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Proximal and distal antecedents of problematic information technology use in organizations

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Abstract

Purpose – Excessive use of work-related information technology (IT) devices can lead to major performance and well-being concerns for organizations. Extant research has provided evidence of the incidence of such problematic IT use in organizations. We extend the understanding of problematic IT use by examining its individual (proximal) and organizational (distal) antecedents.

Design/methodology/approach – Drawing from the self-worth theory and the concept of fear of being left behind, we address proximal antecedents that lead to problematic IT use. Drawing from the concept of autonomy paradox, we address distal antecedents of problematic IT use through a positive association with the two proximal antecedents. We report the results of a field study involving 846 individuals who use IT for work. Structural equation modeling was employed to analyze the data.

Findings – The results indicate that the proximal antecedents (IT insecurity and fear of missing out) are positively associated with problematic IT use. The distal antecedents (IT use autonomy and involvement facilitation) are positively associated with the proximal antecedents except for the relationship between IT use autonomy and IT insecurity, which was found statistically non-significant. Furthermore, fear of missing out fully mediates the effect of IT use autonomy on problematic IT use, whereas IT insecurity and fear of missing out fully mediate the effects of involvement facilitation on problematic IT use.

Originality/value – The paper theoretically extends the understanding of problematic IT use and identifies novel its proximal and distal antecedents.

Keywords Problematic IT use, Proximal antecedents, Distal antecedents, IT insecurity, Fear of missing out

Paper type Research paper

1. Introduction

Organizational use of information technology (IT) (such as desktop PCs, laptops, smartphones and tablets) can be problematic (Salanova *et al.*, 2013; Turel *et al.*, 2011). Research shows that employees can use work-related IT excessively, keeping their IT devices within reach outside work hours, attending to work emails just before going to sleep and continuously monitoring their devices for new messages (Montag and Walla, 2016). Although such connectivity stemming from IT use facilitates organizational communication and allows for swift completion of work tasks (Elhai *et al.*, 2017; Vaghefi *et al.*, 2017), it can manifest in adverse organizational outcomes such as concentration problems and decreased cognitive

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abilities (Tarafdar *et al.*, 2019), reduced performance and workplace well-being (Andreassen *et al.*, 2012; Wajcman and Rose, 2011), and interpersonal conflicts (Buckner *et al.*, 2012; Vaghefi *et al.*, 2017; Young, 2010). Such findings indicate major performance and well-being concerns for organizations and provide a strong rationale for, and evidence of, what is known as problematic IT use in organizations. For instance, an employee who excessively checks email may consume her/his cognitive resources for screening incoming messages and absorbing new information, even though those resources could be used for other, more important work tasks. The distractions, depleted resources and time spent on such use can, for instance, obstruct the meeting of important deadlines and the conducting of high-quality work. A key enabler of problematic IT use is the seamless possibility of engaging with several applications (e.g. email, organizational tools and social networking services) on a single device (e.g. a smartphone or a laptop).

Problematic IT use is defined as excessive degree of IT use that creates psychological, social and behavioral difficulties in a person's life (Beard and Wolf, 2001; see also Andreassen *et al.*, 2013; Weinstein and Lejoyeux, 2010). Problematic IT use manifests in symptoms such as inability to reduce time spent on IT and failing to get enough sleep due to IT use (Bian and Leung, 2015; Billieux *et al.*, 2015; Weinstein and Lejoyeux, 2010) [1]. Prior evidence of its incidence, as presented above, demonstrates its critical impact on employees' well-being at work. However, understanding of the underlying antecedent factors and the ways they affect this important organizational aspect of IT use is currently missing in the literature.

The notions of *proximal* and *distal* factors provide a framework for examining a nomological network of potential antecedents of a number of organizational outcomes. The outcomes may be both favorable and unfavorable, ranging from individual behavior (e.g. work turnover) to psychological health (e.g. work stress) (Abramson *et al.*, 1989; De Moura *et al.*, 2009). The terms proximal and distal refer to relative distance between the antecedent factors and the observed outcome (Abramson *et al.*, 1989). These two types of factors are theoretically distinct: proximal factors are directly related to the outcome, whereas distal factors influence the outcome only indirectly by their effect on the proximal factors (Abramson *et al.*, 1989). Studies show that several work-related outcomes would not exist without a combination of the two types of antecedent factors and the ways they are directly (i.e. proximal) and indirectly (i.e. distal) relate to the outcomes. For example, individuals' work turnover intention is explained both by their perceptions of work (i.e. proximal antecedents) and the ways that these are influenced by organizational conditions that facilitate working (i.e. distal antecedents) (De Moura *et al.*, 2009; Meyer and Allen, 1997). Studies also show that proximal antecedents are typically factors related to the individual's perceptions (e.g. regarding his or her work) and distal antecedents are typically factors related to the organization (e.g. availability of organizational incentive mechanisms) that influence individual perceptions (De Moura *et al.*, 2009; Meyer and Allen, 1997; Riolli and Savicki, 2003). The combination of the two types of factors is critical because it helps to identify a range of levers that are more (i.e. proximal) or less (i.e. distal) potent in influencing the outcome. To give an example, employee turnover is influenced both by a lack of organizational incentive mechanisms (i.e. distal) for work engagement and a lack of an individual's work satisfaction (i.e. proximal); the former affects the outcome through the latter (De Moura *et al.*, 2009). It is possible to alter both these conditions in order to decrease turnover. However, altering each factor entails a different set of actions, such that it is important to know their respective nature of influence in order to gauge the feasibility of changing each one. Thus, both types of antecedent factors (i.e. proximal and distal) are important for the outcome. We theorize that problematic IT use surfaces similarly due to a combination of factors related both to the individual, such as the employee's perceptions about IT as means to handle work (e.g. Andreassen *et al.*, 2013; Vaghefi *et al.*, 2017) and of organizational conditions that facilitate the use of IT for work (e.g. Mazmanian *et al.*, 2013;

Weinstein and Lejoyeux, 2010). Understanding both types of factors is vital for understanding and anticipating problematic IT use. Thus, our study aims to explain the *proximal and distal antecedents of problematic IT use in organizations.*

