RESEARCH ARTICLE

How technostressors influence job and family satisfaction: Exploring the role of work–family conflict

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Abstract

Recent developments in information and communication technology have blurred the line between the workplace and the home. This can have a negative influence on employees' well-being and thus has gained increasing attention from academics and practitioners. In this study, we developed a research model based on the transactional perspective of stress and the challenge–hindrance stressor framework. We defined the two dimensions of work–family conflict as the perceptual stress resulting from a chronic challenge and hindrance technostressors, which ultimately affect employees' satisfaction in both the work and family domains. We tested our model using a three-wave time-lagged survey study with data collected from 268 employees. Challenge and hindrance technostressors had different effects on these two main forms of work–family conflict (time-based and strain-based) but further induced negative effects on both job and family satisfaction. Overall, we make both scientific and practical contributions to the fields of work-related technology use and work–family conflict.

KEYWORDS
challenge–hindrance stressor framework, family satisfaction, job satisfaction, technostressors, work–family conflict

1 | INTRODUCTION

Managing employee health and productivity is an essential aspect of modern organisational strategies. A study by Aviva (Wedgwood, 2022) showed that, nowadays, more employees were attracted to their current job for the work-life balance (41%) than the salary (36%). Other industry reports have shown that work–life conflicts are the main reason for job resignations (Joblist, 2021). Employees are currently experiencing increasing work–life conflict due to technology-induced stress (Li et al., 2021; Sarker et al., 2018). Previous studies have suggested that technology-related work stress often bleeds over into employees' home domains with the potential to bring harm to both domains (Harris et al., 2021). Clearly understanding technology-related work–family conflict is therefore important, as a failure to intervene in the resulting stress can lead to major personal and family problems for employees (e.g., depression and divorce), which can cause productivity losses worth billions of dollars (Butts et al., 2015).

The term technostress has been coined for the stress-creating effects of technology use, in terms of the stressful experiences resulting from individuals' inability to cope with information systems (IS) in a healthy manner (e.g., Ayyagari et al., 2011; Ragu-Nathan et al., 2008). Previous studies have investigated how technology use at the workplace induces technostress and blurs the boundary between work and family (Ayyagari et al., 2011; Butts et al., 2015). Among them, a significant number of studies examined episodic technostressors which are acute and result from transitory and periodic events (e.g., system breakdown) (Weinert et al., 2020). For example, technology-mediated interruption, which is considered as an episodic technostressor, is found to significantly hinder employees' work and nonwork performance, by increasing errors in tasks and their execution time (Chen & Karahanna, 2018; Galluch et al., 2015). Similarly, Benlian (2020) investigated how daily and transient (i.e., episodic) technostressors trigger short-term work–family spillover and affect employees' home lives. While, it is worth noting that, the chronic technostressors (e.g., "techno-overload" and "techno-invasion") employees experience over the long-term can also significantly impact work–family conflict, as they result in ongoing resource depletion (Harris et al., 2021). In fact, studies have suggested that work–family conflict is associated more closely with chronic stressors because addressing such a source of stress requires a change in work or family life over a long period of time (Galluch et al., 2015). In addition, work–family conflict is often considered to be a type of role stress, which manifests in a prolonged response to chronic job-related stressors (e.g., work overload) (Ahuja et al., 2007; Grzywacz et al., 2006). Accordingly, as information systems (IS) researchers have mainly assumed that technostress is relatively static, investigations of how aggregated and retrospective technostress experiences contribute to employees' work–family conflict and ultimately influence their performance in both domains are needed.

In addition, previous research generally considers technostressors as negative and associated with undesirable outcomes (Ragu-Nathan et al., 2008). However, studies of organisational stress have suggested that stressors are multifaceted and consist of challenge stressors (i.e., motivating and beneficial) and hindrance stressors (i.e., damaging) (Lepine et al., 2005). The IS literature has also suggested that studies of the distinction between these two types of technostressors can reveal their diverse psychological and behavioural effects (Whelan et al., 2022). Information communication technology (ICT)-induced work stressors in current digitised work environments are generally considered to contribute to work–family conflict (Harris et al., 2021; Tams et al., 2020), and so defining a broader conceptualisation of technostressors for further examinations of their impact on work–family conflict is of benefit.

As work–family conflict serves as one of the key mechanisms linking work and family, it is also essential to understand the nature of work–family conflict when investigating the impact of technostressors on both domains. Organisational behaviour research has found that the time devoted to a role and the strain it can produce are two core components of work–family conflict (Netemeyer et al., 1996). In terms of resources in work and family domains, chronic technostressors experienced over time can affect employees' intentional time resource allocation (time-based work–family conflict) and unintentional emotional resource depletion (strain-based work–family conflict) (Edwards & Rothbard, 2000), ultimately influencing employee performance. Specific dimensions of work–family conflict probably influence how technostressors are translated into the job- and family-related outcomes and should therefore be identified (e.g., Ayyagari et al., 2011; Wayne et al., 2013).

Based on the above, we regard technology-driven work–family conflict as an organisational problem, and we intend to examine how challenge and hindrance technostressors impact employees' time-based and strain-based work–family conflict and how both types of work–family conflict influence employees' job and family satisfaction, as formulated in our research question: *How do challenge and hindrance technostressors influence job and family satisfaction through different dimensions of work–family conflict?* We extend the transactional perspective of technostress (Galluch et al., 2015; Ragu-Nathan et al., 2008) and draw on the work–family conflict literature (Edwards & Rothbard, 2000), and we apply the challenge–hindrance stressor framework (Lepine et al., 2005). We regard time-based and strain-based work–family conflict as the perceptual stress from technostressors. We also examine satisfaction with work and family as the manifestation of strain in these respective domains. Family satisfaction is a widely accepted subjective evaluation of the quality of family circumstances. Such satisfaction can help preserve the well-being of individuals, and it can feed back to their work performance (Greenhaus & Powell, 2006). Job satisfaction is an important factor in the work environment, and thus examining it as an outcome of technostress and its cross-boundary effects on work and family life is essential (Allen et al., 2000; Ragu-Nathan et al., 2008; Suh & Lee, 2017). We focus on job and family satisfaction and clarify how technostressors influence the mechanisms linking work and family, and how they ultimately affect employee well-being in both domains.

2 | RESEARCH BACKGROUND

We first review the framing of technostress in the literature, which informs our theoretical approach. We then review the research into work–family conflict and identify the key issues related to the effects of technology.

2.1 | Theoretical framing of technostress

2.1.1 | The transactional perspective of stress

From a transactional perspective, individuals experience and respond to stress when environmental demands interfere with their abilities to accomplish necessary or desirable tasks (Cooper et al., 2001; Lazarus, 1966), and chronic stress refers to the ongoing process of exposure to stressors and subsequent stressful feelings. Accordingly, individuals' perceptions of stress can be considered as leading to psychological and behavioural reactions. Transactional stress arises from primary and secondary appraisal processes (Lazarus & Folkman, 1984). For the primary appraisal, individuals conduct primary evaluations when first encountering a stressor and then assess its relevance, level of negativity, and seriousness. Stressors that are deemed to be relevant and harmful will result in perceptual stress. For the secondary appraisal, individuals will engage in coping responses to deal with perceptual stress, which ultimately leads to psychological or behavioural outcomes (Perrewé & Zellars, 1999). Figure 1 illustrates the transactional
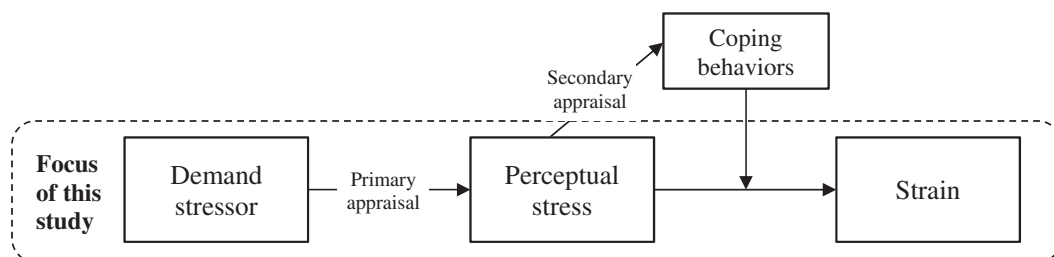

FIGURE 1 The transactional perspective of stress.

perspective of stress (Galluch et al., 2015). In this study, we focus on the primary appraisal process as we examine how differences in the evaluation (e.g., as encouraging or threatening) of chronic technostressors influence perceptual stress (in the work–family relationship) and ultimately affect strain in both work and family domains (i.e., job and family satisfaction).

