after hours after regular work hours (Chen & Karahanna, 2018; Yin et al., 2018) | Work-life conflict (direct)<br>Work-related technology use (indirect) | Perceived interruption overload has a positive relationship with work-life conflict.<br><br>Perceived interruption overload has a negative indirect effect on work-related technology use wich is mediated by work-life conflict. | 6 |
| | Bauwens, Muylaert, Clarysse, Audenaert & Decramer (2020) | Cross-sectional survey, 288 secondary school teachers, Belgium | Boundary theory (Ashford et al., 2000)<br><br>The Unified Theory of Acceptance and Use if Technology (UTAUT; Venkatesh, Morris, Davis & Davis, 2003) | Work-related ICT use after hours (WIA; Boswell and Olson-Buchanan, 2007 & Richardson and Benbunan-Fich, 2011)<br><br>Segmentation preferences | Work-life balance (direct) | WIA has a negtaive relationship with work-life balance | 7 |
| | Yeh, Ma, Pan, Chuang & Jhuang (2020) | Daily diary study, 39 full-time employees, Taiwan? | Online Support Theory (Cole, Nick, Zelkowitz, Roeder, & Spinelli, 2017)<br><br>Dynamic behaviour theory (Beal, Weiss, Barros & McDermid, 2005) | Daily cross-domain ICT usage at home (Fenner & Renn, 2010)<br><br>Segmentation preferences | Job stress (direct) | Daily cross-domain ICT usage at home has a negative relationship with job stress | 6 |
| | Thörel, Pauls, & Göritz (2020) | Cross-sectional survey, 267 working adults, Germany | Border Theory (Clark, 2000)<br><br>Boundary theory (Ashforth et al., 2000) | Work-related extended availability (WREA) – measured through the number of accepted work phone calls, emails and short messages during leisure time (Pauls et al., 2017) | Psychological detachment (direct)<br><br>Sleep problems (indirect)<br><br>(emotional exhaustion-direct) | WREA has a negative relationship with psychological detachment.<br><br>WREA has a positive indirect relationship with sleep problems which is fully mediated by psychological detachment. | 6 |

| | | | | | WREA has a positive relationship with emotional exhaustion but only for those with strong segmentation preferences. | |
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| Park, Kim & Lee (2020) | Cross-sectional survey, 387 working adults, Korea | Job demands–resources model (Bakker & Demerouti, 2007; Demerouti, et al., 2001)<br><br>Conservation of Resources (COR) Theory (Hobfoll, 1989) | Work-related smartphone use after work (Derks et al., 2014) | Burnout (direct) | Work-related smartphone use after work has a sig positive effect on burnout. | 7 |
| Lei & Su (2019) | Daily diary study, 53 front-line employees in the service industry, China | Conservation of Resources (COR) Theory (Hobfoll, 1989) | Work-related use of Information and Communication Technologies after Hours (W_ICTs) – adoped from Derks & Bakker, 2014) | Work engagement (vigour, decitation, absorption)<br><br>State of recovery in the morning | W_ICTs has a negative relationship with vigour and dedication.<br><br>W_ICTs has a negative relationship with morning recovery. | 6 |
| Stich, Tarafdar, Stacey & Cooper (2019) | Cross-sectional survey, 118 full time workers across different industries, USA. | Person-Environment Fit theory (Cooper et al., 2001; Edwards 1996) | Email misfit (discrepancy between how many emails one receives/sends and to what they actually desire) | Workplace stressors:<br>- Work relationship stressors<br>- Job control stressors<br>Job conditions stressors | Email misfit has a positive relationship with work relationship -, job control -, and job conditions stressors. | 7 |
| Vayre & Vonthron (2019) | Cross-sectional survey, 502 work-related ICT users in executive positions, France | N.A. | Daily internet use for professional purposes (Vayre & Vonthron, 2019).<br><br>This was measured in terms time and location of use and in the questionnaire, it was indicated that these uses could be of different nature (i.e., sending work e- | Work-family conflict<br>Work engagement<br>Internet addiction (problematic internet use) | Daily internet use for professional purposes (intensive and porous use) has a positive relationship with work-family conflict and internet addiction and a negative relationship with vigor. | 6 |

| | | | mails and documents, searching for information, videoconferences with co-workers or clients, etc.) | | | |
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| Yang, Zhang, Shen, Liu & Zhang, (2019) | Cross-sectional survey, 350 married emmployees in 81 working groups, China | Boundary theory (Ashforth et al., 2000)<br><br>COR Theory (Hobfoll, 1989) | Work-related ICT use at home (Boswell & Olson-Buchanan, 2007)<br><br>Segmentation preferences | Work-famiy conflict | Work-related ICT use at home has a positive relationship with work-family conflict | 7 |
| Molino, Cortese & Ghislieri, (2019) | Cross-sectional survey, 432 working adults, Italy | Job demands–resources model (Bakker & Demerouti, 2007; Bakker & Demerouti, 2017) | Off-work hours Technology-Assisted Job Demand (off-TAJD; Ghislieri et al., 2017) | Workaholism (direct) Exhaustion (indirect) | Off-TAJD has a positive relationship with workahilism.<br><br>Off-TAJD has a positive indirect relationship with exhaustion through workaholism. | 7 |
| Tennakoon (2018) | Cross-sectional survey, 109 professionals who use ICT for work and non-work lives, Sri Lanka. | Work-family border theory (Clark, 2000)<br><br>Boundary theory (Ashforth et al., 2000)<br><br>The theory of cognitive dissonance (Festinger, 1957) – moderating influence of perceptions towards ICT | Work-related ICT use beyond work time (WK_ICT). | Work-life conflict | WK_ICT has a positive relationship with work-to-life conflict. | 7 |
| Chen & Casterella (2018) | Cross-sectional survey, 312 full-time knowledge workers, USA | Media Synchronicity Theory (MST; Dennis, Fuller & Valacich, 2008) | Frequency and duration of work-related technology use during after-work time (no ref.). | Work-life balance (direct) | After-hours work-related technology use has an inverted U-shaped relationship with work–life balance.<br><br>(meaning that using technology for work tasks during nonwork time enhances work–life balance up to a point, after which work–life balance deteriorates) | 7 |

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| Gombert, Rivkin & Kleinsorge, (2018) | Daily diary study,74 employees, Germany | Self-determination theory (Deci & Ryan, 2000) | Work-related smartphone use during off-job time (Derks & Bakker, 2014) | Day-specific wellbeing: <br> - Ego depletion (direct) <br> Need for recovery (direct) | Work-related smartphone use has a positive relationship with ego depletion and need for recovery. | |
| Gadeyne, Verbruggen, Delanoeije & De Cooman. (2018) | Cross-sectional survey, 467 working parents, Belgium | N.A. | Work-related smartphone use outside work hours and work-related PC/laptop use outside work hours (Boswell and Olson-Buchanan, 2007) <br><br> Segmentation preferences | Time-based work-to-home conflict | Only work-related PC/laptop use – and not smartphone use – outside work hours has a positive relationship with time-based work-to-home conflict. <br><br> (This effect is buffered for people who have a preference to integrate work and personal life - only when their work environment is characterized by low organizational integration norms/low work demands.) | 6 |
| Stich, Tarafdar, Stacey & Cooper (2018) | Cross-sectional survey, 504 full-time workers, USA | Cybernetic theory of stress (Cummings & Cooper, 1979; Edwards, 1992) | Email load (amount of sent, received and read e-mails - Dabbish & Kraut, 2006; Stich et al., 2018) | Workload stress (direct) <br> Desired e-mail load (distal) <br> Psychological strain (distal) <br> Negative emotions (distal) <br> Organisational commitment (distal) | Email load has a positive relationship with workload stress. <br><br> In turn, workload stress has a negative relationship with desired e-mail load and organisational commitment and a positive relationship with psychological strain and negative emotions. | 6 |
| Yin, Ou, Davison & Wu (2018) | Cross-sectional survey, 178 employees using MICT's for work, China | Coping Theory / cognitive load theory? TMSC? (Lazarus, 1993; Folkman et al., 1986) <br><br> Coping model of user adaptation (Beaudry & Pinsonneault; 2005) | (MICT) Information overload (adapted from Eppler & Mengis, 2004) | Job satisfaction (direct) | Information overload has a significant negative effect on job satisfaction. | 6 |
| Braukmann, Schmitt, Ďuranová & Ohly (2018) | Study 2: Daily cross-sectional diary study, 154 knowledge workers from different industries, Germany | Work-family border theory (Clark, 2000) <br><br> Boundary theory (Ashforth et al., 2000) | Negative ICT evening events, categorised as work emails, work calls, and continuing work tasks Braukmann et al., 2018) | Psychological detachment (direct) <br> Sleep quality (direct) | Work e-mails and continuing work tasks in the evening have a negative effect on psychological detachment. <br><br> Work call and work emails in the evening have a negative relationship with sleep quality. | 6 |

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|---|---|---|---|---|---|---|
| Son & Chen (2018) | Cross-sectional survey, 462 full-time workers who use a smartphone for work, Taiwan. | Work-family border theory (Clark, 2000) | Daily smartphone use (Derks & Bakker, 2014)<br><br>Work overload due to smartphone use (Yun et al., 2012)<br><br>Segmentation preferences | Work stress (direct)<br>Life satisfaction (direct)<br>Time-based work interference with leisure (WIL) (direct)<br>Strain-based WIL | Daily smartphone use has a positive relationsip with work stress and (contrary to predictions) with life satisfaction.<br><br>Work overload due to smartphone use has a positive relationship with time-based and strain-based WIL, work stress and (contraty to predictions) life satisfaction. | 6 |
| Chen, Huang, Gao & Petrick (2018) | Cross-sectional survey, 500 smartphone users who work full time, Taiwan. | Work-family border theory (Clark, 2000) | Work-related smartphone use on vacation (Chen et al., 2018)<br><br>Work-overload due to smartphone use (and work-life separation culture) (Yun, Kettinger & Lee, 2012) | Work stress (direct)<br>Life satisfaction (distal) | Work-related smartphone use on vacation, work overload have a positive relationship with work stress.<br><br>(Work-life separation culture has a negative relationship with work stress.)<br><br>In turn, work stress has a negative relationship with life satisfaction | 5 |
| Emanuel, Molino, Colombo, Cortese & Ghislieri (2018) | Cross-sectional survey, 543 working adults, Italy | Job demands–resources model (Bakker & Demerouti, 2007; 2017) | Off-work hours Technology-Assisted Job Demand (off-TAJD; Ghislieri et al., 2017) | Exhaustion (direct)<br>Turnover intentions (indirect) | Off-TAJD has a positive effect on exhaustion.<br><br>Off-TAJD has a positive indirect relationship with turnover intentions through exhaustion. | 5 |
| Xie, Ma, Zhou & Tang (2018) | Cross-sectional survey, 447 college cousellors (S1) and 340 full time employees from different companies (S2), China | Boundary Theory (Ashforth et al., 2000; Clark, 2000) | Work-related use of information and communication technologies after hours (W_ICTs; Ma, Xie, Ma, et al., 2016).<br><br>Segmentation preferences | Emotional exhaustion (direct) | W_ICTs positively predicts emotional exhaustion.<br><br>(This relationship is moderated by work-home integration preferences in a way that it is weaker for integrators.) | 7 |