We draw from two theoretical framings to theorize the antecedent factors. First, we draw from *self-worth theory* (Martin *et al.*, 2001) to explain proximal antecedents relating to the individual. This theory is based on an individual's achievement motivation. It posits that individuals tend to maximize their performance toward likely success in order to protect their self-worth (Covington, 1984). Specifically, the theory highlights how individuals maximize their efforts to the extent of hurting themselves due to a *fear of falling behind*, for example, not being able to keep up with their peers (Martin *et al.*, 2001). Although this has potentially favorable outcomes (e.g. getting more work done), such individuals have a hard time slowing down and are at risk of overburdening themselves (Wiegand and Geller, 2005). We theorize that problematic IT use in organizations may happen in a similar way; organizational IT users may push the use of IT for work to the limits (e.g. Weinstein and Lejoyeux, 2010). We thus examine the proximal antecedents of problematic IT use through this concept of fear of falling behind (Martin *et al.*, 2001). We study two proximal factors that embody the notion of the fear of falling behind: *IT insecurity* refers to an individual's fear that he or she needs to constantly keep up with the use of new IT to avoid being replaced (Ragu-Nathan *et al.*, 2008) and *fear of missing out* refers to an individual's apprehension of not keeping up with their colleagues in relation to work-related communication (Andreassen *et al.*, 2012; Rutherford, 2001). Both are specific to IT use. Individuals who experience high levels of IT insecurity think that colleagues may outsmart them if they do not keep up their use of work-related IT (Tarafdar *et al.*, 2007; Yellowlees and Marks, 2007). Individuals who experience high levels of fear of missing out tend to constantly monitor incoming work-related information on their IT devices (Andreassen *et al.*, 2012; Leung and Zhang, 2017). We hypothesize that IT insecurity and fear of missing out are positively associated with problematic IT use. We note that both relate to an *individual's* perception of fear of falling behind.

Second, we draw on the concept of *autonomy paradox* (Mazmanian *et al.*, 2013) to explain the distal factors relating to the organization. This concept suggests that organizations want to encourage their employees to use IT effectively for work. Accordingly, they institute enabling organizational conditions. However, such conditions can exacerbate an individual's fears of falling behind due to a lack of IT use for work. That paradox here is that while the enabling organizational conditions are intended to help the individual use IT for work, they may amplify the individual's fears of not using IT enough and thus contribute to problematic IT use. Thus, we study organizational factors that encourage the use of IT as distal factors that influence problematic IT use. We do this by examining their effects on the proximal factors. We examine two such factors as distal antecedent factors. *IT use autonomy* refers to the extent to which individuals can decide where, when and how to use IT to accomplish work (Mazmanian *et al.*, 2013). *Involvement facilitation* refers to organizational mechanisms that encourage and incentivize employees to use new organizational IT (Andreassen *et al.*, 2012; Mazmanian *et al.*, 2013; Ragu-Nathan *et al.*, 2008). We hypothesize that IT use autonomy and involvement facilitation are positively associated with IT insecurity and fear of missing out. We note that both relate to *organizational* conditions.

To empirically investigate our research objective, we report on the results of a cross-sectional field study using survey data from 846 organizational IT users who use IT for work. Data analysis using structural equation modeling analysis shows support for most of the hypothesized relationships.

The article is structured as follows. We first provide the theoretical foundation for the study by reviewing the literature on problematic IT use. Then, we present the research hypotheses. Next, we validate these hypotheses using an empirical study. Finally, we discuss the study's contributions to theory and practice.

2. Theoretical background

2.1 Problematic IT use in the organizational context

Problematic IT use denotes that an individual has a high propensity to use IT (Billieux *et al.*, 2015) and uses it excessively, to the extent that it creates negative psychological, behavioral and/or social difficulties for him/her (Andreassen *et al.*, 2013; Beard and Wolf, 2001). Problematic IT use may not include underlying pathological conditions (e.g. depression) or be a sign of a mental disorder (e.g. Griffiths *et al.*, 2016; Weinstein and Lejoyeux, 2010), unlike IT addiction. Although problematic use in the form of excessive IT use creates difficulties in a person's life, it does not necessarily mean that individuals who engage in problematic IT use suffer from a compulsion. Thus, factors associated with the development of IT addiction, such as aversion of negative feelings by using IT (i.e. negative reinforcement), may not explain problematic IT use (Robinson and Berridge, 2001). Due to the aforementioned reasons, researchers have suggested that problematic IT use is different from IT addiction (Elhai *et al.*, 2017; Gmel *et al.*, 2017).

Problematic IT use can be associated with different types of IT that individuals use in their daily activities. Most studies focus on the context of non-work IT use and examine problematic IT use of applications such as the Internet (e.g. Teo *et al.*, 2017; Yellowlees and Marks, 2007), mobile phones (e.g. Bianchi and Phillips, 2005; Billieux *et al.*, 2008) and, more recently, social networking websites such as Facebook (e.g. Lee *et al.*, 2012; Ryan *et al.*, 2014). Our review of the literature is presented in Appendix 1 for details. Antecedents of problematic IT use in relation to non-work use of IT include fear of missing out (Elhai *et al.*, 2020), anxiety (Teo *et al.*, 2017; Yellowlees and Marks, 2007), low self-esteem (Kim and Davis, 2009) and emotional instability (Billieux *et al.*, 2015; Ko *et al.*, 2009). Studies have also shown that preferences for online social interaction (Caplan, 2003), sensation seeking (Shi *et al.*, 2011; Zhang *et al.*, 2015) and online procrastination (Davis *et al.*, 2002) can influence problematic IT use in daily use of the Internet. These are all factors associated with the individual.

Problematic IT use can also exist vis-à-vis the organizational use of IT. It is not necessarily bound to specific IT applications because individuals typically use multiple applications to do their work, most commonly accessed through an IT device such as desktop, laptop or tablet (Buckner *et al.*, 2012; Mazzetti *et al.*, 2014). These applications include email, enterprise resource planning tools and social networking services. Thus, problematic use of IT can derive from the combined effects of several applications when an individual routinely uses a large selection of different applications accessed on a desktop computer, smartphone or laptop. Indeed, studies investigating work-related IT use have shown that individuals often keep several applications accessible throughout the day to track potentially relevant information that may affect the accomplishment of ongoing work tasks (Turel *et al.*, 2011; Wajcman and Rose, 2011). This is enabled by the use of work-related IT devices such as desktop PCs, laptops, smartphones and tablets, which function as hubs for accessing multiple applications (Mazzetti *et al.*, 2014; Porter and Kakabadse, 2006). The continuous connectivity emanating from the use of IT devices for work can cause problems. This is shown by observations such as individuals being more exposed to constant interruptions (Duke and Montag, 2017), never being disconnected from their work IT and browsing work-related emails or social media conversations as among the last things they do before going to bed and the first thing they do upon waking up (Mazmanian *et al.*, 2013; Montag and Walla, 2016). Such problematic use can harm individual well-being and cause interpersonal disputes at work (Buckner *et al.*, 2012; Elhai *et al.*, 2017; Gmel *et al.*, 2017; Young, 2010). Problematic IT use may also lead to severe concentration problems. Duke and Montag (2017) found that individuals prone to problematic IT use faced increasing amounts of interruptions via IT, which in turn reduced their involvement with work-related activities. This finding is worrying as reduced involvement contributes to individuals' hyperactivity and lack of attention to work (Kushlev *et al.*, 2016).