ICT in the workplace has changed employee work patterns and skills, and the accompanying challenges may lead to technostress (Tarafdar et al., 2010). Technostress was first defined as "a modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner" (Brod, 1984, p. 430). The psychophysiological approach toward understanding technostress suggested that unresolved stressful situations will chronically activate individuals' regulating systems, resulting in cumulative "wear and tear" effect overtime (Atanasoff & Venable, 2017). This further demonstrates that technostress experience is relatively chronic in nature and it generates time-lagged effects on individuals. Accordingly, the transactional perspective of stress from the organisational psychology literature has been applied as a theoretical approach to technostress in IS studies. Based on this perspective, we develop a research model to investigate the relationships between technostressors, work–family conflict, and job and family outcomes. We propose that the various technostressors stemming from the diverse characteristics of technology can place demands on the individual and lead to perceptual stress, which can persist over the long term. In our research model, technostressors represent the environmental demand stressors resulting from ICT in the workplace. For example, the demanding conditions in which employees feel the need to be constantly connected and to be reachable anytime through ICTs can be considered as a demand technostressor, which is likely to be perceived as threatening by employees (Harris et al., 2011). The resulting perceived technology-driven "invasion" can lead to further perceptual stress before more serious symptoms emerge (Butts et al., 2015). We follow studies that have conceptualised role conflict as perceptual stress at a chronic level, and regard work–family conflict as a type of perceptual stress (Carlson, 1999; Peterson et al., 1995; Tarafdar et al., 2007). We further investigate job and family satisfaction as determined by perceptual stress. These factors can be considered as behavioural variables and thus outcomes of stress in the work and family domains (Ragu-Nathan et al., 2008).

2.1.2 | The challenge-hindrance technostressor framework

In their prominent study of technostress, Ragu-Nathan et al. (2008) identified the five major technostressors including techno-overload, −invasion, −complexity, −insecurity, and −uncertainty. These technostressors are all regarded as harmful to employees. Studies of organisational stress have suggested that individuals' appraisals of a stress-inducing situation determine their responses (Lepine et al., 2005). Stressors can challenge and motivate employees (Podsakoff et al., 2007), and the challenge–hindrance stressor framework has recently been applied to studies of technostress in IS research (e.g., Benlian, 2020; Califf et al., 2020).

We follow Maier et al. (2021) to distinguish between and define challenge and hindrance technostressors. Specifically, challenge technostressors refer to technological demands that potentially benefit personal growth, reward, or learning. IS research has shown that the use of technology for work can create "good stress" in various ways, such as motivating employees to develop their IT skills (Wan et al., 2012) and challenging them to think unconventionally when addressing unstructured problems (Aral et al., 2012; Califf et al., 2020; Mennecke et al., 2000). Employees may push themselves to learn more about mobile technology so they can more easily transfer tasks between work and home, thus alleviating any potential conflict (Diaz et al., 2012; Ohly & Latour, 2014). Hindrance technostressors refer to technological demands that potentially induce personal loss, constraint or harm (Maier et al., 2021). Tackling the threats from and the pressure of hindrance technostressors can be beyond employees' abilities (Tarafdar et al., 2019). The "dark side" of technostress is generally assumed in the literature, as technology-related stressors are regarded as harmful and pose obstacles and constraints on employees (e.g., Ayyagari et al., 2011; Maier et al., 2019; Tams et al., 2018).

2.2 | The work–family conflict literature

We define work–family conflict as the perceptual stress resulting from technostressors. Work and family are often the two most important aspects of life. Work and family were previously studied independently, but the overlap between them has since been recognised (Frone et al., 1992). Work–family conflict has been used to measure the tension between the domains of work and family and can be defined as "a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect" (Greenhaus & Beutell, 1985, p. 77). This definition implies a bidirectional relationship between work and family such that work interferes with family life (work-to-family conflict) and family life interferes with work (family-to-work conflict) (Frone et al., 1992). Individuals have been found to experience work-to-family conflict almost three times more frequently than family-to-work conflict (Frone et al., 2010), and thus our focus is only on the work-to-family conflict in this study, as work domain variables (e.g., work-related ICT use) are more likely to lead to this type of conflict (e.g., Mauno et al., 2006).

Work-to-family conflict can result from various sources. Greenhaus and Beutell (1985) identified and distinguished between three forms: time-, strain- and behaviour-based conflict. Time-based work-to-family conflict arises when the time devoted to work interferes with the ability to fulfil family duties. Strain-based work-to-family conflict involves the anxiety or strain resulting from work interfering with this ability. Thus, mental stress from work can negatively affect family life and satisfaction (Wayne et al., 2013). Finally, behaviour-based work-to-family conflict suggests that the behaviour required at work is incompatible with the expectations of the family, and effective work behaviour may be counterproductive at home (Carlson et al., 2000). The varying effects of these three forms of work-to-family conflict have been examined, and each form is found to be a distinct concept (Byron, 2005). However, studies have also suggested that behaviour-based work-to-family conflict is difficult to operationalise, and has little supporting empirical evidence (Kelloway et al., 1999). Mauno et al. (2006) suggested that this construct has less predictive validity than the other two forms, and several IS studies have suggested that research on behavioural role conflict is infrequent and focusing on time- and strain-based work–family conflict is more appropriate (e.g., Ghislieri et al., 2017; Riglea et al., 2021). Weinert et al. (2017) also found that in the context of IT-related work–family conflict, behaviour-based conflict had no effect on employees' levels of work exhaustion, whereas the effects of time- and strain-based work–family conflict was significant. In our study context, workplace technostressors are less likely to lead to behavioural habits that can be transferred to and generate counterproductive effects in home environments. Research into technology-related stress has also shown that the cross-boundary effects of behaviour-based conflict are less pronounced than those of either time- or strain-based conflict (Harris et al., 2011). Thus, we focus on time- and strain-based conflict when assessing the influence of technostressors.

Information technologies in the workplace are rapidly developing, and the effects of technology on employees' work–family balance have been explored (Lv et al., 2022). Our review of the literature (Appendix A) suggests that studies of technology-induced work–family conflict focus primarily on work-related antecedents (e.g., job autonomy, work overload, work schedule flexibility, and ICT availability) (Ahuja et al., 2007; Armstrong et al., 2007; Greenhill & Wilson, 2006; Kao et al., 2020) or the individual characteristics (e.g., gender, career status, and technology addiction) (Duxbury et al., 1992; Greenhill & Wilson, 2006; Turel et al., 2011). Although numerous studies on the impact of work-related stressors on work–family conflict have been conducted in the broader psychology and organisational behaviour literature (Byron, 2005; Frone et al., 1992; Grandey & Cropanzano, 1999), few have examined how technostressors influence the work–family interface. Work–family conflict has been considered a type of stressor (e.g., Ayyagari et al., 2011), and role conflict is a consequence of other stressors (Galluch et al., 2015; Tarafdar et al., 2007). Benlian et al. (2020) found that stressors experienced by employees in the work domain due to intrusive technology may have adverse effects on the employees' relationships with household members, suggesting that work–family conflict is a common consequence of technostress.

Our literature review (Appendix A) shows that almost all IS investigations have treated work–family conflict as a unidimensional construct, although it may be multidimensional (Greenhaus & Beutell, 1985), as limited research

suggests (e.g., Ghislieri et al., 2017; Riglea et al., 2021). As a mechanism that links work and family (Edwards & Rothbard, 2000), work–family conflict can explain from the resource perspective how work technostressors affect both domains through intentional time resource allocation and unintentional emotional resource depletion. Edwards and Rothbard (2000) suggested that although time- and strain-based work–family conflict both indicate negative relationships between work and family, they represent different types of individual intent (i.e., whether these relationships are intentionally created, modified, or eliminated by the individual). The concept of time-based work–family conflict involves resource drain, namely the transfer of time or attention between domains, which usually results from intentional allocation decisions. In contrast, strain-based work–family conflict indicates that mere participation in one domain can produce a strain that negatively affects the other domain, usually through unintentional efforts. Thus, work–family conflict is a manifestation of the perceptual stress resulting from the relationship between technostressors and job- and family-related outcomes (Michel & Hargis, 2008).

3 | RESEARCH MODEL AND HYPOTHESES

Based on the transaction perspective of stress (Galluch et al., 2015) and the challenge–hindrance stressor framework (Lepine et al., 2005), we explore how chronic challenge and hindrance technostressors affect employees' job and family satisfaction through work–family conflict. Thus, we address the recommendation of Tarafdar et al. (2019) that both the negative and positive aspects of technostress should be considered, and Benlian's (2020) suggestion that diverse work–family linking mechanisms are involved in the context of technostress. We identify that the environmental demands stressor involves challenge and hindrance types of technostressors and that the perceptual stress resulting from work–family conflict is triggered by chronic technostressors, which ultimately affects both domains. Figure 2 depicts our research model and Table 1 gives the definitions of the constructs.

3.1 | Impact of work–family conflict on job and family satisfaction

Work–family conflict serves as a mechanism linking employees' work and family (Michel & Hargis, 2008). Studies have suggested that this type of conflict leads to role stress through the depletion of resources when balancing work and family roles (Grandey & Cropanzano, 1999). Employees experiencing such stress are more likely to receive negative feedback at work and at home, and thus are more likely to have lower levels of job and family satisfaction (Bacharach et al., 1991). We further advance the literature by examining the impacts of time-based and strain-based work–family conflict on these forms of satisfaction.
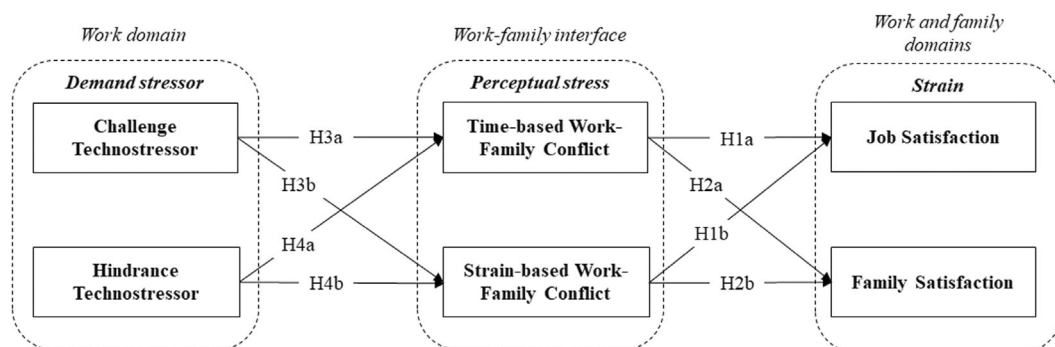

FIGURE 2 Research model.