| Authors | Method | Theory | IV/Construct | DV/Outcomes | Findings | |
|---|---|---|---|---|---|---|
| Stich, Tarafdar, Cooper & Stacey (2017) | Cross-sectional survey, 504 full-time workers, USA | N.A. | Actual and desired computer mediated communication use (Stich et al., 2017) | Workplace stressors (work relationships, work-life balance, job security and change, job conditions, resources and communications, job control and work-load). | Actual and desired CMC use (primarily E-mail) combined predict a number workplace stressors, including resources and communication stress, job control stress, relationship stress, workload stress, job security stress and job conditions stress (unclear in what direction)<br><br>CMC use alone for video conferencing, audio conferencing, instant messaging and enterprise social networking has a positive relationship with work–life balance stress.<br><br>CMC use for video conference alone predicts and relationship stress, workload, job security stress.<br>CMC use for enterprise social networks predicts relationship stress, workload stress, job security stress and job conditions stress. | 5 |
| Bowen, Govender, Edwards & Cattell (2018) | Cross-sectional survey, 630 construction professionals, South Aftrica | Boundary theory (Nippert-Eng, 1996)<br><br>JD-R-model (Demerouti et al., 2001; Bakker & Demerouti, 2007) | Work Contact outside working hours (Bowen et al., 2018) - based on Schieman & Young, 2013 | Work-family conflict (direct)<br>Sleep problems (direct) | Work contact outside of working hours has a positive relationship with work-family conflict and sleep problems. | 5 |
| Carlson, Thompson, Crawford, Boswell & Whitten (2018) | Cross-sectional survey, 344 workers and their spouses, USA? | Family systems theory (FST; Bowen, 1971)<br><br>Work-Home Resources model (Ten Brummelhuis & Bakker, 2012) – based on COR theory (Hobfoll, 1989) | Mobile Device (MD) use for work during family time (mWork; Ferguson et al., 2016) | Work-family conflict (direct)<br><br>Relationship tension (indirect)<br>Spouse family – to – work conflict (distal)<br>Spouse job satisfaction (distal)<br>Spouse job performance (distal) | mWork has a positive relationship with work-family conflict.<br><br>mWork has a positive indirect relationship with relationship tension through work-family conflict.<br><br>In turn, relationship tension has a positive effet on spouse family-to-work conflict, which in turn negatively affects spouse job satisfaction and performance. | 7 |

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| Wang, Chen & Duan (2017) | Time-lagged cross-sectional survey, 423 employees, China? | Work-family border theory (Clark, 2000) | Technology use for work at home during off-job time (Park et al., 2011) | Time-based work-family conflict (direct) Strain-based work-family conflict (direct) Psychological detachment (direct) | Technology use for work at home during off-job time has a positive relationship with time-based and strain-based work-family conflict and with psychological detachment. | 7 |
| Ghislieri, Emanuel, Molino, Cortese & Colombo (2017) | Cross-sectional survey, 671 working adults, Italy | JD-R-model (Demerouti et al., 2001; Bakker & Demerouti, 2007) | Off-work hours Technology-Assisted Job Demand (off-TAJD; Ghislieri et al., 2017) | Work-family conflict (direct) | Off-TAJD has a positive relationship with work-family conflict | 5 |
| Mellner (2016) | Cross-sectional survey, 2876 employees from four large organisations in private and public sector, Sweden | Boundary theory (Ashforth et al., 2000; Clark, 2000; Nippert-Eng, 1996) | After-hours availability expectations (single-item)  Work-related smartphone use outside regular work hours (Mellner, 2016) | Psychological detachment (direct) Boundary control (direct) | After- hours availability expectations has a negtative relationship with psychological detachment and boundary control  Work-related smartphone use outside regular work hours had a negtative relationship with psychological detachment and boundary control. | 6 |
| Ferguson, Carlson, Boswell, Whitten, Butts & Kacmar (2016) | Cross-sectional survey, 344 full-time employees and their spouse (N = 688), USA | COR theory (Hobfoll, 2001)  Family systems theory (Bowen, 1971; Minuchin, 1974) | The use of a mobile device for work during family time (mWork; Diaz, Chiaburu, Zimmerman, & Boswell, 2012) | Strain-based WFC (direct) Time-based WFC (direct) Behaviour-based WFC (direct)  Burnout (distal) Turnover intentions (distal) Organisational commitment (distal)  Spousal resentment towards the job incumbent's organisation (distal) Spousal commitment to the job incumbent's organisation (distal) | MWork has a positive relationship with all WFC dimensions (time-based, strain-based and behavior-based).  In turn, strain-based WFC has a positive effect on burnout.  MWork has an indirect relationship with turnover intentions through strain-based WFC, burnout and organisational commitment.  MWork has an indirect relationship with turnover intentions through all three dimensions of WFC, spousal resentment, and spousal commitment to the organisation. | 7 |

| | | | | | MWork has an indirect relationship with turnover intentions by crossing over through strain- based WFC, burnout, and spousal commitment. | |
| --- | --- | --- | --- | --- | --- | --- |
| Ragsdale & Hoover (2016) | Time-lagged cross-sectional survey, 313 full-time employees, USA? | JD-R model (Demerouti et al., 2001) | Work-related cellphone use (WRCP use - Ragsdale & Hoover, 2016) | Work-family conflict Work engagement Emotional exhaustion | MWork has a indirect relationship with turnover intentions through strain-based WFC, burnout, spousal commitment, and the job incumbent's commitment. WRCP use has a positive relationship with work-family conflict and work engagement. WRCP use has a negative relationship with emotional exhaustion (contradicting) – but using cell phone attachment as a moderator the relationship becomes positive for those with low attachment. | 5 |
| Chesley & Johnson (2015) | Secondary data from a large cross-sectional survey (2008), 806 workers who use ICT, USA | Boundary theory (Ashforth et al., 2000; Clark, 2000; Nippert-Eng, 1996 | ICT-facilitated work extension ICT use and changes in overall work time ICT use at work | Work-related stress (direct) Distress (direct) | ICT-facilitated work extension has a positive relationship with work-related stress. ICT-facilitated increase in overall work time has a positive relationship with distress. Using emails for work has a positive relationship with distress | 7 |
| Derks, van Duin, Tims & Bakker (2015) | Daily diary study, 79 full-time employees who use a smartphone for work, Netherlands. | Boundary theory (Ashforth et al., 2000) | Daily smartphone use after work hours (Derks & Bakker, 2014) (+ Supervisor expectations regarding smartphone use and staying connected to work after hours | Work-home interference | Daily smartphone use has a sig positive effect on work-home interference. (This relationship was moderated by superviros expectations, in a way that the relationship was stronger when employees face high expectations to stay connected to work after hours.) | 5 |

| Butts, Becker & Boswell (2015) | Daily diary study (ESM), 341 working adults, USA | Affective events theory (AET; Weiss & Cropenzano, 1996)  Appraisal theory of emotion (Lazarus, 1991) | Electronic communication during non-work time (affective tone of the message & time required to deal with communication) – single items | Anger (direct) Happiness (direct) Work-to-non-work conflict (direct, indirect) | Affective tone has a positive relationship with anger and a negative relationship with happiness.  Time required to deal with electronic communication during non-work time has a positive relationship with work-to-non-work conflict.  Time required to deal with electronic communication during non-work time has s significant indirect effect on work-to-non-work conflict through anger. | 6 |
|---|---|---|---|---|---|---|
| Derks, van Mierlo & Schmitz (2014) | Daily diary study, 70 employees who use smartphones for work, Germany | Boundary Theory (Ashforth et al., 2000) | Daily work-related smartphone use after work (Derks & Bakker 2012)  Segmentation norms | Psychological detachment | Daily work-related smartphone use after work has a negative relationship with daily psychological detachment | 7 |
| Kotecha, Ukpere & Geldenhuys (2014) | Cross-sectional survey, 216 academics from a higher education institution, South Africa. | N.A. | Technology-assisted supplemental work (TASW; Fenner & Renn, 2010) | Time-based work-life conflict (direct) Strain-based work-life conflict (direct) | TASW has a positive relationship with time - and strain-based work-life conflict. | 5 |
| Ohly & Latour (2014) | Cross-sectional survey, 1714 working adults, Germany | Self-determination theory (Ryan & Deci, 2000) | Using smartphones for work in the evening (SUWE) | Positive affect (direct) Psychological detachment (direct) | SUWE has a negative relationship with positive affect.  The frequency of SUWE has a negative relationship with psychological detachment | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Chesley (2014) | Cross-sectional survey, 2556 emplyed participants of the National Study of the Changing Workforce survey, USA | N.A. | Work-related ICT use (single item) | Work intensification:<br>- Work pacing (direct)<br>- Interruptions at work (direct)<br>- Multitasking (direct)<br><br>Work strain (indirect)<br>Distress (indirect) | Work-related ICT use has a positive relationship wotk pacing, interruptions and multitasking.<br><br>The positive relationship between work-related ICT use and work strain is fully mediated by work pacing, interruptions and multitasking.<br><br>Work-strain in turn has a sig positive effect on distress. | 6 |
| Brown, Duck & Jimmieson (2014) | Cross-sectional survey, 219 full time University employees, Australia | Transactional model of stress (Lazarus & Folkman, 1984) | Email quantity (Dabbish & Kraut, 2006), email quality and normative response pressure (Brown et al., 2014) | Emotional exhaustion (direct) | Email quantity, email quality (high ambiguity) and normative response pressure have positive relationship with emotional exhaustion.<br><br>(Normative response pressure moderates the relationship between email ambiguity and emotional exhaustion in a way that the relationship is stronger for workers who expeirnece high normative response pressure) | 6 |
| Chen & Karahanna (2014) | Cross-sectional survey, 137 employees of a Fortune 1000 technology firm, USA | N.A. | Frequency of WTN (work-to-nonwork) technology-mediated interruptions. | Work-to-non-work conflict | The frequency of WTN technology-mediated interruptions has a positive relationship with WTN conflict. | 7 |
| Haeger & Lingham (2014) | Cross-sectional survey, 270 (96 boomers), full time workers across different industries, N.A. | N.A. | E-mail usage (part of work-life fusion concept which looks at technology use in pursuit of work-life management) | Work-life balance (direct)<br>Job Satisfaction (direct) | E-mail usage has a negative effect on work-life balance and job satisfaction (this was only found for the Boomer cohort) | 5 |