Of the various studies, only two have examined the antecedents of problematic IT use in organizations. In the first study, Buckner *et al.* (2012) found conscientiousness, typically a positive personality trait, to be negatively associated with problematic IT use. In the second study, Rozgonjuk *et al.* (2020) found fear of missing out to be a contributor to problematic use of social media (see Appendix 1). Here, we observe an important research potential because the antecedents of problematic IT use in non-work and organizational contexts are likely to differ given the differences in the respective IT use environments. Studies that examine problematic IT use in the non-work context represent a perspective in which the individual seeks positive emotion from the use of IT, often in the hedonic and voluntary sense. In contrast, in the work context, the individual as an employee is highly dependent on the use of IT for work as it provides them with the means to accomplish work. Here, an increase in IT use enables the employee to get more work done. Thus, use is essential and not voluntary. Research also suggests that individuals' use of IT in the organizational context is influenced by organizational factors relating to IT use (D'Arcy *et al.*, 2014; Elie-Dit-Cosaque *et al.*, 2012; Pirkkalainen and Salo, 2016). We thus aim to address this distinct organizational perspective of problematic IT use and explain its antecedents. Specifically, we examine the proximal and distal antecedents of problematic IT use, as we explain next.

2.2 Theorizing antecedents of problematic IT use in organizations

The framing of proximal and distal antecedents is helpful as a theoretical foundation to understand the antecedents of an outcome when multiple types of theoretically distinct antecedent factors influence the outcome, their influence is direct (i.e. proximal) or indirect through the proximal factors (i.e. distal), and the nature of each aforementioned relationship (i.e. positive or negative effects of the antecedent factors) can be accounted for (Abramson, 1989; Riolli and Savicki, 2003; Davis, 2001). In the case of organizational phenomenon (e.g. work turnover, work engagement, workplace stress), proximal factors are often related to the individual (e.g. perceptions of work) and distal to the organization (e.g. conditions facilitating work) (De Moura *et al.*, 2009; Meyer and Allen, 1997; Riolli and Savicki, 2003). We theorize that this is similarly the case for problematic IT use because it is increasingly recognized that the organizational context of IT use is a competitive and comparative one (Stich *et al.*, 2017), where the use of IT (e.g. quick response to work email) is often associated with superior work performance (e.g. greater responsiveness). In such a setting, problematic IT use is likely to be influenced not only by the individual's own way of dealing with IT but also by organizational factors. In the following sections, we posit that problematic IT use is influenced by multiple antecedent factors that are related to the individual (proximal) and the organization (distal); wherein the former affects problematic IT use directly and the latter indirectly through proximal factors; and that the combination of the two types of factors can be toxic, such that the organizational factors influence the individual factors in an undesirable way, leading to problematic IT use. Next, we identify these proximal and distal factors.

2.2.1 Proximal antecedents of problematic IT use. Research on non-work use of IT indicates that problematic IT use is explained by factors related to the individual (e.g. Teo *et al.*, 2017; Yellowlees and Marks, 2007). Research on organizational phenomena such as work turnover and workplace stress similarly suggests that proximal antecedents are factors related to the individual (De Moura *et al.*, 2009; Meyer and Allen, 1997; Riolli and Savicki, 2003). For instance, proximal antecedents of workplace stress include the individual's perception about the demands of a situation. Workplace stress manifests if the demands of the situation are evaluated as stressful (Riolli and Savicki, 2003). In the context of IT use, the findings of Buckner *et al.* (2012) and other practical observations (e.g. Andreassen *et al.*, 2013; Wajcman and Rose, 2011) indicate that an individual's perception of IT use for work can be related to problematic IT use. Thus, we examine factors related to the individual as proximal antecedents.

We draw our understanding of proximal antecedents from self-worth theory. This theory focuses on the individual's achievement motivation in competitive environments where individuals compare their own performance to others, i.e. schools and organizations (Wiegand and Geller, 2005; Martin *et al.*, 2001). The theory highlights that individuals can doubt the sufficiency of their actions for achieving goals such as for performing well at work. Further they are likely to expend much effort to ensure their success such goals (Wiegand and Geller, 2005; Martin *et al.*, 2001), often pushing their efforts to the limits of their well-being in order to do so (Martin *et al.*, 2001). Their well-being can thus be under threat, for example, due to working too hard (Covington and Roberts, 1994; Wiegand and Geller, 2005). Self-worth theory points out that this is essentially because of an individual's fear of falling behind at work wherein individuals compare their own organizational behaviors to those of others, and fear being left behind professionally if they do not compare well.

In the context of organizational IT use, a similar finding has emerged in recent research, wherein individuals who are apprehensive of falling behind engage in excessive use of IT to accomplish more work (Andreassen *et al.*, 2012; Buckner *et al.*, 2012). Such a *fear of falling behind* can be defined as individuals' fear that they lose something vital if others surpass them in IT use to accomplish more work (Porter and Kakabadse, 2006). Such perceptions can lead to negative outcomes as they overemphasize the importance of their peers' activities and distort individuals' views of what their colleagues or employer might find as ideal or acceptable ways to use IT to accomplish work (Mazzetti *et al.*, 2014; Porter, 2001). In this way, we anchor the fear of falling behind as being indicative of a proximal antecedent of problematic IT use. We investigate two factors that embody this concept.

First, we investigate *IT insecurity*. IT insecurity is the extent to which an individual feels threatened about losing his/her job to other people who have a better understanding of new IT (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007). The theoretical premise for selecting this variable is that IT insecurity captures the IT-specific experience of the fear of being left behind because of inadequate IT use. Second, we investigate *fear of missing out,* defined as the perception that an individual runs the risk of missing out on crucial work-related information if they do not use IT enough (Andreassen *et al.*, 2012; Rutherford, 2001). Prior studies on non-work use of IT have demonstrated that fear of missing out leads to problematic IT use (Elhai *et al.*, 2020). It can also increase the frequency of disruptive interruptions (Rozgonjuk *et al.*, 2019a).

Although to our best knowledge, prior studies have not explicitly examined the relationship of fear of missing to problematic use of IT in organizations; they do highlight its significance in the organizational context of IT use. The study of Rozgonjuk *et al.* (2020), for example, examined the daily use of social media and demonstrated that fear of missing out increases social media-related problematic use and reduces work-related productivity. Furthermore, research shows that individuals feel highly pressured to keep up with organizational communication using IT (Andreassen *et al.*, 2012; Mazmanian *et al.*, 2013). The worry of being left behind on crucial work-related information can be harmful because it pushes individuals to pay even more attention to their IT (Leung and Zhang, 2017; Wiltermuth and Gino, 2013).