TABLE 1 Summary of construct definitions.

Constructs	Definition
Technostressors	
Challenge Technostressor	"IS use demands that present the potential for a user's personal growth, development, reward, or learning" (Maier et al., 2021)
Hindrance Technostressor	"IS use demands that present the potential for a user's loss, constraint or harm" (Maier et al., 2021)
Linking mechanisms	
Time-based Work–Family Conflict	"time devoted to the work role interferes with fulfilling family duties" (Greenhaus & Beutell, 1985)
Strain-based Work–Family Conflict	"the strain or fatigue associated with work intrudes into and interferes with the performance of family roles" (Greenhaus & Beutell, 1985)
Strain	
Job Satisfaction	"the feeling of pleasure and achievement that employees experience in their job" (Bala & Venkatesh, 2016)
Family Satisfaction	"equitable reciprocal exchanges based on the ability of family members to jointly realise family-related values in behaviour" (Bowen, 1988)

Time-based work–family conflict involves the draining of cognitive resources that result from individuals' intentional allocation of time or attention to both the work and family domains (Edwards & Rothbard, 2000). This type of conflict can be exacerbated when employees devote more time to work in an attempt to resolve technostressors, thus blurring the line between work and family (Allen et al., 2013). Employees may respond to such conflicts by complaining about their work, as they view it as limiting their ability to fulfil their family duties (Henle & Blanchard, 2008), which further reduces their job satisfaction. Previous literature has also demonstrated that a high level of work-to-family conflict indicates the company is placing undue burdens that cannot be reconciled with family duties, which could significantly decrease employees' organisational commitment and increase turnover intention (Ahuja et al., 2007). In such a way, job satisfaction would be decreased due to time-based work–family conflict. Accordingly, we propose:

Hypothesis 1a. Time-based work–family conflict negatively influences job satisfaction.

Employees can also experience reduced satisfaction with family life when they have little time to fulfil their family roles (Wright & Cropanzano, 1998). Time-based work–family conflict can increase stressors experienced at home due to unfulfilled responsibilities (Halbesleben et al., 2009), thus decreasing satisfaction in family life. Time-based work–family conflict also prevents employees from enjoying quality time with important life partners, which brings harm to the development of family ties and a harmonious family atmosphere (Allen et al., 2000). In such a way, employees' satisfaction with family life will be decreased. Thus, we develop the following hypotheses:

Hypothesis 1b. Time-based work–family conflict negatively influences family satisfaction.

Strain-based work–family conflict is a drain on emotional resources and limits the capability to fulfil family duties without intentional effort (Edwards & Rothbard, 2000). Armstrong et al. (2007) found that work-related exhaustion can interact with the challenges of managing family responsibilities, thus leading to a work–family imbalance. As nowadays employees regard work-life balance as one of the most important criteria when evaluating their jobs, disruptions in the work–life balance can lead to lower levels of job satisfaction (Mumu et al., 2021). In addition, a high level of strain-based work–family conflict would hinder employees' psychological well-being, which is a key factor

contributing to happiness at work (Riglea et al., 2021). Therefore, we believe that strain-based work–family conflict could significantly decrease employees' job satisfaction.

Hypothesis 2a. Strain-based work–family conflict negatively influences job satisfaction.

Affective event theory (Weiss & Cropanzano, 1996) suggests that positive and negative affect in the work domain can influence individuals' attitudes and behaviour at home, and ultimately their well-being in the family domain. Thus, work-related strain can induce negative emotions in the family, affect the ability to fulfil the family role, and negatively affect family satisfaction. In addition, strain-based work–family conflict can deplete an individual's energy and psychological resources, thus decreasing their satisfaction with the quality of their family life (Voydanoff, 2004). Employees' family roles and relationships are also affected when they bring negative emotions home from work (Benlian, 2020). Unsatisfactory relationships influence the emotional states of these individuals and ultimately their satisfaction with family life (Wayne et al., 2013). Consequently, we propose:

Hypothesis 2b. Strain-based work–family conflict negatively influences family satisfaction.

3.2 | Impacts of technostressors on work–family conflict

We apply the challenge–hindrance technostressor framework in this study. Although employees may find some technostressors harmful to their family life, other technostressors may motivate them to develop a work–family balance (Maier et al., 2021). Thus, we expect challenge technostressors to reduce the two main forms of work–family conflict and hindrance technostressors to increase them.

3.2.1 | Challenge technostressors and work–family conflict

Challenge technostressors provide opportunities for personal growth and achievement. Some characteristics of ICT encourage individuals to master its use, thus enhancing their feelings of personal accomplishment (Maier et al., 2021). For example, computers have made workplaces more efficient and effective, and employees may be expected to accomplish more work in less time to match this technological potential (Mandel, 2005), or to address multiple tasks simultaneously (Srivastava et al., 2015). High workload and time pressure are commonly identified as challenge stressors, as they can be motivations for personal growth and achievement (Cavanaugh et al., 2000; Lepine et al., 2004). Employees can develop better time management skills and become more efficient through the use of IT (Zhao et al., 2020), which can reduce the need to use the family time for work. Similarly, the requirement to stay abreast of constant changes in workplace IT systems can improve employees' sense of self-efficacy (Burton-Jones & Grange, 2013), thereby enhancing their ability to balance work and family duties. Although employees must spend time and effort learning how to use new IT systems, their confidence and efficiency in other work tasks will increase after overcoming any uncertainty (Benlian, 2020). This suggests that frequent IT updates are a type of challenge technostressor and may benefit employees by improving their effectiveness and productivity at work (Kim & Kankanhalli, 2009), thus potentially reducing time-based work–family conflict. Maier et al. (2021) suggested that when working with complex information systems under tight schedules, individuals find innovative and efficient ways of using them to accomplish tasks, thus freeing up time for family duties.

Extending the above logic, we expect challenge technostressors to reduce work–family conflict. When employees are faced with complex ICT features and have to work under heavy workloads and tight schedules, they may perceive any ICT-induced self-development as challenging and improve their skills and innovativeness (Aral et al., 2012), resulting in higher productivity. Challenge technostressors can then reduce time-based work–family

conflict as employees will be motivated to manage challenging tasks in the work and family domains. Based on the above arguments and previous empirical findings, we thus hypothesise the following:

Hypothesis 3a. Challenge technostressors negatively influence time-based work–family conflict.

Studies of work stress have indicated that challenge stressors such as accomplishing complex tasks can increase positive emotions because employees achieve goals they consider meaningful (Eberly et al., 2013). For example, the ability to use IT to improve the efficiency of tasks increases the probability of being rewarded at work, thus generating positive feelings of personal accomplishment (Zhao et al., 2020). Employees can also achieve career success and a sense of fulfilment after responding to ICT upgrades by updating their IT skills or increasing their relevant competencies (Wan et al., 2012; Wang & Haggerty, 2011). The experience of achievement when facing challenge technostressors elicits positive emotions that can be transferred into the home domain, thus decreasing the possibility of strain-based work–family conflict. Such emotions can also influence the family domain by enhancing the sense of role engagement and performance (Greenhaus & Powell, 2006). Thus, dealing with challenge technostressors generates positive affect by encouraging employees' personal growth, and such positive emotions can be transferred into the home domain (Califf et al., 2020). The psychological resources available for family duties can also be increased by dealing with such challenges (Greenhaus & Powell, 2006). We, therefore, expect challenge technostressors to increase the emotional and psychological resources available for employees to fulfil their family duties, thus reducing the likelihood of strain-based work–family conflict.

Hypothesis 3b. Challenge technostressors negatively influence strain-based work–family conflict.

3.2.2 | Hindrance technostressors and work–family conflict

Hindrance technostressors threaten personal development when the harmful characteristics of ICT induce a sense of crisis and exhaustion (Tarafdar et al., 2019), which may contribute to work–family conflict. Hindrance stressors can lead to role conflict and ambiguity (Podsakoff et al., 2007), and ICT-induced hindrance stressors can impose constraints on employees' resources and reduce the time they have for fulfilling family duties. For example, managers can now contact employees at any time and anywhere and employees may be expected to read and respond to work-related messages outside of work hours through social networking applications (Zhang et al., 2021). This can generate technostressors that lead to concentration problems (Chen et al., 2022; Salo et al., 2019). Employees may then feel that their personal time has been invaded (Tarafdar et al., 2015). Technology-induced invasions (e.g., e-mail interruptions after work) can blur the boundary between work and home life, thus having a negative effect on the home (Chen & Karahanna, 2018) that will probably be perceived as a hindrance to well-being. Although the time demanded by a single instance of technology-induced invasion may be negligible, collectively they can consume significant time that can otherwise be spent on family duties (Chen & Karahanna, 2018).