| Authors | Method | Theory | IV | DV | Findings | Quality |
|---|---|---|---|---|---|---|
| Wright, Abendschein, Wombacher, O'Connor, Hoffman, Dempsey, ... & Shelton (2014) | Cross-sectional survey, 168 employees, USA | N.A. | Work-related communication technology use outside of regular work hours<br><br>(measured via the length/frequency of use of certain ICTs) | Work-life conflict (direct)<br><br>Job burnout (distal)<br>Job satisfaction (distal) | Work-related communication technology use outside of regular work hours has a positive relationship with work-life conflict.<br><br>In turn, work-life conflict has a positive effect on burnout and a negative effect on job satisfaction. | 6 |
| Berkowsky (2013) | Cross-sectional survey, 1100 full-time working adults, USA | Boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996)<br><br>Spillover theory (Zedeck, 1992) | ICT use for work purposes outside of work (measured via frequency of use, i.e. how often do you check work emails at home) | Work-home spillover | The frequency of checking work e-mails at home has a positive relationship with work-home spillover. | 6 |
| Mark, Voida & Cardello (2012) | Experimental study, 13 workers from an scientific research organiation, USA | N.A. | Working with e-mails vs. working without emails | Stress via heart rate variability<br>Multitasking via computer window switching activity logs | In the no email condition, participants had lower levels of stress (HRV), showed longer activity on individual applications and document windows and switched between these less (hence less multitasking), compared to when working with e-mails. | 6 |
| Diaz, Chiaburu, Zimmerman & Boswell (2012) | Cross-sectional survey, 193 non-academic University managers, USA | Theory of planned behaviour (Ajzen, 1991) | (work-related) Communication technology use during non-work hours (Boswell & Olson-Buchanan, 2007; Diaz et al., 2012) | Work-to-life conflict (direct)<br>Work satisfaction (distal) | Work-related communication technology use during non-work hours has positive relationship with work-to-life conflict.<br><br>Work-to-life conflict has a negative relationship with work satisfaction. | 5 |
| Barley, Meyerson & Grodal (2011) | Mixed methods study, results are from the quantitative daily diary methodology. 72 employees, USA | N.A. | Work-related ICT communication (reported via communication logs –i.e. what medium, how often and for how long each day) | Overload | Time spent on e-mails has a positive relationship with overload. | 7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Park, Fritz & Jex (2011) | Cross-sectional survey, 431 full-time employees who commute to work, USA | Boundary theory (Ashforth et al., 2000; Clark, 2000; Nippert-Eng, 1996)<br><br>COR theory (Hobfoll, 2001)<br><br>(Social learning theory) | Frequency of work-related technology use at home after working hours<br><br>Segmentation preferences | Psychological detachment (direct) | The frequency of work-related technology use at home after working hours has a negative relationship with psychological detachment. | 6 |
| Fenner & Renn (2010) | Cross-sectional survey, 227 full-time employees, USA | Boundary theory (Ashforth et al., 2000; Clark, 2000; Nippert-Eng, 1996)<br><br>Technology acceptance model (TAM; Davis, 1989)<br><br>Psychological climate theory (Kopelman, Brief & Guzzo, 1990) | Technology-assisted supplemental work (TASW; Fenner & Renn, 2010) | Work-to-family conflict (direct) | TASW has a positive relationship with Work-to-family conflict. | 7 |
| Boswell & Olson-Buchanan (2007) | Cross-sectional survey, 360 non-academic University employees and 35 significant others, USA? | Boundary theory (Ashforth et al., 2000; Kossek et al., 2005; Nippert-Eng, 1996) | Frequency of CT use after hours | Work-life conflict<br>Work-life conflict (significant other) | CT use after hours has a positive relationship with work-life conflict for employees and their significant others | 7 |

*Note.* N = 114 Studies;

## Appendix C – Article 2 appendices

**Additional Results:** Summary of assumptions (2a), attrition analysis (2b), longitudinal measurement invariance (2c), descriptive statistics (2d), and correlations (2e).

### Appendix 1 - Email Guidelines (summary)

# "X" Internal E-mail Guidelines

## Contents

## Appendix 2 – Survey items

**Techno-overload** (Ragu-Nathan et al., 2008)

1. I am forced by this technology to work much faster.∗
2. I am forced by this technology to do more work than I can handle.
3. I am forced by this technology to work with very tight time schedules.
4. I am forced to change my work habits to adapt to new technologies.
5. I have a higher workload because of increased technology complexity.

**Techno-invasion** (Ragu-Nathan et al., 2008)

1. I spend less time with my family due to this technology.∗
2. I have to be in touch with my work even during my vacation due to this technology.
3. I have to sacrifice my vacation and weekend time to keep current on new technologies.
4. I feel my personal life is being invaded by this technology.

**Organisational Expectation for E-mail Monitoring** (Becker et al., 2021)

1. People who influence my behaviour at work think that I should monitor electronic communications away from work.
2. People who are important to me at work expect me to respond to electronic communication away from work.
3. In this company it is expected that people will read and act on email outside of working hours.

**Email monitoring frequency during nonwork time** (Becker et al., 2019)

1. How frequently did you check work communications during nonwork time today?

**Time spent on work-related emails during nonwork time** (Becker et al., 2019)

1. How many minutes did you spend dealing with work-related electronic communications during nonwork time today?

**Work–family multitasking** (Schieman & Young, 2010)

**1.** "How often do you try to work on job tasks and home tasks at the same time while you are at home?"

**Psychological Detachment** (Sonnentag & Fritz, 2007).

1. I forget about work.
2.  I don't think about work at all.
3.  I distance myself from my work.
4. I get a break from the demands of work.

**Work-home conflict** Kreiner,(2006)

1. The demands of my work interfere with my home and personal life.
2. The amount of time my job takes up makes it difficult to fulfill home responsibilities.
3. Things I want to do at home do not get done because of the demands my job puts on me.
4. My job produces strain that makes it difficult to fulfill home duties.
5. Due to work-related duties, I have to make changes to my plans for home activities.

**Burnout** (Shirom & Melamed, 2006)

1. I feel tired.
2. I have no energy for going to work in the morning.
3. I feel physically drained.
4. I feel fed up.
5. I feel like my ''batteries'' are ''dead.''
6. I feel burned out.
7. My thinking process is slow
8. I have difficulty concentration.
9. I feel I am not thinking clearly.
10. I feel I am not focused on my thinking.
11. I have difficulty thinking about complex things.
12. I feel I am unable to be sensitive to the needs of coworkers and customers.
13. I feel I am not capable of investing emotionally in coworkers and customers.
14. I feel I am not capable of being sympathetic to coworkers and customers.

**Productivity** (Kessler *et al.*, 2003).

1. 'Using the 0 (*the worst job performance*) to 10 (*top performance*) scale, how would you rate your usual job performance over the past month?'

# Appendix 3 - Additional Results

Summary of assumptions (2a), attrition analysis (2b), longitudinal measurement invariance (2c), descriptive statistics (2d), and correlations (2e).

## 3a. Assumptions

An a-priory power analysis conducted using G*Power revealed that a minimum sample size of 130 participants was needed to detect a medium effect size (f = .25) at 95 % power for repeated measures multivariate analysis using four measurement occasions. Therefore, the longitudinal sample of this study (N = 176) met the sample size requirements. Multivariate normality was satisfied as the Mahalanobis distance values were below the critical value ($x^2$). However, the assumptions of independence of observations and compound symmetry (sphericity), which traditional approaches such as RM MANOVAs are sensitive to, are often not met within longitudinal data. That is, because outcomes are assessed multiple times within the same participants thus increasing the chance for individual errors to be correlated. And because measurements spaced with smaller time gaps are likely to be more highly correlated than those spaced further apart and individuals are likely to differ in their rate of change, making it unlikely for the variances and covariance's of the variables to be equal (Hedeker, 2004). Indeed, Maulchy's test of sphericity revealed that the assumption for homogeneity of variance was violated (p's <.05). Nevertheless, hierarchical linear models such as mixed, multilevel or growth curve models are robust to such violations and offer a more flexible approach by allowing

random intercepts and slopes between individuals, thus providing more reliable results than traditional approaches (Hedeker, 2004, Holman et al., 2010).

### 3b. Attrition analysis

Non-random sampling effects were examined using Goodman and Blum's (1996) four-step procedure. Tables highlighting statistics for all steps can be seen in supplemental materials 1. The first step revealed that participants without management responsibilities and with higher levels of techno-invasion were more likely to not complete all surveys ($p < .05$), suggesting that the data is not missing at random. To assess the potential impact of this on the means, variances and relationships of the variables in this study, it was proceeded with step two to four. Results showed that there were no substantial effects of non-random sampling on the means of the study variables (i.e. any sig differences were < 10 % of the range of the scale) and no evidence of any non-random sampling effects on variances (i.e. no significant differences in variable variances between the whole sample and those who remained) or the relationships between the independent and dependent variables. Therefore although data is missing non-randomly, it is unlikely that this pattern of attrition will would have an impact results (Goldman & Blum, 1996).

### 3.c. Descriptive Statistics

The correlations between study variables for the entire sample at time 1 and time 4 can be seen in Table 3.2. In line with the ICT and organisational stress research discussed, the correlations among the ICT stressors were in expected direction and significantly associated with employee psychological detachment, burnout, WLC and performance outcomes.

Table 3.1 shows a comparison between the means between Time 1 and Time 4 and the experimental and control group. As hypothesised, all email stressors showed linear change throughout the course of this study and were significantly lower at T4 than at T1 (EMF: t (100) = 2.51, $p < .05$; TOE: t (100) = 3.98, $p < .01$; WFM: t (100) = 2.40, $p < .05$; techno-overload: t (100) = 3.47, $p < .01$; techno-invasion: t (100) = 4.03, $p < .01$; OEEM: t (100) = 3.23, $p < .01$). While there were small improvements in the control group, no significant change was detected in any of the email stressors (ts (74) < 2.00, p > .05). In the intervention group, all employee outcomes apart from emotional exhaustion, showed linear improvements throughout the course of the study. Statistically significant change was found for psychological detachment (t (100) = -2.80, $p < .01$), physical exhaustion (t (100) = 2.79, $p < .01$) and WLC (t (100) = 3.01, $p < .01$). In the control group, while psychological detachment and physical exhaustion improved slightly and WLC remained unchanged, all other employee outcomes worsened over the course of the study. Nevertheless, no significant change was found in any case (ts (74) < 1.29, $p > .05$).