2.2.2 Distal antecedents of problematic IT use. In the work context, distal antecedents are typically factors relating to the organization (Gagné *et al.*, 1997; Riolli and Savicki, 2003; Spreitzer, 1992). For example, distal antecedents of work engagement include hierarchical structure, socio-political support (Spreitzer, 1992) and organizational support mechanisms, such as encouraging individuals to challenge their current ways of working and trying out new ideas in practice (Gagné *et al.*, 1997; Yuan and Woodman, 2010). Studies show that distal antecedents are factors that are associated with the outcome indirectly through their effect on the proximal antecedents. For example, in relation to work engagement, organizational support mechanisms contribute to individuals' work engagement by affecting the proximal antecedents of their perceptions of work (Gagné *et al.*, 1997; Spreitzer, 1992; Yuan and Woodman, 2010).

We draw our understanding of the distal antecedents of problematic IT use from the autonomy paradox concept (Mazmanian *et al.*, 2013), which shows that factors in the organizational environment can affect individuals' perceptions about IT use, such as making them doubt the sufficiency of the extent to which they use IT for work. The autonomy paradox provides insights into two key organizational factors that encourage IT use and yet may contribute to individuals' fear of falling behind. The first way is by enabling autonomy in the use of IT, which refers to individuals' independence in choosing where, when and how they use IT to accomplish their work (Elhai *et al.*, 2017; Mazmanian *et al.*, 2013). The second way is by encouraging the use of IT with incentives and rewards (Andreassen *et al.*, 2012; Mandel, 2005). Although these two factors are considered desirable, exposing individuals to IT and emphasizing the importance of its use can make them compare the extent of their IT use with that of their peers (Mazmanian *et al.*, 2013; Porter and Kakabadse, 2006) and can cause them to doubt the adequacy of their IT use for work (Mazzetti *et al.*, 2014). Thus, these factors can strengthen individuals' fear of falling behind. We suggest that these two factors are distal antecedents of problematic IT use. Specifically, we investigate the first, *IT use autonomy*, defined as the degree of control the individual has over the content, timing, location and performance of IT use for work (Wallace, 1995), and the second, *involvement facilitation*, defined as organizational mechanisms that encourage individuals to use and experiment with new IT (Ragu-Nathan *et al.*, 2008). Next, we frame our research hypotheses by developing the theoretical link between organizational factors that encourage the use of IT (distal antecedents) and individuals' fear of falling behind in IT use compared to their colleagues (proximal antecedents), and their combined effect on problematic IT use.

3. Hypotheses development

In this section, we develop the hypotheses for this study, as shown in Figure 1. We first explain the relationship between proximal antecedents and problematic IT use. We next explain the relationship between the proximal and distal antecedents.

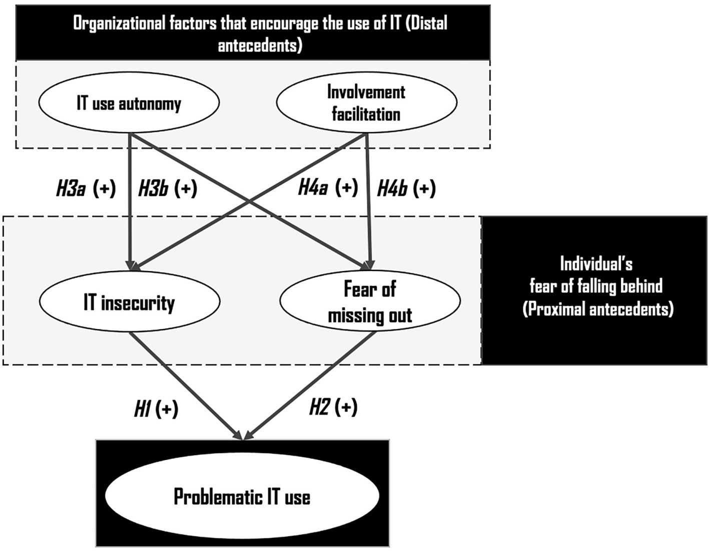

Figure 1.
Research model of problematic IT use in organizations

3.1 IT insecurity and fear of missing out as proximal antecedents of problematic IT use

Our first hypothesis suggests that IT insecurity can be associated with problematic IT use. Evidence shows that individuals compare their IT use to those of others and they often fear being left behind professionally due to insufficient IT use (Mazzetti *et al.*, 2014; Vaghefi *et al.*, 2017) Specifically, they feel that the way they use IT for work purposes is subject to comparison and evaluation by their peers (Yellowlees and Marks, 2007). They feel threatened that they might lose their position if their use of IT does not compare well with their peers (Kets de Vries, 2005; Mazzetti *et al.*, 2014). For example, they may be concerned that their use of IT does not appear to be proficient and proactive. Individuals who feel threatened in this way hold themselves to unreasonable expectations of IT use. Their views on ideal or commendable ways of using IT for work become skewed (Kets de Vries, 2005; Porter, 2001) so they think only noticeably proactive, or even excessive, IT use can satisfy the expectations of the organization (Porter and Kakabadse, 2006). They are unable to detach from their IT devices and may even receive complaints from others (e.g. family and friends) because of such excessive use (Vaghefi *et al.*, 2017; Yellowlees and Marks, 2007). Thus, we hypothesize:

H1. IT insecurity is positively associated with problematic IT use.

Our second hypothesis suggests that fear of missing out can be associated with problematic IT use. Research suggests that the tendency to fear missing out on relevant information, interactions and experiences makes individuals spend an increasing amount of time using IT (Przybylski *et al.*, 2013). Individuals may be unable to break the information consumption loop because of this, and therefore, they use IT excessively (Wiltermuth and Gino, 2013). Literature on IT end-user computing suggests that IT that is used throughout the day exposes individuals to online traffic shared by co-workers and superiors even after working hours (Leung and Zhang, 2017). Individuals might feel that they will be left behind if they do not continuously monitor their IT devices for work-related information (Leung and Zhang, 2017). Not only do they follow what their colleagues are working on, but they also feel pressure to pay attention to any information that might be of use to them professionally (Rush, 2011). IT devices being the primary channel through which they access such information, they can find it difficult to detach from these devices and, for example, fail to rest properly when they need to (Vaghefi *et al.*, 2017; Yellowlees and Marks, 2007). We hypothesize:

H2. Fear of missing out is positively associated with problematic IT use.