The limitations of human cognition mean that dealing with complex technology can deplete an employee's mental energy before gains are made, thus reinforcing the perception of this process as a hindrance (Zhao et al., 2020). Employees may perceive highly complex IT systems as barriers that require long periods of time to master (D'Arcy et al., 2014). Some may devote months to learning and adapting to complicated applications and work patterns (Brillhart, 2004). However, employees often do not have time during work to learn and update their skillsets, and they, therefore, sacrifice their personal time after work (Tu et al., 2005). As IT skills become increasingly valuable, employees may feel threatened by others who learn the relevant skills, as they may perceive this as a threat to the value of their own skills (Ayyagari et al., 2011). They may then spend more time after work trying to keep up with their colleagues. Thus, employees may experience time-based work–family conflict as a result of hindrance technostressors. We, therefore, propose the following hypothesis:

Hypothesis 4a. Hindrance technostressors positively influence time-based work–family conflict.

Hindrance technostressors may also limit the ability to recover from work exhaustion, which can increase tension at home. For example, IT applications such as video conferencing and enterprise social media increase connectivity and interactivity, but also the potential for IT-driven interruptions and remote supervision (Larose et al., 2014; Li et al., 2021; Ragu-Nathan et al., 2008). Constant connectivity to workplace ICT can cause role ambiguity in the work and family domains, as is typical of hindrance stressors, which generally thwart the achievement of personal goals (Zhao et al., 2020). The resulting strain can then increase work–family conflict (Ayyagari et al., 2011). A hindrance technostressor that inhibits employees' personal growth can also reduce their sense of control over the work–family boundary (Cleveland-Clinic, 2019), which produces anxiety and affects performance in the family domain (Allen et al., 2013). Similarly, employees may feel a relentless need to deal with complex IT (Tarafdar et al., 2010). These feelings could lead to further exhaustion and strain, making it difficult for employees to concentrate on their domestic duties (Tarafdar et al., 2007). Employees may also experience high levels of pressure from constant IT development and workplace competition, due to the fear of lagging behind and the consequent job risks (Kakabadse et al., 2000). This perception of technology-induced insecurity has been found to be a significant work hindrance stressor, which can then encroach on family life and cause strain because employees will worry about the effects on their home life if they lose their jobs and cannot provide for their families (Fu & Deshpande, 2014; Mark et al., 2005). In addition, employees will have concerns about the role conflicts resulting from ICT use in the workplace. These can severely undermine their feelings of self-efficacy and contribute to their experience of strain outside work. Thus, we expect employees to experience higher levels of strain-based work–family conflict when they encounter more hindrance technostressors. We, therefore, propose the following hypothesis:

Hypothesis 4b. Hindrance technostressors positively influence strain-based work–family conflict.

4 | RESEARCH METHOD

4.1 | Data collection

To test our hypotheses, we collected data in Asia with the support of a professional research and consulting firm. We conducted our study with employees of eight companies in the service industry whose job duties required frequent IT use. After obtaining agreement from the respondents, the research and consulting firm compiled a participant list of 400 employees from 80 work teams who were responsible for customer care, online sales, research and development (R&D), and business systems operation. As frequent IT users, these employees were likely to face technostress.

We collected data at 3-week intervals to examine the effects of ongoing chronic technostress experienced by employees, as in previous studies (Liu et al., 2021; Vogel et al., 2016), and to assess the surveyed teams' operations. Human resources (HR) managers and supervisors informed us that the surveyed teams held meetings every 3 weeks to review outcomes and discuss issues. The influence of mediation mechanisms (work–family conflict in our study) on employee subsequent job outcomes (job and family satisfaction in our study) can become apparent within a 3-week period (c.f., Walker et al., 2012; Xie et al., 2017), so we considered 3-week intervals between measurement points as appropriate for our hypothesis testing.

We informed the participants of the data collection procedures of the surveys, ensured their responses were anonymous and offered them RMB70 (approximately USD11) in cash to improve the response rate and accuracy. We asked the respondents to complete the onsite surveys at work and return them to the research assistants of the service provider. We collected data in three waves to minimise potential common method variance and to more accurately infer the causal relationships in our model (Podsakoff et al., 2003). Figure 3 presents the data collection procedure. At Time 1, we invited 400 employees to provide ratings of challenge technostressors, hindrance technostressors, perceived job technology
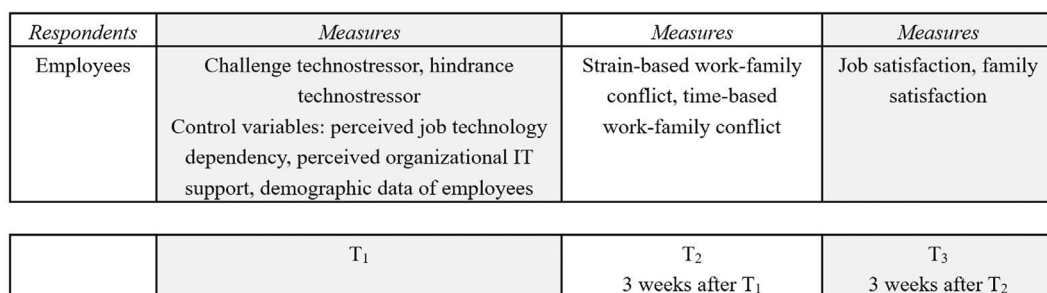
Respondents	Measures	Measures	Measures
Employees	Challenge technostressor, hindrance technostressor Control variables: perceived job technology dependency, perceived organizational IT support, demographic data of employees	Strain-based work-family conflict, time-based work-family conflict	Job satisfaction, family satisfaction

	T_1	T_2 3 weeks after T_1	T_3 3 weeks after T_2

FIGURE 3 Data collection procedure.

TABLE 2 Demographic characteristics of the respondents.

Item	Category	Frequency	Ratio (%)
Gender	Female	113	42.2
	Male	155	57.8
Age (years)	< 26	33	12.3
	26–30	122	45.5
	31–35	59	22.1
	> 35	54	20.1
Education	Below bachelor degree	171	63.8
	Bachelor degree	96	35.5
	Master's degree and above	1	0.4
Organisational tenure (years)	< 2	35	13.1
	2–5	199	74.2
	6–10	30	11.2
	≥ 11	4	1.5
Marital status	Married or living with partner	156	58.2
	Not married	112	41.8
Parental status	Having children under 18	133	49.6
	Otherwise	135	50.4

dependency, perceived organisational IT support to work from home, and their demographic data. We received 305 responses from 65 teams, yielding a response rate of 76.3% (= 305/400). At Time 2, approximately 3 weeks after Time 1, we asked the same respondents to rate their levels of work–family conflict (strain-based and time-based). We received 268 responses, yielding a response rate of 87.9% (= 268/305). At Time 3, approximately 3 weeks after Time 2, we asked the same respondents to rate their levels of job and family satisfaction. We received 268 responses from 64 teams, yielding a response rate of 100%. The respondents' demographic characteristics are summarised in Table 2.

4.2 | Measures

We adapted measures from other research to fit our study context (see Appendix B). We wrote the survey questions in English and then translated them into Chinese. We checked the accuracy using back-translation techniques. The

measurement items for the challenge and hindrance technostressors were adapted from Maier et al. (2021). The items for the challenge technostressors included "I have to complete a lot of work using ICT" and those for the hindrance technostressors included "I have several hassles using ICT" (e.g., system breakdown and software updates). The measurement items for work–family conflict were from Greenhaus and Beutell (1985). They included "My work keeps me from my family activities more than I would like" for time-based work–family conflict and "When I get home from work, I am often too frazzled to participate in family activities or responsibilities" for strain-based work–family conflict. Job satisfaction was measured with three items adapted from Bala and Venkatesh (2016). One item was "I am satisfied with the activities I perform every day". Family satisfaction was measured with five items from Bowen (1988). One item was "I am satisfied that I can turn to my family for help when something is troubling me". A 7-point Likert scale was used in the measures related to the key constructs of the research model.

Employee age, gender, educational level, tenure, marital status, parental status, perceived job technology dependency, and perceived organisational support were controlled during the model testing. The measurement items for perceived job technology dependency were from Shu et al. (2011). They included "IT has become part of the daily routine in my organization" and "All of the knowledge sharing and information transferring are carried out through the internet or intranet in my organization". The measurement items for perceived organisational IT support for working from home were from Kossek et al. (2001) and Kossek and Lautsch (2012). They included "My organization allows me to fulfil my tasks using IT at home" and "My organization matches my preferences for the extent to which I use IT at home to fulfil my task".