**Table 3.1** Means comparison and standard deviations for the experimental and control groups at Time $1 - 4$

| Outcome variable | Experimental group Mean (SD) | Control group Mean (SD) |
|---|---|---|
| *Email stressor* | | |
| Email monitoring frequency 1 | 1.76 ( .98) | 1.88 ( .87) |
| Email monitoring frequency 2 | 1.69 ( .88) | 1.88 (1.04) |
| Email monitoring frequency 3 | 1.60 ( .72) | 1.89 (1.01) |
| Email monitoring frequency 4 | $1.58^2$ ( .71) | 1.77 ( .81) |
| Time on Emails 1 | 1.63 (1.02) | 1.83 (1.16) |
| Time on Emails 2 | 1.55 ( .90) | 1.61 (1.05) |
| Time on Emails 3 | 1.46 ( .84) | 1.59 ( .95) |
| Time on Emails 4 | $1.31^2$ ( .71) | $1.59^1$ (1.01) |
| Work-family multitasking 1 | 1.98 ( .94) | 1.97 ( .95) |
| Work-family multitasking 2 | 1.98 ( .89) | 1.91 ( .86) |
| Work-family multitasking 3 | 1.85 ( .84) | 1.88 (1.01) |
| Work-family multitasking 4 | $1.83^2$ ( .80) | 1.87 ( .88) |
| Techno-overload 1 | 3.38 (1.01) | 3.45 (1.00) |
| Techno-overload 2 | 3.42 (1.01) | 3.34 ( .98) |
| Techno-overload 3 | 3.27 (1.03) | 3.29 (1.03) |
| Techno-overload 4 | $3.13^2$ (1.02) | 3.30 (1.08) |
| Techno-invasion 1 | 2.09 (1.14) | 2.22 (1.06) |
| Techno-invasion 2 | 2.10 (1.13) | 2.00 (1.03) |
| Techno-invasion 3 | 2.00 (1.01) | 1.96 (1.03) |
| Techno-invasion 4 | $1.80^2$ ( .98) | 2.01 (1.13) |
| OEEM 1 | 1.93 (1.09) | 1.81 ( .89) |
| OEEM 2 | 1.88 (1.03) | 1.76 ( .99) |
| OEEM 3 | 1.72 (. 98) | 1.79 (1.10) |
| OEEM 4 | $1.69^2$ ( .95) | 1.71 (1.00) |
| *Employee outcomes* | | |
| Psychological detachment 1 | 3.22 (1.12) | 3.15 (1.08) |
| Psychological detachment 2 | 3.28 (1.13) | 3.20 (1.04) |
| Psychological detachment 3 | 3.46 (1.09) | 3.26 ( .97) |
| Psychological detachment 4 | $3.46^2$ (1.08) | 3.25 ( .99) |
| Physical exhaustion 1 | 3.98 (1.60) | 4.14 (1.59) |
| Physical exhaustion 2 | 4.04 (1.71) | 3.91 (1.04) |
| Physical exhaustion 3 | 3.78 (1.65) | 3.97 (1.59) |
| Physical exhaustion 4 | $3.70^2$ (1.67) | 3.98 (1.70) |
| Cognitive exhaustion 1 | 3.32 (1.57) | 3.39 (1.54) |
| Cognitive exhaustion 2 | 3.48 (1.56) | 3.47 (1.62) |
| Cognitive exhaustion 3 | 3.24 (1.59) | 3.43 (1.70) |
| Cognitive exhaustion 4 | 3.11 (1.48) | 3.51 (1.68) |
| Emotional exhaustion 1 | 2.07 (1.33) | 2.18 (1.51) |
| Emotional exhaustion 2 | 2.14 (1.22) | 2.19 (1.56) |
| Emotional exhaustion 3 | 2.06 (1.30) | 2.11 (1.46) |
| Emotional exhaustion 4 | 2.13 (1.39) | 2.28 (1.65) |
| Work-home conflict 1 | 2.32 (1.23) | 2.21 (1.08) |
| Work-home conflict 2 | 2.30 (1.24) | 2.14 (1.08) |
| Work-home conflict 3 | 2.20 (1.18) | 2.18 (1.09) |
| Work-home conflict 4 | $2.14^2$ (1.39) | 2.21 (1.13) |

| | | |
|---|---|---|
| Performance (4 weeks) 1 | 7.75 (1.43) | 7.84 (1.43) |
| Performance (4 weeks) 2 | 7.72 (1.50) | 7.73 (1.35) |
| Performance (4 weeks) 3 | 7.81 (1.38) | 7.64 (1.55) |
| Performance (4 weeks) 4 | 7.92 (1.45) | 7.72 (1.38) |

*Note*: N (experimental) = 101, N (control) = 75. OEEM = organisational expectations for email monitoring.
[1] Shows significant differences between groups within one time point (assessed at T1 and T4), $p < .05$.
[2] Shows significant differences between T1 and T4 within a group, $p < .05$.

**Table 3.2** Correlations between main study variables at T1 and T4

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. EMF | - | .57** | .55** | .34** | .61** | .59** | -.49** | .19* | .09 | .17* | .54** | -.26** |
| 2. TOE | .65** | - | .37** | .25** | .43** | .42** | -.33** | .17* | .07 | .04 | .40** | -.13 |
| 3. WFM | .57** | .44** | - | .44** | .63** | .58** | -.54** | .27** | .24** | .24** | .48** | -.32* |
| 4. Techno-overload | .30** | .26** | .36** | - | .56** | .38** | -.50** | .45** | .45** | .28** | .52** | -.37** |
| 5. Techno-invasion | .60** | .43** | .60** | .54** | - | .76** | -.60** | .41** | .30** | .30** | .80** | -.33** |
| 6. OEEM | .61** | .45** | .51** | .34** | .54** | - | -.47** | .26** | .23** | .30** | .63** | -.31** |
| 7. Psych Detachment | -.48** | -.42** | -.50** | -.44** | -.59** | -.41** | - | -.43** | -.32** | -.28** | -.59** | .40** |
| 8. Physical Exhaustion | .12 | .17* | .32** | .34** | .33** | .13 | -.39** | - | .74** | .42** | .51** | -.51** |
| 9. Cognitive Weariness | .15* | .13 | .20** | .37** | .28** | .16* | -.26** | .65** | - | .41** | .32** | -.55** |
| 10. Emo Exhaustion | .14 | .11 | .20** | .28** | .26** | .17* | -.26** | .41** | .48** | - | .33** | -.34** |
| 11. WHC | .47** | .44** | .45** | .44** | .62** | .41** | -.64** | .53** | .36** | .36** | - | -.35** |
| 12. Performance | -.15* | -.11 | -.29** | -.26** | -.21** | -.13 | .19* | -.34** | -.38** | -.31** | -.33** | - |

*Note*: N = 176; Correlations below the diagonal line at Time 1, correlations above the diagonal line at T4; for gender: male = 2; for manager: no = 2; OEEM = organisational expectations for email monitoring; EMF = email monitoring frequency during nonwork time; TOE = Time spent on emails during nonwork time; WFM = work-family multitasking; WHC = work-home conflict; Psych = psychological; Emo = emotional.
* < p.05; ** <.01

### 3.e. Measurement invariance

To examine if the measures used in this study were stable over repeated data collection points (longitudinal measurement invariance, MI) a number of CFA models were fitted for scales consisting or two or more items measuring an underlying latent construct. The results presented in Table 2.3 support measurement invariance. Although model (employee outcomes) shows a significant decrease in model fit when compared to model 2, indicated by a significant $x^2$ increase, as no change in the remaining fit indices was detected, the model can be accepted to support MI.

**Table 3.3**. Longitudinal measurement invariance statistics for scales from T1-T4

| Measures | $x^2$ (df) | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|
| ICT Demands | | | | | |
|    Model 1: Configural | 1369.95 (940) | .95 | .94 | .05 | .06 |
|    Model 2: Metric | 1410.53 (967) | .95 | .94 | .05 | .06 |
|    Model 3: Scalar | 1441.68 (993) | .95 | .94 | .05 | .06 |
| Employee Outcomes | | | | | |
|    Model 1: Configural | 5846.45 (3761) | .91 | .90 | .06 | .05 |
|    Model 2: Metric | 5663.61 (3796) | .92 | .91 | .05 | .05 |
|    Model 3: Scalar | 5760.41 (3850)* | .92 | .91 | .05 | .05 |

*Note:* Model 1: same factor structure (unconstraint factor loadings and item intercepts); Model 2: same (fixed) factor loadings; Model 3: same (fixed) factor loadings and item intercepts over time. Invariance is indicated by a $\Delta x^2$ of $p <.05$ (Van de Schoot, Lugtig & Hox, 2012) *and* $\Delta$CFI of $<.01$ between models (Cheung & Rensvold, 2002). Potential invariance indicated by decrease in model fit highlighted by a significant $\Delta x^{2*}$ when compared to the previous model.

## Appendix 4 - Fit Indices for all Models

**Table 4.1. Goodness of fit indices for all Models**

| Models | Chi-Square (df) | CFI | RMSEA | SRMR |
|---|---|---|---|---|
| *Hypotheses 1 & 2,4, 6, 8 – Intervention effects* | | | | |
| Model 1 (no predictors) | 1642.32** (971) | .93 | .06 | .04 |
| Model 2 (demographic predictors) | 1972.54 ** (1154) | .91 | .06 | .04 |
| **Model 3** (demographic + group predictors) | 1803.45** (1128) | .92 | .06 | .04 |
| *Hypotheses 3,5, 7, 9 – mediation effects of ICT Demands* | | | | |
| **Model 4** (Group – Techno-overload – WHC) | 33.01 (25) | .99 | .04 | .05 |
| **Model 5** (Group – Techno-invasion – WHC) | 48.92 (24) | .98 | .08 | .03 |
| Model 6 (Group – EMF – WHC) | 54.71** (24) | .97 | .08 | .05 |
| Model 7 (Group – TOE – WHC) | 47.78** (25) | .98 | .07 | .05 |
| **Model 8** (Group – Techno-overload – Psych Det) | 24.83 (25) | 1.00 | .00 | .04 |
| **Model 9** (Group – Techno-invasion – Psych Det) | 36.60 (25) | .99 | .05 | .03 |
| Model 10 (Group – EMF – Psych Det) | 39.55* (24) | .98 | .06 | .04 |
| Model 11 (Group – TOE – Psych Det) | 54.27** (25) | .97 | .08 | .06 |
| **Model 12** (Group – Techno-overload – Phys Ex) | 36.91 (25) | .99 | .05 | .04 |
| Model 13 (Group – Techno-invasion – Phys Ex) | 47.94 (25) | .98 | .07 | .03 |
| Model 14 (Group – EMF – Phys Ex) | 34.82 (25) | .99 | .05 | .04 |
| Model 15 (Group – TOE – Phys Ex) | 20.17 (73) | 1.00 | .00 | .04 |
| **Model 16** (Group – Techno-overload – Cog Ex) | 30.90 (25) | .99 | .04 | .05 |
| **Model 17** (Group – Techno-invasion – Cog Ex) | 36.63 (25) | .99 | .05 | .04 |
| Model 18 (Group – EMF – Cog Ex) | 38.88*(25) | .99 | .06 | .05 |
| Model 19 (Group – TOE – Cog Ex) | 23.54 (25) | 1.00 | .00 | .05 |
| **Model 20** (Group – Techno-overload – Performance) | 22.00 (25) | 1.00 | .00 | .05 |
| Model 21 (Group – Techno-invasion – Performance) | 51.63*(27) | .98 | .07 | .05 |
| Model 22 (Group – EMF – Performance) | 37.53 (25) | .99 | .05 | .06 |
| Model 23 (Group – TOE – Performance) | 16.96 (25) | 1.00 | .00 | .06 |
| *Hypothesis 10 – mediation effects of burnout* | | | | |
| **Model 24** (Techno-overload – PE – Performance) | 63.03 (49) | .99 | .04 | .05 |
| **Model 25** (Techno-overload – CE – Performance) | 52.55 (49) | .99 | .02 | .05 |
| | | | | |
| Model 26 (Techno-invasion – Phys Ex – Performance) | 99.02** (51) | .97 | .07 | .05 |
| Model 27 (Techno-invasion – Cog Ex – Performance) | 78.29** (51) | .99 | .06 | .05 |
| Model 28 (EMF – Phys Ex – Performance) | 70.98* (49) | .99 | .05 | .05 |
| Model 29 (EMF – Cog Ex – Performance) | 82.05** (49) | .98 | .06 | .06 |
| Model 30 (TOE – Phys Ex – Performance) | 40.56 (49) | 1.00 | .00 | .05 |
| Model 31 (TOE – Cog Ex – Performance) | 43.58 (49) | 1.00 | .00 | .05 |