3.2 IT use autonomy and involvement facilitation as distal antecedents of problematic IT use

IT use autonomy encourages individuals to exercise their freedom to use IT in the ways they prefer. It allows individuals to set their own times of use and choose their preferred software applications to accomplish work (Boswell and Olson-Buchanan, 2007). Research shows that people who are insecure about the proficiency of their IT use find IT use autonomy troubling. This is because they observe and compare their own autonomous use with their colleagues' use of their IT devices (Montag and Walla, 2016; Porter and Kakabadse, 2006). For example, if they see their colleagues using IT in an autonomous way, perhaps during non-work hours or when they are reported to be on vacation, they might find themselves reflecting unduly on their own use of IT for work, thinking that they do not properly take advantage of their IT use autonomy to similarly use IT during vacations and non-work hours and that their IT use is somehow inadequate. They may find their colleagues' autonomous use as a cue that they are being outpaced in IT-related activities and fear being replaced (Andreassen *et al.*, 2013; Ng *et al.*, 2007). Thus, their IT-related insecurities may be further strengthened. We hypothesize:

H3a. IT use autonomy is positively associated with IT insecurity.

Further, research on work behaviors provides insights into the relationship between autonomy provided to the individual and their fear of missing out. Although autonomy gives individuals the flexibility to decide when to focus on work, their attention may also remain on work-related activities during moments of rest (Sewell, 1998). This happens because they can find it hard to stop thinking about whether their colleagues are working when they themselves are not (Barker, 1993).

Literature on IT end-user computing indicates that individuals who have IT use autonomy often use IT to find out what their colleagues are doing and feel pressured to keep up with organizational communication (Andreassen *et al.*, 2012; Boswell and Olson-Buchanan, 2007). Autonomy can amplify individuals' expectations of their availability (Mazmanian *et al.*, 2013), such that they associate constant availability, such as attending to their messages in the evenings (Leung and Zhang, 2017), with the expected way of working. They worry that they may not be able to stay available with the help of their IT as much as they would want to (Mazmanian *et al.*, 2013). Thus, they fear missing out on relevant work-related information. Based on these observations, we posit that IT use autonomy strengthens the fear of missing out.

H3b. IT use autonomy is positively associated with fear of missing out.

Research on work behaviors shows that individuals who are rewarded for working actively (e.g. with bonuses and promotions) can suffer from a sense of doubt regarding how much work is adequate for them to compare well with their peers (Mazzetti *et al.*, 2014; Porter, 1996). They can feel that unless they reach their goals and be rewarded, they might be criticized or even let go (Barker, 1993; Rutherford, 2001). Similar observations can be made in relation to IT use in organizations. Incentivizing noticeable use of IT to accomplish work might not serve all individuals in a beneficial manner. This is because many individuals may feel insecure about the adequacy of their use of work-related IT (Kets de Vries, 2005). Being aware that using IT to accomplish work is a reason to be rewarded, and they want to compare well with their colleagues in order to reach for those rewards (Porter, 2001). However, they might feel that encouragement for using IT signals that active IT use is imperative, and that failing to do so would make them susceptible to criticism from their colleagues (Porter and Kakabadse, 2006). Thus, the possibility that colleagues could be outsmarting them at work via IT use is a serious threat (Porter, 2001; Vaghefi *et al.*, 2017), as is the possibility that their positions may be in danger if they do not use IT at work. Thus, we posit that organizational efforts to encourage IT use can strengthen the IT insecurity of individuals.

H4a. Involvement facilitation is positively associated with IT insecurity.

Organizational efforts to involve individuals in experimentation with new IT are shown to influence the extent to which individuals follow their colleagues' work-related online activities and the extent to which they interact with colleagues via IT (Bock *et al.*, 2005; Ford and Staples, 2010). This can foster an individual's expectation of using IT for instantaneous work-related communication (Rutherford, 2001). They might feel that in order to be rewarded, they have to be present and proactive on various work-related communication channels (e.g. email and organizational social networking sites) (Andreassen *et al.*, 2012), which they access through IT devices. Thus, their worry about missing out on relevant work-related information is strengthened. Therefore, we hypothesize:

H4b. Involvement facilitation is positively associated with fear of missing out.

4. Methods and results

We adopted a survey research design to test our hypotheses. An online survey was carried out in three phases: (1) survey design, (2) data collection and (3) analysis and results. The phases are described below.

4.1 Survey design

The survey items used for this study were adapted and modified from existing scales. The IT insecurity scale was drawn from the construct of techno-insecurity (Tarafdar *et al.*, 2007). The fear of missing out scale was adapted from Przybylski *et al.* (2013). We adjusted the scale to the context of organizational use of IT by removing items that reflected the use of IT for personal amusement (e.g. to pass time). Additionally, we interchanged the word "friend" with "people" on the fear of missing out scale to allow it to encompass colleagues and other relevant stakeholders that individuals relate to in their use of IT for work. The concept of IT use autonomy was based on Fishbein and Ajzen (2011). The scale for involvement facilitation was drawn from Ragu-Nathan *et al.* (2008). All scale items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A sixth option of "No response" was also provided. The full list of the scale items and their definitions are provided in Appendix 2 (Table A2).

We did not find any existing scales on problematic IT use that would have reflected work-related use of IT. Thus, for problematic IT use, we selected and adapted Charlton and Danforth's (2010) scale for pathological IT use [2]. This scale was adopted because a subset of it is closely related to the theoretical definition of problematic IT use. The scale presents several criteria including salience (i.e. sleep problems due to IT use), conflict (i.e. social problems due to IT use), relapse and reinstatement (i.e. individuals' unsuccessful attempts to reduce the time using IT) and withdrawal (negative feelings that occur when the individual cannot use IT). Not all of these are relevant to problematic IT use. We modified the scale to be contextually appropriate for the organizational use of IT and aligned the items with the concept of problematic IT use by reflecting excessive use of work-related IT and specifically contextualizing the items to "work IT use". Specifically, we chose the psychological, social and behavioral aspects of problematic IT use that can manifest in work-related use of IT (Andreassen *et al.*, 2013; Beard and Wolf, 2001; Weinstein and Lejoyeux, 2010). The first item, "I have made unsuccessful attempts to reduce excessive time spent using my work IT", captures the psychological aspect and aligns with the relapse and reinstatement criteria. The second item, "Others complain about my excessive work IT use", depicts the social aspect and aligns with the conflict criteria. The third item, "I often fail to get enough sleep because of my excessive work IT use", captures the behavioral aspect, aligning with the salience criteria. We chose to exclude Charlton and Danforth's (2010) criterion of withdrawal because that is not an aspect of problematic IT use (Beard and Wolf, 2001; Billieux *et al.*, 2015).

4.2 Data collection

We collected survey data from an online panel of employees in the United States. We selected SurveyGizmo because it has over 50 million panel members, including working professionals from major firms in the United States [3]. The use of online respondent panels addressed two criteria. One, it ensured reach to professionals from a large number of organizations and industries (Lowry *et al.*, 2016a). Two, given the large reach, issues of social desirability that might arise due to knowledge of colleagues in organization-specific surveys were avoided. We were interested in reaching individuals with a variety of backgrounds and occupations to reduce possible biases related to specific organizational and occupational conditions.