5 | RESULTS AND ANALYSIS

Although our proposed model operates at the individual level, our data structure is nested, with 268 employees within 64 teams. Single-level analyses (e.g., ordinary regression) violate the assumption of observation independence when hierarchically clustered data are used and lead to downwardly biased standard errors (Preacher et al., 2010). Multilevel structural equation modelling (MSEM) can address our mediation hypotheses when the data are hierarchically organised (see Appendix C for a review; Preacher et al., 2010). As such, we followed Preacher et al. (2010) and conducted two-level path analyses using multilevel SEM with Mplus 7.4 (Muthén & Muthén, 1998). In this approach, we first conducted a psychometric assessment of the measurement model and then evaluated the hypothesised model. This approach ensured that the conclusions drawn from the hypothesised model were based on a set of measures with desirable psychometric properties (Hair et al., 2010). To avoid identifying any spurious cross-level moderation effects, we centered all of the predictors at the individual level (i.e., grand-mean centering) to reduce multicollinearity (Hofmann, 1997; Hofmann & Gavin, 1998). To confirm the robustness of our hypothesis testing, we also tested the conditional indirect effects using Monte Carlo bootstrap simulations in R (Preacher & Selig, 2012).

Adopting the multilevel SEM, we first calculated the intraclass correlation coefficient (1) or ICC(1) for the dependent variables to explain the between-team variance of endogenous variables in the model (Bliese & Hanges, 2004). The results of analysis of variance (ANOVA) show significant variances at the team level (for time-based work–family conflict, F-value = 9.64, $p < 0.01$; for strain-based work–family conflict, F-value = 13.11, $p < 0.01$; for job satisfaction, F-value = 4.44, $p < 0.01$; and for family satisfaction, F-value = 6.08, $p < 0.01$). The estimated ICC(1)s are 0.67 for time-based work–family conflict, 0.74 for strain-based work–family conflict, 0.45 for job satisfaction, and 0.55 for family satisfaction. Implying that around 67% variances of time-based work–family conflict, 74% variances of strain-based work–family conflict, 45% variances of job satisfaction, and 55% variances of family satisfaction were attributable to the team-level factors. These results substantiate that two-level path analysis using multilevel SEM is appropriate for testing our hypotheses (Wu & Kwok, 2012). Rather than adding predictive variables at the team level (Bryk & Raudenbush, 1992), we thus controlled for between-level

variances of the predictive variables that are significantly explained at the team level in the subsequent analyses (Sun & van Emmerik, 2015; Wang et al., 2019).

5.1 | Measurement model

We tested the measurement model by assessing convergent and discriminant validity using the Mplus 7.4 software. We determined convergent validity using four criteria: (1) the composite reliability (CR) and Cronbach's alpha should be above 0.70; (2) the average variance extracted (AVE) should be above 0.50; (3) all item loadings should be greater than 0.707; and (4) the ratio of the overall model's chi-squared (χ^2)/degrees of freedom should be below 5.0, the Tucker-Lewis index (TLI) should be above 0.90, the comparative fit index (CFI) should be above 0.90, and the root mean square error of approximation (RMSEA) should be below 0.080 (Hair et al., 2010). All of the items passed the reliability and validity tests. Table 3 shows that all of the criteria for convergent validity were met, with CR values ranging from 0.93 to 0.98, Cronbach's alphas ranging from 0.92 to 0.98, AVE values ranging from 0.69 to 0.92, and item loadings higher than 0.707. The confirmatory factor analysis (CFA) model including all eight of the studied variables exhibited an acceptable fit ($\chi^2_{(712)} = 1866.99$, CFI $= 0.92$, TLI $= 0.91$, and RMSEA $= 0.078$).

We analysed discriminant validity using the guidelines from Gefen et al. (2000), by examining whether the square root of the AVE for each latent construct was larger than its correlation with other factors. Table 4 also summarises the major descriptive statistics and the correlations derived from the sample. All of the square root values of the AVEs were larger than their correlations with other factors, confirming discriminant validity.

We further tested the multicollinearity of the composite constructs (Cenfetelli & Bassellier, 2009) using the variance inflation factor (VIF) statistic. All of the VIFs ranged from 1.091 to 3.815, well below the threshold of 10 (Harter et al., 2002), suggesting that multicollinearity was unlikely to be a serious issue in this study.

Given that all of the data were self-reported and some were collected from the same source, we sought to minimise the potential effects of common method bias (CMB). We applied several procedural and statistical approaches as recommended by Podsakoff et al. (2003) to minimise potential effects. First, the participants were reassured of the anonymity and confidentiality of their responses, to alleviate any apprehension they had and to address social desirability. Second, we constructed a psychological separation in the survey instrument to reduce the participants' perceptions of any direct connection between the constructs. We used differing sets of instructions and added filler items between the constructs, which we placed in different parts of the survey. Third, the results of Harman's one-factor test showed that more than one factor had an eigenvalue greater than 1, and the first factor accounted for 26.40% of the total variance explained. Finally, based on Podsakoff et al. (2003) and Williams et al. (2003), we included a common method factor that included all of the principal constructs' indicators. We calculated the degree to which each indicator's variance was substantively explained by the principal construct and by the method. The average substantively explained variance of the indicators was 0.91 and the average method-based variance was 0.078. The ratio of substantive variance to method variance was about 12:1, which is a small magnitude. Thus, the results suggest that CMB was unlikely to have exaggerated the relationships examined in this study.

5.2 | Hypothesised model

To assess the hypothesised model, we calculated the *Pseudo R^2* (Snijders & Bosker, 1999), the coefficients (i.e., β), and the corresponding *p*-values. The model explained approximately 35% of the variance in job satisfaction and 29% in family satisfaction. Table 5 presents the results of the multilevel SEM for the hypothesis testing. Perceived organisational IT support for working from home was positively related to job satisfaction ($\beta = 0.23$, $p < 0.05$), indicating that the employees were able to fulfil their tasks through the provision of IT support by their organisations. Time-based work–family conflict was negatively related to job ($\beta = -0.19$, $p < 0.05$) and family satisfaction

TABLE 3 Convergent validity.

Constructs	Items	Loadings	Cronbach's alpha	CR	AVE
Challenge technostressor	CT1	0.93	0.97	0.97	0.79
	CT2	0.94			
	CT3	0.91			
	CT4	0.84			
	CT5	0.83			
	CT6	0.85			
	CT7	0.85			
	CT8	0.85			
	CT9	0.93			
	CT10	0.93			
Hindrance technostressor	HT1	0.85	0.97	0.97	0.80
	HT2	0.94			
	HT3	0.89			
	HT4	0.88			
	HT5	0.89			
	HT6	0.89			
	HT7	0.91			
Strain-based work–family conflict	SWC1	0.96	0.94	0.96	0.90
	SWC2	0.96			
	SWC3	0.92			
Time-based work–family conflict	TWC1	0.90	0.96	0.94	0.84
	TWC2	0.95			
	TWC3	0.90			
Job satisfaction	JOS1	0.97	0.97	0.97	0.91
	JOS2	0.93			
	JOS3	0.96			
Family satisfaction	FS1	0.97	0.98	0.98	0.92
	FS2	0.97			
	FS3	0.96			
	FS4	0.96			
	FS5	0.94			
Perceived job technology dependency	PJTD1	0.82	0.93	0.93	0.69
	PJTD2	0.83			
	PJTD3	0.86			
	PJTD4	0.85			
	PJTD5	0.86			
	PJTD6	0.77			
Perceived organisational IT support to work from home	POS1	0.86	0.92	0.93	0.81
	POS2	0.97			
	POS3	0.86			

Abbreviations: AVE, average variance extracted; CR, composite reliability; CT, challenge technostressor; FS, family satisfaction; HT, hindrance technostressor; JOS, job satisfaction; PJTD, perceived job technology dependency; POITS, perceived organisational IT support to work from home; SWC, strain-based work–family conflict; TWC, time-based work–family conflict.

TABLE 4 Discriminant validity (correlations between constructs).

Construct	CT	HT	SWC	TWC	JOS	FS	PJTD	POITS	EMA	EMG	EME	EMT	MS	PS
CT	**0.89**													
HT	−0.16	**0.89**												
SWC	−0.20	0.39	**0.95**											
TWC	−0.22	0.41	0.70	**0.92**										
JOS	0.28	−0.36	−0.61	−0.52	**0.95**									
FS	0.13	−0.24	−0.60	−0.54	0.59	**0.96**								
PJTD	0.19	−0.25	−0.19	−0.23	0.16	0.22	**0.83**							
POITS	0.19	−0.35	−0.11	−0.09	0.22	0.16	0.18	**0.90**						
EMA	0.01	0.20	0.16	0.09	−0.11	−0.01	−0.28	−0.10	--					
EMG	0.06	0.17	0.03	0.02	−0.04	−0.05	−0.06	−0.16	0.07	--				
EME	0.12	0.12	−0.05	0.03	0.07	0.05	0.27	−0.09	−0.26	0.19	--			
EMT	0.05	0.01	0.00	−0.02	−0.06	0.09	−0.01	−0.17	0.52	0.08	−0.05	--		
MS	0.02	0.08	0.01	0.04	0.01	0.03	−0.16	−0.03	0.40	−0.08	−0.18	0.30	--	
PS	0.20	0.04	0.05	0.03	0.00	0.05	−0.15	−0.01	0.48	−0.07	−0.20	0.33	0.84	--
Mean	5.24	3.48	3.03	3.23	4.84	4.70	5.75	5.00	31.46	0.58	3.36	3.66	0.58	0.50
SD	0.93	1.37	1.43	1.60	1.63	1.87	0.98	1.10	6.43	0.50	0.50	2.23	0.49	0.50

Note: Square root of AVE for each latent construct is given in diagonals. Correlations values above 0.16 were significant at $p < 0.01$ and between 0.12 and 0.16 were significant at $p < 0.05$.