*Note*: N= 176, EMF = Email Monitoring Frequency out of hours; TOE = Time on Emails out of hours. WHC = work-home conflict; Psych Det = Psychological detachment; Phys Ex = Physical exhaustion; Cog Ex = Cognitive Exhaustion;  All models have random intercepts and slopes. Models with sig effects highlighted in bold.  * $p < .01$, ** $p < .01$.

# Appendix 5 - Supplemental Materials

## SM1 - Attrition Analysis Tables

### Step 1: Assessing the presence of non-random sampling.

**Table 5.1.** Logistic Regression: Stayers versus Leavers

| Variables | B | S.E. |
|---|---|---|
| Group (intervention = 2) | .06 | .27 |
| Age | .00 | .01 |
| Gender (male = 2) | .34 | .33 |
| Manager (no = 2) | -.99** | .35 |
| Email monitoring frequency (EMF) | -.25 | .20 |
| Time on emails (TOE) | -.25 | .16 |
| Work-family multitasking (WFM) | -.02 | .18 |
| Techno-overload | .04 | .17 |
| Techno-invasion | -.41* | .19 |
| OEEM | .24 | .17 |
| Psychological detachment | .07 | .17 |
| Physical exhaustion | -.06 | .13 |
| Cognitive exhaustion | .01 | .12 |
| Emotional exhaustion | -.18 | .11 |
| Work-home conflict | .10 | .18 |
| Performance | .23 | .12 |
| Constant | 2.80 | 1.91 |
| -2 log likelihood | 335.26 | |
| Model Chi-square | 42.01** | |

*Note:* N = 284, logistic regression for differences between those who did and did not respond to all surveys. Leavers = I, Stayers = 2; OEEM = organisational expectations for email monitoring
*p < .05; **p < .01

### Step 2: Assessing the effects of non-random sampling on means.

**Table 5.2.** T-tests Stayers versus Leavers

| | Mean (SD) | | |
|---|---|---|---|
| Variables | Stayers | Leaver | t(df) |
| Group (intervention = 2) | 1.57 ( .50) | 1.56 ( .50) | -.15 (225.71) |
| Age | 45.30 (11.64) | 44.66(9.98) | -.49 (252.55) |
| Gender (male = 2) | 1.22 ( .46) | 1.18 ( .41) | -.88 (246.31) |
| Manager (no = 2) | 1.57 ( .50) | 1.62 ( .49) | .87 (229.73) |
| EMF | 1.81 ( .93) | 2.18 (1.05) | 2.95 (206.68)** |
| TOE | 1.72 (1.08) | 2.03 (1.14) | 2.28 (217.01)* |
| WFM | 1.98 (.94) | 2.31 (1.00) | 2.74 (216.49)** |
| Techno-overload | 3.41 (1.01) | 3.67 ( .92) | 2.23 (242.10)* |
| Techno-invasion | 2.15 (1.10) | 2.67 (1.10) | 3.86 (226.80)** |
| OEEM | 1.88 (.97) | 1.99 (.99) | .93 (225.43) |
| Psychological detachment | 3.19 (1.10) | 2.78 (1.07) | -3.11 (231.09)** |
| Physical exhaustion | 4.05 (1.59) | 4.62 (1.59) | 2.95 (227.18)** |
| Cognitive exhaustion | 3.35 (1.55) | 3.93 (176) | 2.84 (205.34)** |

| | | | |
|---|---|---|---|
| Emotional exhaustion | 2.12 (1.41) | 2.74 (1.56) | 3.39 (207.23)** |
| WHC | 2.27 (1.17) | 2.71 (1.10) | 3.21 (237.62)** |
| Performance | 7.79 (1.43) | 7.13 (1.88) | -3.13 (182.67)** |

*Note: N (stayers) = 176; N (leavers) = 108; OEEM = organisational expectations for email monitoring; EMF = email monitoring frequency during nonwork time; TOE = Time spent on emails during nonwork time; WFM = work-family multitasking; WHC = work-home conflict* \*p < .05; \*\*p < .01

## Step 3: Assessing the effects of non-random sampling on variances.

Note: This test compares the variance of a sample to that of the population from which it was drawn. For our purposes, the "population" is the whole sample (i.e., the time-1 sample) and the "sample" is the subsample of people who responded at both times 1 and 2 (stayers). Significant positive values for z indicate variance enhancement, negative values indicate variance restriction, and non-significant z indicates no change in the variance due to attrition. While it may seem counter-intuitive that variances can be enhanced by attrition, this will occur if the participants who drop out of the study are in the middle range of scores on the dependent variable.

**Table 4.3.** Difference in Variances: Whole Sample versus Leavers

| | *Variances (n)* | | |
|---|---|---|---|
| *Variables* | *Whole Sample (N=284)* | *Stayers (N=176)* | *z* |
| Group (intervention = 2) | .246 | .248 | .08 |
| Age | 121.605 | 135.546 | 1.07 |
| Gender (male = 2) | .191 | .208 | .83 |
| Manager (no = 2) | .243 | .247 | .15 |
| Monitoring frequency | .987 | .873 | -1.08 |
| Time on Emails OOO | 1.234 | 1.165 | -.52 |
| WFM | .954 | .891 | -.06 |
| Techno-overload | .956 | 1.015 | .58 |
| Techno-invasion | 1.278 | 1.220 | -.42 |
| OEEM | .950 | .946 | -.04 |
| Psychological detachment | 1.224 | 1.212 | -.09 |
| Physical exhaustion | 2.597 | 2.536 | -.22 |
| Cognitive weariness | 2.735 | 2.408 | -1.12 |
| Emotional exhaustion | 2.258 | 1.984 | -1.13 |
| WHC | 1.346 | 1.367 | .15 |
| Performance | 2.509 | 2.053 | -1.70 |

*Note:* \*p < .05; \*\*p < .01; critical value z = 1.96; OEEM = organisational expectations for email monitoring; EMF = email monitoring frequency during nonwork time; TOE = Time spent on emails during nonwork time; WFM = work-family multitasking; WHC = work-home conflict

## Step 4: Assessing the effects of non-random sampling on the relationships among variables.

**Table 4.5. Results of Regression Analyses: EMF**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.00 | .00 | -.00 | .00 | |
| Gender | .10 | .13 | -.03 | .14 | |

| | | | | | |
|---|---|---|---|---|---|
| Manager | -.74** | .11 | -.88** | .13 | |
| Group | -.04 | .11 | .06 | .13 | |
| Constant | 3.19** | .39 | 3.37** | .45 | |
| F | 11.65** | | 12.28* | | |
| R2 | .13 | | .22 | | |
| Adjusted R2 | .14 | | .21 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

### Table 4.6. Results of Regression Analyses: TOE

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.00 | .01 | -.00 | .01 | |
| Gender | -.25 | .13 | -.09 | .16 | |
| Manager | -1.08** | .12 | -1.01** | .15 | |
| Group | -.07 | .12 | -.14 | .15 | |
| Constant | 3.97** | .42 | 3.49** | .52 | |
| F | 20.60** | | 12.20** | | |
| R2 | .23 | | .22 | | |
| Adjusted R2 | .22 | | .20 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

### Table 4.7. Results of Regression Analyses: WFM

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.01* | .01 | -.01 | .01 | .00 (p = 1.00) |
| Gender | -.08 | .12 | -.09 | .15 | |
| Manager | -.78** | .11 | -.84** | .13 | |
| Group | -.09 | .11 | .06 | .13 | |
| Constant | 3.90** | .38 | 3.69** | .18 | |
| F | 14.06** | | 10.14* | | |
| R2 | .17 | | .19 | | |
| Adjusted R2 | .16 | | .17 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

### Table 4.8. Results of Regression Analyses: Techno-overload

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .00 | .01 | .00 | .01 | |
| Gender | .11 | .13 | .12 | .16 | |

| | | | | | |
|---|---|---|---|---|---|
| Manager | -.51** | .12 | -.69** | .15 | |
| Group | -.07 | .11 | -.03 | .14 | |
| Constant | 4.01** | .40 | 4.00** | .51 | |
| F | 6.10** | | 6.96** | | |
| R2 | .08 | | .14 | | |
| Adjusted R2 | .07 | | .12 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

### Table 4.9. Results of Regression Analyses: Techno-invasion

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | B | S.E. | B | S.E. | t |
| Age | .00 | .01 | .00 | .01 | |
| Gender | .20 | .15 | .13 | .17 | |
| Manager | -.81** | .13 | -.98** | .16 | |
| Group | -.03 | .13 | .06 | .15 | |
| Constant | 2.41** | .45 | 3.46** | .53 | |
| F | 11.37** | | 11.44** | | |
| R2 | .14 | | .21 | | |
| Adjusted R2 | .13 | | .19 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

### Table 4.10. Results of Regression Analyses: OEEM

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | B | S.E. | B | S.E. | t |
| Age | .00 | .01 | .01 | .01 | |
| Gender | .14 | .13 | .10 | .15 | |
| Manager | -.66** | .11 | -.86** | .14 | |
| Group | -.10 | .11 | .17 | .13 | |
| Constant | 2.52** | .39 | 2.49** | .46 | |
| F | 9.99** | | 12.27** | | |
| R2 | .13 | | .22 | | |
| Adjusted R2 | .11 | | .21 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

### Table 4.11. Results of Regression Analyses: Psychological Detachment

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | B | S.E. | B | S.E. | t |
| Age | .00 | .01 | .00 | .01 | |
| Gender | -.16 | .14 | -.30 | .17 | |
| Manager | .81** | .13 | .811** | .16 | |

| | | | | | |
|---|---|---|---|---|---|
| Group | -.04 | .12 | .01 | .16 | |
| Constant | 1.90** | .44 | 2.21** | .54 | |
| F | 11.46** | | 8.50** | | |
| R2 | .14 | | .17 | | |
| Adjusted R2 | .13 | | .15 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