Given our focus on problematic IT use, we were interested in individuals who use IT frequently in their work and are potentially at risk of using IT excessively. Specifically, we were interested in the use of their primary or most frequently used IT device to handle work. We chose to exclude the use of secondary devices because such use might not be representative of individuals' use of IT for work and they would be unlikely to use it to an excessive degree. In order to situate the questions for the respondents, we asked them to name their most frequently used IT device for work and relate their answers throughout the survey to that device. We included three specific screening statements on *work IT use* to make sure the respondents used the chosen IT for their work tasks. These statements included the following: "I use this IT to support my work activities", "I use this IT in my work" and "I use this IT to accomplish my work tasks". If any of the responses were less frequent than "occasionally" (the mid-point of a five-step scale ranging from "never" to "a great deal"), the respondent was informed that he or she could not proceed further in the survey as they would unlikely fit the scope of the study on problematic IT use. Each section of the survey contextualized the survey items specifically to work-related use of IT. We ensured this with instructions such as "Keep in mind the work IT you chose and typed in at the start of the survey" and ". . .how you use [the chosen] IT in your work". The combination of the guidelines and the contextualized survey items (with wording such as "work IT use" and "my work IT") informed the respondents that non-work-related use of IT was excluded from the study, allowing them to reflect on their preferred means of using IT for work, which may take place during or after office hours.

A total of 1,049 responses were collected. We first removed any responses that did not clearly indicate the most frequently used IT device. The exclusion criteria included a missing response, an unclear response (e.g. unidentifiable device, brand or model) and naming more than one IT device. At this point, 874 responses remained. We then performed a careful data screening process, including the removal of invalid responses due to careless response patterns (responses with close to 0 standard deviation and irrelevant remarks in the open- and additional-feedback request fields) or incomplete data (responses with 2% or more missing values in the indicator variables or any missing values in the control variables of gender, age, and IT experience) [4]. This left us with 846 valid responses for the data analysis. The descriptive statistics of the demographics of this sample are provided in Table 1.

We also included several control variables and constructs in our model. Gender (coded as 0 = male, 1 = female) and age (in years) were controlled for because they have been associated with problematic IT use in prior literature (e.g. Shi *et al.*, 2011; Zhang *et al.*, 2015). Additionally, we controlled for IT use experience (in years) to account for individuals' IT use background as well as their education and the industry in which they were working. Our

Variable	Category	Frequency
Gender	Female	444 (52.5%)
	Male	402 (47.5%)
Age	20–35 years	335 (39.6%)
	36–50 years	224 (26.5%)
	51–65 years	287 (33.9%)
Education	No degree	192 (22.7%)
	Undergraduate degree	467 (55.2%)
	Postgraduate degree	184 (21.7%)
	N/A	3 (0.4%)
Industry	Service	200 (23.6%)
	Education	113 (13.4%)
	ICT	109 (12.9%)
	Healthcare	89 (10.5%)
	Retail and wholesale	66 (7.8%)
	Construction and real estate	62 (7.3%)
	Manufacturing	56 (6.6%)
	Non-profit	54 (6.4%)
	Other	96 (11.3%)
	N/A	1 (0.1%)
IT device	Laptop/PC/Mac	710 (83.9%)
	Smartphone/tablet	136 (16.1%)

Table 1. Sample demographics

theoretical perspective on problematic IT use posits that IT use provides a means to accomplish work and that an increase in IT use enables more work to get done. Thus, we also controlled for two work-related factors. One, we controlled for work IT use in terms of the extent to which individuals use their chosen IT device to accomplish work. This was measured as a reflective construct with the three aforementioned screening statements as its indicators (e.g. "I use this IT to support my work activities"). Two, we controlled for work mental load to capture the cognitive demands of the work on problematic IT use. This was measured as a reflective construct with three indicators adapted from Van Veldhoven and Meijman (1994) (e.g. "My job requires me to be attentive to many things at the same time").

4.3 Analysis and results

The data analysis and results are reported in four sub-sections. First, we describe how the data analysis was carried out. Second, we evaluate the construct and indicator reliabilities and validities. Third, we examine the existence of common method variance (CMV) in the model indicators and common methods bias (CMB) in the model estimates. Fourth, we report the results of model estimation and hypothesis testing.

4.3.1 Data analysis. For the data analysis, we used the IBM SPSS Statistics version 24 and the Mplus version 7.11 software. The SPSS software was used to screen the data and for preliminary analysis. In contrast, the Mplus software was used to examine the indicator and construct reliabilities and validities, as well as to estimate the research model through structural equation modeling. We used the MLR option of Mplus as the model estimator, which stands for maximum likelihood estimator robust to standard errors. The missing values in the indicator variables were handled by using the full information maximum likelihood (FIML) option of Mplus, which uses all the available data in the model estimation.

4.3.1.1 Sampling adequacy. We evaluated the adequacy of the sample for factor analysis using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (Kaiser, 1970, 1974) and Bartlett's test of sphericity (Bartlett, 1951). Of these, the value of the KMO measure (0.882) and the result of Bartlett's test ($\chi^2(253) = 10{,}536.565$, $p < 0.001$) both suggested that the correlations between the indicators in the sample were sufficient for factor analysis.

4.3.2 Construct and indicator reliabilities and validities. Reliability and validity were evaluated at both indicators and construct levels by using a fully correlated measurement model that did not hypothesize any regression relationships between the constructs or their controls. As a criterion for acceptable indicator reliability and validity, it is commonly expected that the standardized loading of each indicator should be statistically significant and greater than or equal to 0.707 (Fornell and Larcker, 1981). As can be seen from Appendix 2, which reports the standardized loadings of the indicators along with their means and standard deviations (SD), only three indicators (PITU1, FOMO3 and INFA1) were not found to meet this criterion. However, given that their standardized loadings were very close to the 0.707 threshold (0.682, 0.704 and 0.679), and that even standardized loadings as low as 0.400 have been considered sufficient in prior IS studies (e.g. Gefen *et al.*, 2000), we considered the indicator reliability and validity, all in all, to be at an acceptable level and decided not to drop the two indicators from the study [5].