Abbreviations: CT, challenge technostressor; EMA, employee age; EME, employee education; EMG, employee gender; EMT, employee tenure; FS, family satisfaction; HT, hindrance technostressor; JOS, job satisfaction; MS, marital status; PJTD, perceived job technology dependency; POITS, perceived organisational IT support to work from home; PS, parental status; SWC, strain-based work–family conflict; TWC, time-based work–family conflict.

TABLE 5 Unstandardised coefficients of multilevel structural equation modelling for the hypothesis testing.

Predictors	Time-based work–family conflict		Strain-based work–family conflict		Job satisfaction		Family satisfaction	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	3.27**	0.17	3.10**	0.16	4.80**	0.14	4.67**	0.19
Level-1 control variables								
Employee age	0.02	0.02	0.01	0.01	−0.01	0.02	0.03	0.02
Employee gender	−0.09	0.16	−0.05	0.11	−0.06	0.21	−0.10	0.22
Employee education	0.07	0.15	−0.04	0.12	0.26	0.17	0.08	0.20
Employee tenure	−0.08*	0.03	−0.02	0.04	−0.03	0.04	0.02	0.04
Marital status	0.10	0.18	−0.08	0.21	0.16	0.30	−0.29	0.35
Parental status	0.03	0.20	0.00	0.20	0.07	0.32	0.37	0.39
Perceived job technology dependency	−0.03	0.14	0.10	0.14	−0.04	0.12	0.18	0.13
Perceived organisational IT support to work from home	0.12	0.09	0.17*	0.07	0.23*	0.09	0.09	0.10
Level-1 predictors								
Challenge technostressor	−0.44**(H3a)	0.09	−0.34**(H3b)	0.11	0.12	0.12	0.10	0.13
Hindrance technostressor	0.32**(H4a)	0.09	0.28**(H4b)	0.07	−0.02	0.07	−0.05	0.08
Time-based work–family conflict					−0.19*(H1a)	0.08	−0.30*(H1b)	0.12
Strain-based work–family conflict					−0.52**(H2a)	0.14	−0.43*(H2b)	0.17
Pseudo R^2	0.21		0.26		0.35		0.29	

Note: N = 268 at the employee level (level 1); N = 64 at the team level (level 2). SE, standard error. *p < 0.05, **p < 0.01 (two-tailed).

($\beta = -0.30$, p < 0.05). Thus, Hypotheses 1a and 1b were supported. Similarly, strain-based work–family conflict was negatively related to job ($\beta = -0.52$, p < 0.01) and family satisfaction ($\beta = -0.43$, p < 0.05). Thus, Hypotheses 2a and 2b were supported. In addition, employee tenure was negatively related to time-based work–family conflict ($\beta = -0.08$, p < 0.05), indicating that newer employees perceived relatively higher levels of time-based work–family conflict. Challenge technostressors were negatively related to time-based ($\beta = -0.44$, p < 0.01) and strain-based work–family conflict ($\beta = -0.34$, p < 0.01). Thus, Hypotheses 3a and 3b were supported. Similarly, the perceived organisational IT support for working from home was positively related to strain-based work–family conflict ($\beta = 0.17$, p < 0.05). Thus, although the organisations provided IT support for the employees to increase their efficiency, this led to work–family conflict. Hindrance technostressors were positively related to time-based ($\beta = 0.32$, p < 0.01) and strain-based work–family conflict ($\beta = 0.28$, p < 0.01). Thus, Hypotheses 4a and 4b were supported.

5.3 | Post hoc analysis

We present the results of the indirect effects in Table 6. The indirect effect of challenge technostressors on job satisfaction through time-based work–family conflict was significantly positive (indirect effect = 0.08, 95% CI [0.01, 0.17]), indicating a significant mediation effect. Similarly, their indirect effect on family satisfaction through time-based work–family conflict was significantly positive (indirect effect = 0.13, 95% CI [0.03, 0.24]).

The indirect effect of hindrance technostressors through time-based work–family conflict on job satisfaction was significantly negative (indirect effect = −0.06, 95% CI [−0.13, −0.01]), indicating a significant mediation effect.

TABLE 6 Conditional indirect effects of technostressors on job and family satisfaction.

Paths and effects	Estimate	95% confidence interval
Challenge technostressor → Time-based work–family conflict → Job satisfaction	0.08	[0.01, 0.17]
Challenge technostressor → Time-based work–family conflict→ Family satisfaction	0.13	[0.03, 0.24]
Hindrance technostressor → Time-based work–family conflict→ Job satisfaction	−0.06	[−0.13, −0.01]
Hindrance technostressor → Time-based work–family conflict→ Family satisfaction	−0.10	[−0.21, −0.01]
Challenge technostressor → Strain-based work–family conflict → Job satisfaction	0.18	[0.05, 0.37]
Challenge technostressor → Strain-based work–family conflict → Family satisfaction	0.15	[0.02, 0.35]
Hindrance technostressor → Strain-based work–family conflict → Job satisfaction	−0.14	[−0.26, −0.05]
Hindrance technostressor → Strain-based work–family conflict → Family satisfaction	−0.12	[−0.23, −0.03]

Note: Indirect effects estimates and confidence intervals are generated from 20 000 Monte Carlo bootstrap simulations. Unstandardised effects are presented in the table.

Similarly, this indirect effect on family satisfaction was significantly negative (indirect effect = −0.10, 95% CI [−0.21, −0.01]).

The indirect effect of challenge technostressors on job satisfaction through strain-based work–family conflict was positive and significant (indirect effect = 0.18, 95% CI [0.05, 0.37]), indicating a significant mediation effect. Similarly, the indirect effect on family satisfaction through strain-based work–family conflict was significantly positive (indirect effect = 0.15, 95% CI [0.02, 0.35]).

Finally, the indirect effect of hindrance technostressors on job satisfaction through strain-based work–family conflict was negative and significant (indirect effect = −0.14, 95% CI [−0.26, −0.05]), indicating a significant mediation effect. Similarly, the indirect effect on family satisfaction through strain-based work–family conflict was significantly negative (indirect effect = −0.12, 95% CI [−0.23, −0.03]).

6 | DISCUSSION AND IMPLICATIONS

We applied a transaction perspective regarding stress and the challenge–hindrance stressor framework and drew on the work–family conflict literature. We examined how challenge and hindrance technostressors affect employee job and family satisfaction by exploring the roles of time-based and strain-based work–family conflict. We empirically tested the research model with 268 employees in a three-wave time-lagged study. The results confirmed most of the hypothesised relationships, with technostressors accounting for 21% and 26% of the variance in time-based and strain-based work–family conflict, respectively. In summary, the findings demonstrate how challenge and hindrance technostressors can affect work–family conflict (both time-based and strain-based) and thus job and family satisfaction. In this section, we discuss our findings in relation to our two research questions. We then highlight the implications for research and practice. We conclude by addressing this study's limitations and offering suggestions for future research.

6.1 | Discussion of the results

In terms of the two research questions in our study, we find that work–family conflict serves as a key mechanism linking technostressors with both work and family outcomes. We also find that both time- and strain-based work–family conflict negatively influence employees' job and family satisfaction, accounting for 35% and 29% of their variance, respectively. These results demonstrate that the blurred boundary between work and family due to technology use can significantly hinder employees' well-being and decrease their satisfaction with both their work and family

lives. Other studies have found that increased work–family conflict can result in decreased work- and nonwork-related performance (e.g., Chen & Karahanna, 2018; Riglea et al., 2021), and we extend these findings by revealing that the outcomes are determined by the specific dimensions of work–family conflict. Strain-based rather than time-based work–family conflict was found to have a stronger negative effect on employees' job and family satisfaction. This indicates that although working overtime has become a normal part of many jobs and employees have accommodated this time-based demand, the spillover of strain-based negative emotions from the work domain into the family domain is a cause for concern.

Second, our findings demonstrate that ICT use in the workplace can induce both challenge and hindrance technostressors, which have different impacts on work–family conflict. Hindrance technostressors aggravate employees' time- and strain-based work–family conflict, whereas challenge technostressors can enable them to achieve more of a work–family life balance in terms of both time allocation and strain reduction. Our findings thus extend the understanding of how different types of technostressors (e.g., techno-overload and techno-invasion) (Gaudioso et al., 2017; Harris et al., 2021) can affect work–family conflict by demonstrating that whether employees regard technostressors as harmful or encouraging can significantly affect their perceptual stress at the work–family interface. Whereas other studies have generally shown that technostressors hinder employees' work–family balance (e.g., Ayyagari et al., 2011; Harris et al., 2021), we suggest that if they are perceived as presenting opportunities for personal growth, technostressors can motivate employees to improve their work efficiency and induce a positive sense of accomplishment, thus enabling them to better perform their family duties. We also identified the aggregated effects of chronic technostress on the work–family interface by applying a time-lagged survey. Affective spillover has been applied to explain the cross-boundary effect of episodic technostressors (Benlian, 2020), but we contribute to IS research by revealing the mechanisms (e.g., time- and strain-based work–family conflict) through which chronic technostressors experienced over time affect both work and family outcomes.