**Table 4.12. Results of Regression Analyses: Physical Exhaustion**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | B | S.E. | B | S.E. | t |
| Age | -.02* | .01 | -.02 | .01 | .00 (*p* = 1.00) |
| Gender | .02 | .22 | .03 | .26 | |
| Manager | -.51** | .19 | -.53* | .25 | |
| Group | -.16 | .19 | -.11 | .24 | |
| Constant | 6.20** | .67 | 5.90** | .84 | |
| F | 3.18* | | 2.05 | | |
| R2 | .04 | | .05 | | |
| Adjusted R2 | .03 | | .02 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

**Table 4.13. Results of Regression Analyses: Cognitive Exhaustion**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | B | S.E. | B | S.E. | t |
| Age | .00 | .01 | .00 | .01 | |
| Gender | .03 | .23 | .11 | .26 | |
| Manager | -.25 | .20 | -.21 | .24 | |
| Group | -.30 | .20 | -.05 | .24 | |
| Constant | 5.68** | .61 | 3.61** | .84 | |
| F | 1.01 | | .29 | | |
| R2 | .01 | | .01 | | |
| Adjusted R2 | .00 | | .00 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

**Table 4.14. Results of Regression Analyses: Emotional Exhaustion**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | B | S.E. | B | S.E. | t |
| Age | -.01 | .01 | -.00 | .01 | |
| Gender | .57* | .20 | .65* | .24 | |
| Manager | -.14 | .18 | -.04 | .22 | |
| Group | -.17 | .18 | -.09 | .21 | |
| Constant | 2.44** | .63 | 1.56* | .74 | |

| | | | | |
|---|---|---|---|---|
| F | 2.74* | | 2.10 | |
| R2 | .04 | | .05 | |
| Adjusted R2 | .02 | | .03 | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

**Table 5.15. Results of Regression Analyses: WHC**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .00 | .01 | .00 | .01 | |
| Gender | .22 | .15 | .22 | .19 | |
| Manager | -.68** | .14 | -.71** | .17 | |
| Group | .04 | .13 | .16 | .17 | |
| Constant | 3.22** | .47 | 2.74** | .60 | |
| F | 7.43** | | 5.39** | | |
| R2 | .10 | | .11 | | |
| Adjusted R2 | .08 | | .09 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

**Table 5.16. Results of Regression Analyses: Performance**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .00 | .01 | .00 | .01 | |
| Gender | -.27 | .23 | -.31 | .24 | |
| Manager | .32 | .20 | -.40 | .22 | |
| Group | -.05 | .20 | -.12 | .22 | |
| Constant | 7.30** | .70 | 7.71** | .76 | |
| F | 1.18 | | 1.51 | | |
| R2 | .02 | | .03 | | |
| Adjusted R2 | .00 | | .01 | | |

*Note:* N (whole sample) = 284; N (stayers) = 176; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01;

**Table 5.17.** Unstandardised Model Results for the Intervention Effects on Email Stressors (H1) and Employee Outcomes (H3)

| | Model 1 | | | | Model 2 | | | | | | | | | | | | Model 3 | | | |
| | Intercept | | Slope | | Age on Intercept | | Age on Slope | | Gender on Intercept | | Gender on Slope | | Manager on Intercept | | Manager on Slope | | Group on Slope | | Intercept with Slope | |
| Variables | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE | *B* | SE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Hypothesis 1** | | | | | | | | | | | | | | | | | | | | |
| *Email stressors* | | | | | | | | | | | | | | | | | | | | |
| EMF | 1.81** | .07 | .06** | .02 | .00 | .01 | -.00 | .00 | .06 | .14 | .08 | .06 | -.81** | .12 | .12* | .06 | **-.08*** | .04 | -.10** | .03 |
| TOE | 1.72** | .05 | .07* | .03 | .00 | .01 | .00 | .00 | .07 | .14 | .07 | .07 | -.86** | .12 | .15* | .06 | -.10* | .05 | -.13** | .04 |
| WFM | 1.98** | .07 | .12* | .06 | -.01 | .01 | .00 | .00 | -.09 | .13 | .15 | .08 | -.75** | .11 | .13 | .07 | -.08 | .06 | -.19* | .04 |
| Techno-overload | 3.41** | .08 | .12** | .02 | .01 | .01 | -.00 | .00 | .06 | .16 | -.04 | .05 | -.68** | .13 | .07 | .05 | **-.11*** | .03 | -.07* | .03 |
| Techno-invasion | 2.15** | .08 | .09** | .02 | .01 | .01 | -.00 | .00 | .19 | .16 | .03 | .06 | -.83** | .16 | .14** | .05 | **-.14**** | .04 | -.08* | .03 |
| OEEM | 1.88** | .07 | .04 | .02 | .01 | .01 | -.00 | .00 | .24 | .15 | -.00 | .06 | -.70** | .13 | .10* | .05 | -.06 | .05 | - | - |
| | | | | | | | | | | | | | | | | | | | | |
| **Hypothesis 3** | | | | | | | | | | | | | | | | | | | | |
| *Employee outcomes* | | | | | | | | | | | | | | | | | | | | |
| Psych. Detach. | 3.18** | .08 | .10** | .02 | .00 | .01 | -.00 | .00 | -.23 | .16 | .02 | .06 | .78** | .15 | -.07 | .05 | **.10*** | .05 | -.11** | .03 |
| Phys. Exhaust. | 4.05** | .12 | .16** | .04 | -.02 | .01 | .00 | .00 | -.12 | .27 | .03 | .09 | -.46* | .23 | .07 | .07 | **-.17*** | .07 | -.10 | .06 |
| Cog Exhaust. | 3.35** | .12 | .20** | .04 | -.00 | .01 | -.00 | .00 | .11 | .27 | -.02 | .10 | -.25 | .23 | .01 | .08 | **-.23**** | .07 | -.21** | .07 |
| Emo. Exhaust. | 2.12** | .10 | .14* | .06 | .00 | .01 | .00 | .00 | .69** | .22 | -.15 | .10 | .01 | .19 | -.01 | .08 | -.07 | .08 | -.06 | .07 |
| WHC | 2.27** | .09 | .10** | .02 | .00 | .01 | -.00 | .00 | .23 | .19 | -.04 | .06 | -.73** | .16 | .09 | .05 | **-.13**** | .05 | -.09** | .03 |
| Performance | 7.79** | .11 | .12* | .05 | .00 | .01 | .00 | .00 | -.27 | .23 | .00 | .08 | .33** | .20 | -.19* | .07 | **.13*** | .06 | -.09 | .06 |

**Note:** Note: N= 176, EMF = Email Monitoring Frequency out of hours; TOE = Time on Emails out of hours; WFM = Work-Family Multitasking; OEEM = Organisational Expectations for Email Monitoring; WHC = work-home conflict; Psych Det = Psychological detachment; Phys Ex = Physical exhaustion; Cog Ex = Cognitive Exhaustion; Emo Exhaust = emotional exhaustion;
  * $p < .05$, ** $p < .01$.

### SM 3 - Additional Results: Objective Email Volume

**Table 5.18.** Comparison of Means between email volume at T1 vs. T4 measured via automatic tracking filters

|  | Experimental Group | | Wait-list Control Group | |
| --- | --- | --- | --- | --- |
|  | T1<br>Mean (SD) | T4<br>Mean (SD) | T1<br>Mean (SD) | T4<br>Mean (SD) |
| **During the workday** | | | | |
| Emails received | 347 (305) | 349 (289) | **318 (293)** | **395 (370)** |
| Emails read | 338 (286) | 328 (279) | **303 (297)** | **365 (324)** |
| Emails sent | 221 (192) | 217 (230) | **200 (210)** | **247 (226)** |
| **During non-work time** | | | | |
| Emails received | **55 (78)** | **41 (55)** | 57 (74) | 68 (132) |
| Emails read | 49 (98) | 35 (113) | 50 (109) | 44 (96) |
| Emails sent | **25 (56)** | **14 (45)** | 23 (50) | 23 (55) |
| Emails sent by managers | 49 (77) | 30 (66) | 44 (66) | 42 (74) |

*Note:* N=176; sig differences between time-points highlighted in bold (e.g., In the Experimental group, emails received and sent during none work time significantly reduced from time 1 (baseline) to time 4 (4 weeks post intervention implementation). In the control group, emails received, read and sent significantly increased.

# Appendix D – Article 3 appendices

## Appendix 1 - Additional Results

### *1.a. Assumptions*

An a-priory power analysis conducted using G*Power revealed that a minimum sample size of 130 participants was needed to detect a medium effect size (f = .25) at 95 % power for repeated measures multivariate analysis using four measurement occasions. Therefore, the current sample (N = 204) met the sample size requirements. Multivariate normality was satisfied as the Mahalanobis distance values were below the critical value ($x^2$). However, the assumptions of independence of observations and compound symmetry (sphericity), which traditional approaches such as RM MANOVAs are sensitive to, are often not met within longitudinal data. That is, because outcomes are assessed multiple times within the same participants thus increasing the chance for individual errors to be correlated. And because measurements spaced with smaller time gaps are likely to be more highly correlated than those spaced further apart and individuals are likely to differ in their rate of change, making it unlikely for the variances and covariance's of the variables to be equal (Hedeker, 2004). Indeed, Maulchy's test of sphericity revealed that the assumption for homogeneity of variance was violated (p's <.05). Nevertheless, hierarchical linear models such as mixed, multilevel or growth curve models are robust to such violations and offer a more flexible approach by allowing random intercepts and slopes between individuals, thus providing more reliable results than traditional approaches (Hedeker, 2004, Holman et al., 2010).

### *1.b. Attrition analysis*

Non-random sampling effects were examined using Goodman and Blum's (1996) four-step procedure. Tables highlighting statistics for all steps can be seen in supplemental materials 1. The first step revealed that participants in the intervention group were more likely to not complete the follow up survey (*p* <.05), suggesting that the data is not missing at random. This pattern was to be expected due to the higher demand placed on the EG, where data was collected 4 times (every two weeks from baseline) compared to the control group, where data was collected twice (baseline and final follow up 6 weeks later). To assess the potential impact of this on the means, variances and relationships of the variables in this study, it was proceeded with step two to four. Results showed that there were no substantial effects of non-random sampling on the means of the study variables (i.e. any sig differences were < 10 % of the range of the scale) and no evidence of any non-random sampling

effects on variances (i.e. no significant differences in variable variances between the whole sample and those who remained) or the relationships between the independent and dependent variables. Therefore, although data is missing non-randomly, it is unlikely that this pattern of attrition has had an impact on the results (Goldman & Blum, 1996).