Construct reliability was evaluated by checking that the composite reliability (CR) of each construct was greater than or equal to 0.7 (Fornell and Larcker, 1981; Nunnally and Bernstein, 1994). The CR of each construct is reported in the first column of Table 2. As can be seen, all the constructs met this criterion. In turn, construct validity was evaluated by examining the convergent and discriminant validity of each construct. Convergent validity was evaluated based on the average variance extracted (AVE) of the constructs, which refers to the average proportion of variance that a construct explains in its indicators. In order to exhibit acceptable convergent validity, each construct should have an AVE greater than or equal to 0.5. This means that, on average, each construct should explain at least half of the variance of

Table 2. Construct reliabilities, AVEs, square roots of AVEs and construct correlations with 95% confidence intervals

	CR	AVE	PITU	ITIS	FOMO	ITUA	INFA	WITU	WOML	Gender	Age	ITEX
Problematic IT use (PITU)	0.837	0.633	0.796									
IT insecurity (ITIS)	0.904	0.653	0.786*** [0.738, 0.834]	0.808								
Fear of missing out (FOMO)	0.798	0.570	0.746*** [0.689, 0.803]	0.706*** [0.652, 0.761]	0.755							
IT use autonomy (ITUA)	0.887	0.724	0.285*** [0.211, 0.358]	0.187*** [0.113, 0.260]	0.331*** [0.255, 0.407]	0.851						
Involvement facilitation (INFA)	0.782	0.547	0.390*** [0.312, 0.468]	0.377*** [0.303, 0.450]	0.446*** [0.367, 0.525]	0.577*** [0.514, 0.640]	0.739					
Work IT use (WITU)	0.905	0.761	−0.049 [−0.125, 0.027]	−0.076 [−0.153, 0.000]	−0.100* [−0.176, −0.023]	0.087* [0.010, 0.164]	0.042 [−0.043, 0.126]	0.872				
Work mental load (WOML)	0.749	0.500	−0.014 [−0.093, 0.066]	−0.046 [−0.129, 0.037]	−0.062 [−0.148, 0.024]	0.142** [0.052, 0.232]	0.199*** [0.103, 0.295]	0.147** [0.055, 0.240]	0.707			
Gender	–	–	−0.208*** [−0.279, −0.138]	−0.229*** [−0.297, −0.161]	−0.210*** [−0.283, −0.138]	−0.212*** [−0.280, −0.144]	−0.180*** [−0.254, −0.106]	−0.012 [−0.082, 0.059]	0.042 [−0.039, 0.123]	–		
Age	–	–	−0.270*** [−0.337, −0.203]	−0.122*** [−0.191, −0.054]	−0.211*** [−0.282, −0.140]	−0.104** [−0.174, −0.034]	−0.204*** [−0.276, −0.131]	0.043 [−0.029, 0.115]	0.025 [−0.054, 0.103]	−0.129*** [−0.195, −0.062]	–	
IT experience (*ITEX*)	–	–	−0.292*** [−0.354, −0.230]	−0.188*** [−0.251, −0.126]	−0.252*** [−0.321, −0.183]	−0.131*** [−0.203, −0.059]	−0.296*** [−0.366, −0.226]	0.198*** [0.132, 0.263]	0.100** [0.027, 0.173]	−0.030 [−0.098, 0.037]	0.658*** [0.618, 0.698]	–

Note(s): CR = composite reliability, AVE = average variance extracted (diagonal axis represents the square roots of AVE), 95% confidence intervals highlighted in brackets, ***$p < 0.001$, **$p < 0.01$

its indicators (Fornell and Larcker, 1981). The AVE of each construct is reported in the second column of Table 2. As can be seen, all the constructs met this criterion.

Discriminant validity was evaluated comprehensively based both on the traditional criterion by Fornell and Larcker (1981) and on two additional criteria by Bagozzi *et al.* (1991) as well as Anderson and Gerbing (1988), which also take into account the sampling error in the estimated correlations between the constructs (Shiu *et al.*, 2011). First, the criterion by Fornell and Larcker (1981) requires that in order to exhibit acceptable discriminant validity, each construct should have a square root of AVE greater than or equal to its absolute correlation with the other constructs in the model. This means that, on average, each construct should share at least an equal proportion of variance with its indicators than it shares with the other constructs. The square root of AVE of each construct (on-diagonal cells) and the correlations between the constructs (off-diagonal cells) are reported in the remaining columns of Table 2. As can be seen, all the constructs met this criterion. Second, the criterion by Bagozzi *et al.* (1991) examines the 95% confidence intervals of the estimated correlations between the constructs, which are also reported in Table 2. None of these confidence intervals was found to contain unity, thus suggesting that all the constructs have acceptable discriminant validity (Bagozzi *et al.*, 1991). Third, the criterion by Anderson and Gerbing (1988), which is based on the prior work by Bagozzi and Phillips (1982), conducts comparisons between an unconstrained model and nested models in which one of the correlations between the constructs is constrained to unity. All these unity constraints were found to result in a statistically significant deprecation in the model fit when examined with the χ^2 difference test, in which the $\Delta\chi^2$ value was corrected with the Satorra–Bentler scaling correction factor due to the usage of the MLR estimator in estimating the models (Satorra and Bentler, 2010), thus indicating an acceptable discriminant validity (Anderson and Gerbing, 1988). For example, in terms of the three constructs with the strongest and potentially problematic correlations from the perspective of discriminant validity (i.e. problematic IT use, IT insecurity and fear of missing out), when constraining the correlation between problematic IT use and IT insecurity to unity, the χ^2 difference test yielded $\chi^2(1) = 127.280$, $p < 0.001$. In turn, when constraining the correlation between problematic IT use and fear of missing out to unity, the χ^2 difference test yielded $\chi^2(1) = 176.579$, $p < 0.001$. Finally, when constraining the correlation between IT insecurity and fear of missing out to unity, the χ^2 difference test yielded $\chi^2(1) = 161.667$, $p < 0.001$.

4.3.3 Common method variance and bias. The existence of potential common method variance (CMV) in the model indicators and common method bias (CMB) in the model estimates were examined by applying two different tests proposed in prior literature (e.g. Podsakoff *et al.*, 2003). As a first test, we applied Harman's single-factor test (Podsakoff *et al.*, 2003) by estimating a model in which all the model indicators were loaded on a single factor. This model yielded a bad fit with the data ($\chi^2(230) = 8{,}431.267$, $p < 0.001$, CFI $= 0.048$, TLI $= -0.047$, RMSEA $= 0.205$, SRMR $= 0.269$), suggesting no CMV in the model indicators or CMB in the model estimates (Podsakoff *et al.*, 2003).