6.2 | Implications for research

Recent studies and reports have emphasised the importance of employee work–life balance and have assessed whether IT in the workplace can cause work–family conflict. We make three main contributions to this emerging research. First, we advance the literature by focusing on both technostress and work–family conflict along with the effects on satisfaction in both domains, unlike previous studies that have mainly investigated technostress as a within-domain (i.e., the work domain) phenomenon, with few examining its effects on the work–family interface. In addition, we extend the IS literature by examining the largely overlooked positive aspects of technostress (Califf et al., 2020; Tarafdar et al., 2019) by distinguishing the technostressors that employees tend to regard as hindering their work–life balance from those perceived as opportunities for personal growth in terms of both their work and home life. Although some recent studies have examined this dual aspect (e.g., Ding et al., 2019; Maier et al., 2021), investigations into their cross-domain effects are limited. Benlian (2020) examined both the negative and positive consequences of technostressors for employees across life domains, but only at an episodic level. We enrich the understanding of the aggregated effects of ongoing technostressors on the work–family interface. The two-dimensional framework of technostressors applied in our study also provides a deeper understanding of technology-related stress in the context of work–family conflict. Technology now provides more possibilities for balancing work and family lives, along with transformative approaches and arrangements in the workplace (Vodanovich et al., 2010).

Second, our examination of work–family conflict as the mechanism linking work and life domains contributes to the literature by demonstrating how technostress acts as a cross-domain phenomenon that affects individuals' intentional and unintentional allocation of resources to their work and family roles. Most investigations of work–family conflict in IS research have treated this as a unidimensional construct, rather than considering its various dimensions. We draw on the organisational behaviour literature (Netemeyer et al., 1996) and incorporate two forms of work–

family conflict (i.e., time-based and strain-based). Our theoretical frame is therefore cross-disciplinary and addresses the IS-specific qualities of the effects of technostress on both domains (Tarafdar & Davison, 2018).

Finally, recent IS research into the challenge–hindrance technostress has generally assumed it is relatively static and chronic, but data were collected using a one-time survey approach (Califf et al., 2020; Maier et al., 2021; Zhao et al., 2020), which is limited in terms of capturing the aggregated and retrospective technostress experiences relate to outcomes. We contribute to research into the relationship between chronic technostressors and work–family conflict by conducting a time-lagged analysis in the form of a three-wave time-lagged survey. This provides support for the hypothesised causal relationships between the variables. Thus, our theoretical contribution involves acknowledging and empirically demonstrating that model testing requires appropriate methodologies to provide a more accurate assessment of the outcomes of technology use in the workplace.

6.3 | Implications for practice

Our findings also offer valuable implications for managerial practice. Organisations that provide IT in the workplace are usually advanced and have good connectivity. The benefits they derive largely depend on how well their employees can use the technology and whether it improves their work–life balance. Our findings show that organisations should be aware of chronic hindrance technostressors because they have negative effects on employee work–life balance and their satisfaction with their jobs and family lives. Our conceptualisation of hindrance technostressors can assist managers in developing mechanisms to reduce the likelihood of technostress. However, they should also recognise that technostressors are not universally harmful and that chronic challenge technostressors may be positive. Managers can encourage employees to treat these technostressors as opportunities for personal growth. For example, providing training programs when new IT developments and system upgrades are implemented and highlighting the value of the upgrades can encourage employees to regard these developments as opportunities to become more efficient and reduce future work–family conflict. Managers should design work policies that consider both chronic challenge and hindrance technostressors, such as limiting the extent to which employees' home lives are interrupted by work-specific communication tools and providing incentives for IT multitasking across projects.

We also suggest practical approaches through which managers can improve their employees' well-being in both the work and family domains. Our focus on work–family conflict can help predict satisfaction with both work and family. The literature has suggested that job dissatisfaction can result from factors such as career orientation and task automation (Mcmurtrey et al., 2002). In this study, we reveal previously unexplored effects of family-related factors on job satisfaction. Strain-based rather than time-based work–family conflict has a greater effect on both job and family satisfaction. Managers should therefore focus on workplace stressors but also provide family-friendly working arrangements that provide employees with a balance. Programs focusing on health and productivity can be developed, and managers can attempt to ensure work-related stress does not affect employees' home life. Employees' mental health should be considered and mental health consultation should be provided to them (or even their family members). Employees report less work–family conflict, less job burnout, and higher satisfaction when they believe that their employers care about their family and when they are provided with family-friendly work arrangements (Schooreel & Verbruggen, 2016; Wayne et al., 2013).

7 | LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Our study has some limitations that future research can address. First, we focus on time-based and strain-based work–family conflict as the mechanisms through which technostressors affect job satisfaction. Although the two dimensions of work–family conflict are widely accepted, they are not the only possible linking mechanisms. Other mechanisms that link work and home life through technostressors should thus be identified.

Second, work–family conflict implies a bidirectional relationship between the work and family domains (i.e., work-to-family and family-to-work conflict) (Frone et al., 1992), and we solely consider the effects of IT on work-to-family conflict. Future studies can explore the potential family-to-work impact of IT use in the home. For example, Venkatesh (2020) pointed out that remote working (or work-from-home) has changed the nature of employment, with employees facing many new technological challenges that they are not prepared for, which can lead to family-to-work conflict. These effects should therefore be investigated.

Third, the data in this study were only collected from one geographical location, which can raise concerns about external validity. Future studies should replicate our research in other regions and countries to enhance its generalisability. In addition, the cultural context can be considered, as this can affect organisational processes, behaviour, and outcomes, and thus how employees perceive and react to technostressors (Krishnan, 2017).

Fourth, we controlled the effects of specific variables on dependent variables in our data analysis. However, other possible variables may play a critical role in work–family conflict and job satisfaction, such as role stress and time availability. Future research can validate our results by controlling other variables.

Fifth, from our discussions with company employees (i.e., HR professionals, supervisors, and subordinates), we learned that the surveyed teams held meetings every 3 weeks to discuss work-related issues. The influence of mediation mechanisms (work-to-family conflict in our study) on subsequent job outcomes (job satisfaction and family satisfaction in our study) have been found to occur within a 3-week period (De Clercq et al., 2019). De Clercq et al. (2019) mentioned that 3-week time lags were sufficient to reduce concerns about reverse causality but short enough to minimise the likelihood of major organisational events occurring during the study period. Thus, we considered 3-week intervals between measurement points appropriate for testing our hypotheses. However, our results can be replicated by collecting data over shorter periods (e.g., 2 weeks).

Finally, our data were collected from a single source and all research constructs were measured by each respondent based on their observations. To address the concern of CMB, objective data on users' actual behaviour could be used to gain insights into how technostressors influence work–family conflict over time. Although our statistical analyses indicated that CMB was not a concern, future research can include objective data to increase the validity and reliability.

8 | CONCLUSION

Researchers and practitioners have demonstrated increasing attention to the influence of technology on the work–home life balance. In this study, we investigate how challenge and hindrance technostressors influence work–family conflict dimensions and their effects on employees' job and family satisfaction. Our model is based on the transaction perspective of stress, the challenge–hindrance stressor framework, and the work–family conflict literature. Workplace challenge technostressors are found to mitigate work–family conflict and hindrance technostressors are found to aggravate it, thus affecting job and family satisfaction. We contribute to the literature by demonstrating the dual nature and various effects of technostressors at the interface of work and the home. We also provide valuable guidance for practitioners and suggest various promising future research directions.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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APPENDIX A

TABLE A1 Literature review on information communication technology (ICT) use and work–family conflict.

Study	Definition of work–family conflict	Work–family conflict dimensions	Antecedents	Consequences	Theory	Research context
Ahuja et al. (2007)	Role tension occurs as job demands interfere with the performance of family duties.	---	Perceived work overload, job autonomy	Work-related: work exhaustion, organisational commitment, turnover intention	---	IT road warriors
Armstrong et al. (2007)	An individual's cognitions about how work and family roles exert incompatible pressures.	---	Work stress, work schedule flexibility	Work-related: job quality, turnover intention	Quality of work–life theory	Female IT professional
Ayyagari et al. (2011)	Perceived conflict between the demands of work and family.	---	Presenteeism	Work-related: strain	---	General
Butts et al. (2015)	Difficulty in transitioning between and meeting the demands of multiple roles	---	Electronic communication affective tone, electronic communication time required	---	Affective events theory	Workers from a variety of industries
Chen and Karahanna (2014)	Inter-role conflict due to incompatible demands from people's work and personal lives so that participation in one makes participation in the other more difficult.	---	Technology-mediated interruptions	Work-related: work performance Nonwork-related: Non-work performance	Work-life interaction theory	Knowledge workers
Chen and Karahanna (2018)	Inter-role conflict due to the incompatible demands from people's work and personal lives in some respect.	Time-based, strain-based (discussed but not examined)	Technology interruption overload, psychological transition, task closure	Work-related: Work exhaustion, work performance Nonwork-related: non-work performance	Work-life interface theory Conservation of resource theory	Knowledge workers

(Continues)

TABLE A1 (Continued)

Study	Definition of work–family conflict	Work–family conflict dimensions	Antecedents	Consequences	Theory	Research context
Cheng et al. (2021)	A form of inter-role conflict in which the behavioural requirements associated with the role performed in the work and family domains are mutually incompatible.	---	Permeability	Work-related: Moral disengagement, behavioural Disengagement	Transactional model of stress Coping theory Moral disengagement theory	After-hours use of instant messaging apps
Cho et al. (2020)	The norms and requirements between work and family oppose and conflict.	---	Response expectations, poor communication, hassles, end-of-work negative affect	---	Boundary theory Spillover theory	ICT use at work and after work
de Carvalho and d'Angelo (2021)	To what extent individuals are equally involved and satisfied with their role at work and their role in the family	---	Techno-overload, techno-complexity, techno-insecurity, techno-invasion, techno-uncertainty	Work-related: intention to remain in an organisation	Boundary theory	General
Duxbury et al. (1992)	A form of role conflict occurs when the demands of work and the family are incompatible.	---	After-hours telecommuting, gender, maternal career, employment	---	---	Married IT professionals
Ghislieri et al. (2017)	A form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect.	Time-based, strain-based (discussed but not examined)	Off-work hours technology assisted job demand	---	JD-R theory	General
Greenhill and Wilson (2006)	Activities from work and family domains are mutually exclusive and lead to increased conflict between work and home.	---	Gender, ICT flexibility, family friendly policy	---	Theory of Marxism	At-home telework
Harris et al. (2011)	A form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect.	---	Technology-related pressure	---	Spillover theory, conservation of resource theory	Workers highly dependent on IT.