### 1.c. Measurement invariance

To examine if the measures used in this study were stable over repeated data collection points (longitudinal measurement invariance, MI) a number of CFA models were fitted for scales consisting or two or more items measuring an underlying latent construct. The results presented in Table 1.1. support measurement invariance. Although model 3 (employee outcomes) shows a significant decrease in model fit when compared to model 2, indicated by a significant $x^2$ increase, as no change in the remaining fit indices was detected, the model can be accepted to support measurement invariance.

**Table 1.1**. Longitudinal measurement invariance statistics for scales from T1-T2

| Measures | $x^2$ (df) | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|
| ICT Demands | | | | | |
| Model 1: Configural | 459.58 (225) | .93 | .91 | .07 | .07 |
| Model 2: Metric | 474.98 (234) | .93 | .91 | .07 | .08 |
| Model 3: Scalar | 486.13 (242) | .93 | .92 | .07 | .08 |
| Employee Outcomes | | | | | |
| Model 1: Configural | 1411.60 (921) | .95 | .94 | .05 | .05 |
| Model 2: Metric | 1734.10 (962) | .92 | .92 | .06 | .05 |
| Model 3: Scalar | 1456.76 (957)* | .95 | .94 | .05 | .05 |

*Note:* Model 1: same factor structure (unconstraint factor loadings and item intercepts); Model 2: same (fixed) factor loadings; Model 3: same (fixed) factor loadings and item intercepts over time. Invariance is indicated by a $\Delta x^2$ of $p < .05$ (Van de Schoot, Lugtig & Hox, 2012) *and* $\Delta$CFI of $< .01$ between models (Cheung & Rensvold, 2002). Potential invariance indicated by decrease in model fit highlighted by a significant $\Delta x^{2*}$ when compared to the previous model.

## 1.d. Correlations table

**Table 1.2.** Correlations between main study variables at T1 and T2

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. EMF | - | .52** | .26** | .20** | .54** | .49** | -.43** | .09 | .10 | .19* | .49** | -.04 |
| 2. TOE | .44** | - | .22** | .27** | .47** | .31** | -.37** | .11 | .09 | .21** | .42** | -.02 |
| 3. WFM | .13 | -.07 | - | .15* | .28** | .22** | -.16* | .22** | .26** | .16* | .28** | -.15* |
| 4. Techno-overload | .25** | .27** | .11 | - | .54** | .19** | -.29** | .43** | .48** | .36** | .47** | -.33** |
| 5. Techno-invasion | .53** | .40** | .01 | .46** | - | .53** | -.51 | .24** | .24** | .33** | .68** | -.22** |
| 6. OEEM | .44** | .18* | .20** | .14* | .43** | - | -.39** | .15* | .09 | .16* | .41** | -.10 |
| 7. Psych Detachment | -.30** | -.34** | -.02 | -.19** | -.41** | -.22** | - | -.18** | -.11 | -.19** | -.52** | .09 |
| 8. Phys Exhaustion | .05 | .05 | .13 | .34** | .15* | .09 | -.10 | - | .75** | .50** | .44** | -.48** |
| 9. Cog Weariness | .05 | .02 | .25** | .34** | .12 | .02 | -.05 | .69** | - | .56** | .44** | -.48** |
| 10. Emo Exhaustion | .11 | .05 | -.02 | .18* | .22** | .10 | -.07 | .34** | .45** | - | .41** | -.28** |
| 11. WHC | .31** | .32** | .13 | .40** | .57** | .36** | -.39** | .44** | .38** | .36** | - | -.33** |
| 12. Performance | .02 | -.04 | -.14* | -.18** | -.10 | -.14* | .03 | -.42** | -.48** | -.18* | -.34** | - |

*Note*: N=204; Correlations below the diagonal line at Time 1, correlations above the diagonal line at T2; EMF = Email Monitoring Frequency out of hours; TOE = Time on Emails out of hours; WFM = Work-Family Multitasking; OEEM = Organisational Expectations for Email Monitoring; WHC = work-home conflict; Psych Det = Psychological detachment; Phys Ex = Physical exhaustion; Cog Ex = Cognitive Exhaustion; Emo Exhaust = emotional exhaustion.
* < p.05; ** <.01

## 1.e. Descriptive statistics and test of group differences

In line with the ICT and organisational stress research discussed, the correlations among the ICT stressors were in expected direction and significantly associated with employee wellbeing, work-life conflict and performance outcomes were found. Table 1.3 shows a comparison between means between experimental and control group.

As hypothesised, all email stressors and employee outcomes improved in the intervention group throughout the course of this study while no variable, other than subjective performance ratings (4 weeks: t (90) = -2.87, $p < .01$) ) improved in the control group. Outcomes that significantly improved within the intervention group throughout the study were e-mail monitoring frequency (t (112) = 3.20, $p < .01$), techno-invasion (t (112) = 4.24, $p < .01$), OEEM (t (112) = 3.17, $p < .01$), psychological detachment (t (112) = -2.77, $p < .01$), all three burnout dimensions (physical exhaustion: t (112) = 6.11, $p < .01$; cognitive exhaustion: t (112) = 2.59, $p < .05$; emotional exhaustion: t (112) = 3.85, $p < .01$) and both performance ratings (4 weeks: t (112) = -4.29, $p < .01$). Additionally, the reduction in work-family multitasking was in the hypothesised direction, but not significant (t (112) = 1.93, $p = .056$).

**Table 1.3**. Means comparison and standard deviations for the experimental and control groups at first and last point of data collection (T1&T2)

| Outcome variable | Experimental group Mean (SD) | Control group Mean (SD) |
|---|---|---|
| *Email stressor* | | |
| Email monitoring frequency 1 | 2.42 (.98) | 2.07[1] (.95) |
| Email monitoring frequency 2 | 2.17[2] (.87) | 2.16 (.89) |
| Time on Emails 1 | 2.00 (1.12) | 2.16 (1.22) |
| Time on Emails 2 | 1.82 (1.00) | 2.12 (1.16) |
| Work-family multitasking 1 | 2.40 (.80) | 2.45 (.82) |
| Work-family multitasking 2 | 2.27 (.74) | 2.44 (.82) |
| Techno-overload 1 | 2.98 (.83) | 3.24[1] (.82) |
| Techno-overload 2 | 2.90 (.93) | 3.30[1] (.86) |
| Techno-invasion 1 | 2.35 (1.00) | 2.38 (1.02) |
| Techno-invasion 2 | 2.09[2] (.93) | 2.37[1] (1.02) |
| OEEM 1 | 2.59 (1.09) | 2.34 (1.18) |
| OEEM 2 | 2.34[2] (1.07) | 2.31 (1.22) |
| *Employee outcomes* | | |
| Psychological detachment 1 | 3.00 (.83) | 3.18 (.93) |
| Psychological detachment 2 | 3.15[2] (.82) | 3.24 (.93) |
| Physical exhaustion 1 | 3.31 (1.51) | 4.14[1] (1.61) |
| Physical exhaustion 2 | 2.82[2] (1.38) | 3.99[1] (1.65) |
| Cognitive exhaustion 1 | 2.94 (1.38) | 3.79[1] (1.47) |
| Cognitive exhaustion 2 | 2.70[2] (1.34) | 3.75[1] (1.68) |

| | | |
|---|---|---|
| Emotional exhaustion 1 | 2.30 (1.53) | 2.58 (1.86) |
| Emotional exhaustion 2 | $1.91^2$ (1.15) | $2.53^1$ (1.48) |
| Work-home conflict 1 | 2.53 (1.05) | $2.89^1$ (1.22) |
| Work-home conflict 2 | 2.42 (1.02) | $2.82^1$ (1.20) |
| Performance (4 weeks) 1 | 7.44 (1.53) | 7.19 (1.53) |
| Performance (4 weeks) 2 | $7.97^2$ (1.21) | $7.56^2$ $(1.35)^1$ |

*Note*: N (experimental) = 113, N (control) = 91. OEEM = organisational expectations for email monitoring
[1] Shows significant differences between groups within one time point, $p <.05$.
[2] Shows significant differences across time within a group, $p <.05$.

# Appendix 2 - Supplemental Materials

## *SM1 - Attrition Analysis Tables*

## Step 1: Assessing the presence of non-random sampling.

**Table 2.1.** Logistic Regression: Stayers versus Leavers

| *Variables* | *B* | *S.E.* |
|---|---|---|
| Group (intervention = 2) | -.25** | .49 |
| Age | .01 | .01 |
| Gender (male = 2) | -.71 | .37 |
| Manager (no = 2) | .06 | .32 |
| Email monitoring frequency (EMF) | .02 | .20 |
| Time on emails (TOE) | .22 | .16 |
| Work-family multitasking | .18 | .19 |
| Techno-overload | -.02 | .21 |
| Techno-invasion | .03 | .21 |
| OEEM | .04 | .16 |
| Work-home conflict | -.36 | .19 |
| Psychological detachment | .22 | .20 |
| Physical exhaustion | -.20 | .14 |
| Cognitive exhaustion | .09 | .16 |
| Emotional exhaustion | .04 | .10 |
| Performance past 4 weeks | .11 | .11 |
| Constant | .89 | .13 |

| | |
|---|---|
| -2 log likelihood | 283.73 |
| Model Chi-square | 63.96** |

*Note:* N = 288, logistic regression for differences between those who did and did not respond to all surveys. Leavers = I, Stayers = 2; OEEM = organisational expectations for email monitoring;

*p < .05; **p < .01

**Step** 2: **Assessing the effects of non-random sampling on means.**

**Table 2.2.** T-tests Stayers versus Leavers

| | Mean (SD) | | |
|---|---|---|---|
| *Variables* | *Stayers* | *Leaver* | *t(df)* |
| Group (intervention = 2) | 1.55 (.50) | 1.93 (.26) | 8.34 (271.18)** |
| Age | 42.12 (11.05) | 42.02(10.59) | -.07 (160.78) |
| Gender (male = 2) | 1.67 ( .47) | 1.82 ( .38) | 2.80 (187.46)** |
| Manager (no = 2) | 1.65 ( .48) | 1.57 ( .50) | -1.26 (149.05) |
| EMF | 2.26 ( .98) | 2.42 (1.03) | 1.15 (147.98) |
| TOE | 2.07 (1.17) | 1.99 (1.01) | -.62 (176.91) |
| WFM | 2.42 ( .81) | 2.32 ( .82) | -.94 (151.63) |
| Techno-overload | 3.10 ( .83) | 3.14 ( .81) | .42 (158.74) |
| Techno-invasion | 2.37 (1.00) | 2.50 (1.08) | .99 (144.69) |
| OEEM | 2.47 (1.13) | 2.64 (1.04) | 1.20 (167.84) |
| WHC | 2.69 (1.14) | 2.98 ( .97) | 2.15(179.88) |
| Psychological detachment | 3.08 (.88) | 2.79 ( .90) | -2.53 (151.65)* |
| Physical exhaustion | 3.68 (1.60) | 3.82 (1.31) | .78 (188.35) |
| Cognitive exhaustion | 3.32 (1.48) | 3.25 (1.31) | -.39 (174.24) |
| Emotional exhaustion | 2.42 (1.68) | 2.59 (1.67) | .77 (155.71) |
| Performance past 4 weeks | 7.33 (1.53) | 7.08 (1.68) | -1.15 (142.76) |

*Note: N (stayers) = 204; N (leavers) = 84;  *p < .05; **p < .01*

**Step 3: Assessing the effects of non-random sampling on variances.**

**Table 2.3.** Difference in Variances: Whole Sample versus Leavers

| | *Variances (n)* | | |
|---|---|---|---|
| *Variables* | *Whole Sample (N=288)* | *Stayers (N=204)* | *z* |
| Group (intervention = 2) | .22 | .25 | 1.63 |
| Age | 118.79 | 122.04 | .33 |
| Gender (male = 2) | .20 | .22 | 1.20 |
| Manager (no = 2) | .23 | .23 | 0 |
| EMF | .99 | .96 | -.36 |
| TOE | 1.26 | 1.36 | .95 |
| WFM | .66 | .65 | -.18 |
| Techno-overload | .68 | .67 | -.17 |
| Techno-invasion | 1.05 | 1.00 | -.57 |
| OEEM | 1.22 | 1.27 | .49 |
| WHC | 1.21 | 1.30 | .89 |
| Psychological detachment | .80 | .77 | -.45 |
| Physical exhaustion | 2.31 | 2.56 | 1.29 |
| Cognitive weariness | 2.04 | 2.19 | .88 |
| Emotional exhaustion | 2.82 | 2.84 | .08 |
| Performance past 4 weeks | 2.46 | 2.35 | -.53 |

*Note:* $*p < .05$; $**p < .01$; critical value $z = 1.96$; EMF = Email Monitoring Frequency out of hours; TOE = Time on Emails out of hours; WFM = Work-Family Multitasking; OEEM = Organisational Expectations for Email Monitoring; WHC = work-home conflict;

**Step 4: Assessing the effects of non-random sampling on the relationships among variables.**

**Table 2.4. Results of Regression Analyses: EMF**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .00 | .00 | -.00 | .01 | |
| Gender | .13 | .13 | .15 | .14 | |
| Manager | -.48** | .12 | -.35* | .14 | |

| Variables | B | S.E. | B | S.E. | t |
|---|---|---|---|---|---|
| Group | .26* | .12 | .29* | .14 | |
| Constant | 2.29** | .42 | 1.97 | .49 | |
| F | 6.92** | | 3.93** | | |
| R2 | .09 | | .07 | | |
| Adjusted R2 | .08 | | .05 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *$p < .05$; **$p < .01$; No values in the *t* column indicate $p > .05$.

**Table 2.5. Results of Regression Analyses: TOE**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .01 | .01 | .02 | .01 | |
| Gender | .17 | .14 | .28 | .17 | |
| Manager | -.47** | .13 | -.37* | .17 | |
| Group | -.19 | .14 | -.28 | .16 | |
| Constant | 2.39** | .48 | 1.91** | .59 | |
| F | 4.87 | | 4.26* | | |
| R2 | .06 | | .08 | | |
| Adjusted R2 | .05 | | .06 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *$p < .05$; **$p < .01$; No values in the *t* column indicate $p > .05$.

**Table 2.6. Results of Regression Analyses: WFM**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.00 | .00 | -.01 | .00 | |
| Gender | -.06 | .11 | -.07 | .12 | |
| Manager | -.15 | .10 | -.19 | .12 | |
| Group | -.12 | .10 | .05 | .11 | |

| | Constant | 2.97** | .36 | 3.19** | .42 | |
|---|---|---|---|---|---|---|
| | F | .93 | | .97 | | |
| | R2 | .01 | | .02 | | |
| | Adjusted R2 | .00 | | .00 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *$p < .05$; **$p < .01$; No values in the *t* column indicate  $p > .05$.

**Table 2.7. Results of Regression Analyses: Techno-overload**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .00 | .00 | .00 | .00 | |
| Gender | .07 | .11 | .12 | .12 | |
| Manager | -.08 | .10 | -.11 | .12 | |
| Group | -.19 | .10 | -.29 | .12 | |
| Constant | 3.39** | .37 | 3.46** | .43 | |
| F | .96 | | 1.82 | | |
| R2 | .01 | | .03 | | |
| Adjusted R2 | .00 | | .02 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *$p < .05$; **$p < .01$; No values in the *t* column indicate  $p > .05$.

**Table 2.8. Results of Regression Analyses: Techno-invasion**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .00 | .01 | .00 | .01 | |
| Gender | .20 | .15 | .13 | .17 | |
| Manager | -.81** | .13 | -.98** | .16 | |
| Group | -.03 | .13 | .06 | .15 | |
| Constant | 2.41** | .45 | 3.46** | .53 | |
| F | 11.37** | | 11.44** | | |

| | | | | |
|---|---|---|---|---|
| R2 | .14 | | .21 | |
| Adjusted R2 | .13 | | .19 | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01; No values in the *t* column indicate  p > .05.

**Table 2.9. Results of Regression Analyses: OEEM**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.00 | .01 | -.00 | .01 | |
| Gender | -.12 | .14 | -.14 | .16 | |
| Manager | -.65** | .13 | -.70** | .16 | |
| Group | .15 | .13 | .19 | .16 | |
| Constant | 3.63** | .47 | 3.76** | .43 | |
| F | 6.85** | | 5.39** | | |
| R2 | .09 | | .09 | | |
| Adjusted R2 | .07 | | .08 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01; No values in the *t* column indicate  p > .05.

**Table 2.10. Results of Regression Analyses: WHC**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.01 | .01 | -.01 | .01 | |
| Gender | .23 | .14 | .24 | .16 | |
| Manager | -.54** | .13 | -.63** | .16 | |
| Group | -.29* | .13 | -.42** | .15 | |
| Constant | 4.34** | .47 | 4.59** | .56 | |
| F | 6.93** | | 6.39** | | |
| R2 | .09 | | .11 | | |
| Adjusted R2 | .07 | | .09 | | |

**Table 2.11. Results of Regression Analyses: Psychological Detachment**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.00 | .00 | -.00 | .01 | |
| Gender | -.13 | .12 | -.25 | .13 | |
| Manager | .19 | .11 | .11 | .13 | |
| Group | -.20 | .11 | -.14 | .13 | |
| Constant | 3.35** | .39 | 3.58** | .45 | |
| F | 2.51* | | 1.65 | | |
| R2 | .03 | | .03 | | |
| Adjusted R2 | .02 | | .01 | | |

**Table 2.12 Results of Regression Analyses: Physical Exhaustion**

| | Whole sample | | Stayers | | |
|---|---|---|---|---|---|
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | -.03* | .01 | -.04** | .01 | |
| Gender | -.11 | .19 | -.12 | .23 | |
| Manager | -.06 | .18 | -.06 | .23 | |
| Group | -.60* | .18 | -73** | .22 | |
| Constant | 6.45** | .64 | 6.69** | .55 | |
| F | 8.11** | | 7.59 | | |
| R2 | .10 | | .13 | | |
| Adjusted R2 | .09 | | .11 | | |

contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01; No values in the *t* column indicate p > .05.

**Table 2.13 Results of Regression Analyses: Cognitive Exhaustion**

| Variables | Whole sample | | Stayers | | |
| | B | S.E. | B | S.E. | t |
|---|---|---|---|---|---|
| Age | -.02 | .01 | -.02 | .01 | |
| Gender | .03 | .18 | .02 | .21 | |
| Manager | -.12 | .17 | -.09 | .21 | |
| Group | -.72** | .17 | -.79** | .20 | |
| Constant | 5.68** | .61 | 5.73** | .73 | |
| F | 7.43** | | 6.45** | | |
| R2 | .09 | | .11 | | |
| Adjusted R2 | .08 | | .10 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01; No values in the *t* column indicate p > .05.

**Table 2.14. Results of Regression Analyses: Emotional Exhaustion**

| Variables | Whole sample | | Stayers | | |
| | B | S.E. | B | S.E. | t |
|---|---|---|---|---|---|
| Age | -.02 | .01 | -.02 | .01 | |
| Gender | .32 | .22 | .20 | .25 | |
| Manager | -.29 | .21 | -.25 | .25 | |
| Group | -.20 | .21 | -.27 | .24 | |
| Constant | 3.50** | .74 | 3.73** | .87 | |
| F | 2.06 | | 1.42 | | |
| R2 | .03 | | .03 | | |
| Adjusted R2 | .01 | | .01 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for

those who responded to all four surveys. *p < .05; **p < .01; No values in the *t* column indicate p > .05.

**Table 2.15  Results of Regression Analyses: Performance**

|  | Whole sample | | Stayers | | |
| --- | --- | --- | --- | --- | --- |
| *Variables* | *B* | *S.E.* | *B* | *S.E.* | *t* |
| Age | .03** | .01 | .04** | .01 | |
| Gender | .12 | .20 | .19 | .22 | |
| Manager | .19 | .19 | .14 | .22 | |
| Group | .10 | .19 | .14 | .21 | |
| Constant | 5.14** | .68 | 4.72** | .76 | |
| F | 4.42 | | 5.80 | | |
| R2 | .06 | | .10 | | |
| Adjusted R2 | .04 | | .08 | | |

*Note:* N (whole sample) = 288; N (stayers) = 204; Two-tailed t-tests are shown for the differences between the regression coefficients for those variables that differ in their contributions between models. The whole sample model was compared to the model for those who responded to all four surveys. *p < .05; **p < .01; No values in the *t* column indicate p > .05.

## SM 2 - *Additional Results: Objective Email Volume*

**Table 2.16.** Comparison of Means between email volume at T1 vs. T2 measured via automatic tracking filters

|  | Experimental Group | | Wait-list Control Group | |
| --- | --- | --- | --- | --- |
|  | T1 Mean (SD) | T2 Mean (SD) | T1 Mean (SD) | T2 Mean (SD) |
| During the workday | | | | |
| Emails received | 456 (385) | 456 (322) | 365 (278) | 412 (313) |
| Emails read | 388 (312) | 384 (279) | 338 (245) | 358 (270) |
| Emails sent | 204 (216) | 196 (167) | 181 (119) | 205 (161) |
| During non-work time | | | | |
| Emails received | 87 (106) | 85 (113) | 69 (81) | 69 (71) |
| Emails read | **69 (125)** | **51 (112)** | 51 (78) | 60 (98) |
| Emails sent | **28 (39)** | **21 (45)** | 26 (41) | 29 (40) |
| Emails sent by managers | **46 (48)** | **31 (56)** | 25 (25) | 45 (53) |

*Note:* N=204; sig differences between time-points highlighted in bold (e.g., in the experimental group, emails read and sent out of hours significantly reduced from T1 (baseline) – T2 (4 weeks post intervention implementation).