TABLE A1 (Continued)

Study	Definition of work–family conflict	Work–family conflict dimensions	Antecedents	Consequences	Theory	Research context
Harris et al. (2021)	Work–family conflict exists when the demands of work are incompatible with the demands of family, and both roles become more difficult as a result.	---	Techno-overload, techno-invasion	---	Conservation of resource theory	Work-related technology use
Kao et al. (2020)	A form of role conflicts emerges when work-role demands interfere with family-role demands.	---	ICT availability demands, workplace telepressure	---	Effort–recovery theory	ICT use during off-work time
Kim et al. (2019)	Being constantly available for both work and family, making individuals feel as if they are always on call.	---	Work role identification, nonwork-to-work permeability, boundary strength at work, autonomy	---	Boundary theory	Smartwork
Ma and Turel (2019)	Inter-role conflict based on irreconcilable demands from the work and family domains	---	IT use for work, peer guanxi, Supervisor-subordinate guanxi	---	Social cognitive theory	IT use in Chinese firms
Othman et al. (2009)	Individuals have to perform multiple roles that place competing demands on time, energy and commitment.	---	Border permeability, border flexibility, border blending, border strength	---	Work–family border theory	At-home telework
Riglea et al. (2021)	Occurs when work and family pressures on the person are mutually incompatible.	Time-based, strain-based (discussed but not examined)	Techno-overload Techno-invasion	Nonwork-related: Psychological well-being	Conservation of resource theory	General
Saim et al. (2021)	Understanding of individuals as to how well work and non-work activities match together and are handled by their	---	Techno-overload, techno-invasion, techno-complexity	---	---	General

(Continues)

TABLE A1 (Continued)

Study	Definition of work–family conflict	Work–family conflict dimensions	Antecedents	Consequences	Theory	Research context
	system of life values, priorities and expectations (reversed).					
Tams et al. (2020)	Experienced under conditions of contradictory, incompatible, or incongruent role requirements that occur when a person is asked to fulfil the requirements from multiple roles at the same time.	---	Perceived interruption overload	Work-related: Work-related technology use	---	Mobile technology use at work
Tams et al. (2022)	Stress from the work role interfering with the family role.	---	Demands from technology-mediated interruptions	Work-related: Use of mobile technology for work	Behavioural theory of operant conditioning	Mobile technology use at work
Turel et al. (2011)	The irreconcilable demands from work and family.	---	Addiction to mobile email, technology-family conflict, work overload		Social cognitive theory	Work-related technology use
Usmani and Das (2021)	A form of inter-role conflict in which there is incompatibility between the roles from the work and family domains	---	Technologically assisted supplemental work	---	Role conflict theory	IT workers
Yang et al. (2019)	The role-transition conflict that an individual experiences when the demands of work spill over into the family.	---	Work-related ICT use at home		Boundary theory	ICT use at work
The present study	A form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect.	Time-based, strain-based (discussed and examined)	Challenge technostressor, hindrance technostressor	Work-related: job satisfaction Nonwork-related: family satisfaction	Transactional process of stress, challenge-hindrance stressor framework	ICT use at work

APPENDIX B

TABLE B1 Measurement of constructs.

Constructs	Measurement items	Reference
Challenge Technostressor	1. I have to complete a lot of work using ICT. 2. I have to work with very tight time schedules using ICT. 3. I have to work at a rapid pace to complete all of my tasks using ICT. 4. I have to perform complex tasks using ICT. 5. I have to use a broad set of ICT-related skills and abilities. 6. I have to balance several projects/tasks that require ICT use. 7. I have to multitask the assigned projects/tasks that require a lot of ICT use. 8. I have high levels of ICT responsibilities.	Maier et al. (2021)
Hindrance Technostressor	1. I have several hassles using ICT (e.g., system breakdown and software updates). 2. I have unclear instructions from my bosses on how to use ICT. 3. I have to deal with unclear ICT features. 4. I have conflicts using ICT. 5. I have inadequate ICT resources to accomplish tasks. 6. I have conflicts with peers about using ICT. 7. I have disputes with coworkers about using ICT.	Maier et al. (2021)
Time-based Work–Family Conflict	1. My work keeps me from my family activities more than I would like. 2. The time I must devote to my job keeps me from participating equally in household responsibilities and activities. 3. I have to miss family activities due to the amount of time I must spend on work responsibilities.	Greenhaus and Beutell (1985)
Strain-based Work–Family Conflict	1. When I get home from work, I am often too frazzled to participate in family activities or responsibilities. 2. I am often so emotionally drained when I get home from work that it prevents me from contributing to my family. 3. Due to all the pressures at work, sometimes when I come home I am too stressed to do the things I enjoy.	Greenhaus and Beutell (1985)
Job Satisfaction	1. I frequently think about quitting this job (reverse question). 2. I am satisfied with the activities I perform every day. 3. Generally speaking, I am very satisfied with this job.	Bala and Venkatesh (2016)
Family Satisfaction	1. I am satisfied that I can turn to my family for help when something is troubling me. 2. I am satisfied with the way my family talks over things with me and shares problems with me. 3. I am satisfied that my family accepts and supports my wishes to take on new activities or directions. 4. I am satisfied with the way my family expresses affection and responds to my emotions, such as anger, sorrow, or love. 5. I am satisfied with the way my family and I share time together.	Bowen (1988)

APPENDIX C

A MULTILEVEL STRUCTURAL EQUATION MODELLING FRAMEWORK

As scholars in organisational science are increasingly collecting hierarchically clustered data, such as employees nested within teams, traditional multiple linear regression methods for assessing the mediation effect are inaccurate in these multilevel settings (Preacher et al., 2010). The main reason is that the assumption of independence of observations is violated when clustered data are used and using ordinary regression will lead to downwardly biased standard errors (Preacher et al., 2010). Accordingly, there is a growing awareness that clustering needs to be considered when addressing mediation hypotheses.

Multilevel modelling MLM; for a thorough review see Bryk and Raudenbush (1992) and Snijders and Bosker (1999), which is greatly superior to multiple linear regression with the clustering data structure. Permitting intercepts and slopes to vary randomly across different data hierarchies (e.g., individual and team levels), MLM could yield more accurate Type I error rates than multiple linear regression (Preacher et al., 2011). However, MLM techniques are identified with two limitations when applied to mediation analysis. First, these techniques do not distinguish between effects (e.g., between-team effect) from within effects (e.g., within-team effect) but only report a single mean slope that conflates the two conditions (Klein et al., 2001). Second, MLM techniques are limited in that they cannot accommodate dependent variables measured at the upper level (e.g., team level) (Preacher et al., 2010). To overcome these two limitations, Preacher et al. (2010) suggested that multilevel structural equation modelling (MSEM) is appropriate to investigate mediation effects in clustered data. MSEM benefits in two aspects: (1) In MSEM, group means on all level 1 variable are treated as latent, thereby correcting for sampling error, and (2) MSEM could separate the between and within parts of all variables, allowing for an examination of direct and indirect effects at each level (Preacher et al., 2010).

To accurately consider the asymmetric nature of the sampling distribution (especially in small samples) of the indirect effect in MSEM, Preacher et al. (2010) suggested that in MSEM the sample size of clusters of at least 20 was necessary to avoid unacceptable bias and recommended confidence interval (CI) with Monte Carlo-based bootstrapping be applied to small samples with more confidence (MacKinnon et al., 2004; Preacher & Hayes, 2004). According to Preacher & Hayes (2004, pp. 721–722), Monte Carlo-based bootstrapping is "a nonparametric approach to effect-size estimation and hypothesis testing that makes no assumptions about the shape of the distributions of the variables or the sampling distribution of the statistic". Monte Carlo-based bootstrapping can be accomplished by taking large samples of size n (where N is the original sample size) from the data, sampling with a replacement, and computing the indirect effect in each sample. In this study, we took the bootstrap sample size of 20 000 to estimate the bias-corrected and accelerated CIs.

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