As a second test, we applied the confirmatory factor analysis (CFA) marker technique by Williams *et al.* (2010). As a theoretically unrelated marker variable, we used the fashion consciousness construct, which has been previously used as a marker variable in the IS context by Malhotra *et al.* (2006). The results of the model comparisons are reported in Table 3. The baseline model refers to the model with the loadings between the marker variable and the model indicators constrained to zero, whereas the Method-C and Method-U models refer to the models in which the loadings between the marker variable and the model indicators are constrained as equal (C = constrained) or remain unconstrained (U = unconstrained). Finally, the Method-R model refers to the model in which the construct correlations were restricted equal to those of the baseline model (R = restricted). As a criterion for model fit, we used the χ^2 difference test, in which the $\Delta\chi^2$ test statistic was corrected with the Satorra–Bentler scaling correction factor (SCF) due to the usage of the MLR estimator in estimating the models (Satorra and Bentler, 2010).

First, we compared the baseline model to the Method-C model. This comparison suggested that the Method-C fitted the data better than the baseline model, meaning that there was CMV in the model indicators. Second, we compared the Method-C model with the Method-U model. This comparison suggested that the Method-U model fitted the data better than the Method-C model, meaning that the CMV in the model indicators was congeneric rather than non-congeneric in nature (Richardson *et al.*, 2009). Finally, we compared the Method-U model with the Method-R model. This comparison suggested that the Method-R model did not fit the data better than the Method-U model, meaning that the CMV in the model indicators did not result in CMB in the model estimates. In summary, we consider neither CMV nor CMB to be a concern in our study.

4.3.4 Model estimation and hypothesis testing. The results of model estimation in terms of the standardized size and statistical significance of the effects, as well as the proportion of explained variance (R^2) in the problematic IT use construct, are reported in Figure 2. The hypothesized model was found to fit the data well when its goodness of-fit was assessed by using the chi-square (χ^2)/degrees of freedom (df) ratio and four fit indices (Hu and Bentler, 1999): the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). Together, these four fit indices assess the model fit from both relative (CFI and TLI) and absolute (RMSEA and SRMR) perspectives (Hooper *et al.*, 2008). The χ^2/degree of freedom (df)

Model	χ^2	df	SCF	$\Delta\chi^2$	Δdf	p
Baseline	918.857	283	1.1070	–	–	–
Method-C	872.771	282	1.1060	37.358	1	<0.001
Method-U	665.526	260	1.1052	205.966	22	<0.001
Method-R	689.622	281	1.1112	25.954	21	0.208

Table 3. Results of the CFA marker technique

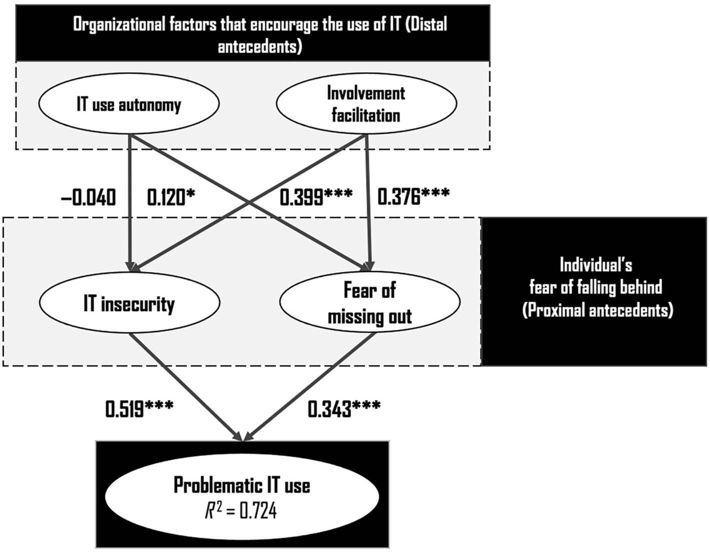

Figure 2. Model estimation results

ratio of 2.1 ($\chi^2(419) = 900.747$) met the cut-off criterion for acceptable fit ($\chi^2/df < 3.0$) suggested by Kline (2005). In addition, three of the four fit indices (CFI = 0.952, TLI = 0.937, RMSEA = 0.037, SRMR = 0.031) indicated a good fit by exceeding the respective cut-off criteria (CFI ≥0.95, TLI ≥0.95, RMSEA ≤0.06, and SRMR ≤0.08) suggested by Hu and Bentler (1999).

In terms of the proportion of explained variance, the model was found to perform well. In total, the model explained 72.4% of the variance in problematic IT use and 14.2 and 20.7%, respectively, of the variance in IT insecurity and fear of missing out. All the hypothesized effects in the model were found to be statistically significant except for the effect of IT use autonomy on IT insecurity.

A summary of the results in terms of the tested hypotheses is provided in Table 4. The non-significant relationship between IT use autonomy and IT insecurity indicates a lack of support for H3a. We note that our respondents were mostly highly qualified in that 76.9% of them had at least a bachelor's degree. Highly qualified individuals are likely to be able to use IT in an informed manner. A possible explanation therefore is that the respondents in our sample were able to harness their IT autonomy in positive ways, such as with increased motivation to use IT (Gagné, 2009). Thus, it is plausible that higher levels of autonomy did not make the respondents feel that they needed to use IT more often in order to protect their jobs.

In addition to the direct effects, we also tested the indirect effects by calculating the effects of IT use autonomy and involvement facilitation on problematic IT use via IT insecurity and fear of missing out. This was done by using the Sobel (1982) test with the added covariance term (MacKinnon, 2000, p. 92) due to the usage of the MLR estimator. The indirect effect of IT use autonomy via IT insecurity (−0.021) was found as statistically not significant, whereas the indirect effect of IT use autonomy via fear of missing out (0.041*) as well as the indirect effects of involvement facilitation via both IT insecurity (0.207***) and fear of missing out (0.129***) were found as statistically significant. This suggests that fear of missing out mediates the effects of both IT autonomy and involvement facilitation on problematic IT use, whereas IT insecurity mediates only the effect of involvement facilitation on problematic IT use. Next, we tested the type of each of these three mediations by adding the direct effects of IT use autonomy and involvement facilitation on problematic IT use into the model. Of them, the effects of both IT use autonomy (0.064) and involvement facilitation (−0.048) were found to be statistically insignificant, suggesting that fear of missing out fully mediates the effect of IT use autonomy on problematic IT use, whereas IT insecurity and fear of missing fully mediate the effects of involvement facilitation on problematic IT use (Baron and Kenny, 1986).

The effects of the control variables and constructs on problematic IT use are summarized in Table 5. As can be seen, gender, IT experience and education had no statistically significant effects on problematic IT use. In contrast, problematic IT use was found to decrease with age. Problematic IT use was also lower in cases of individuals who were working in the service, ICT, manufacturing and non-profit industries.

Hypothesis	Effect	Result
H1: IT insecurity → Problematic IT use	0.519***	Supported
H2: Fear of missing out → Problematic IT use	0.343***	Supported
H3a: IT use autonomy → IT insecurity	−0.040	Not supported
H3b: IT use autonomy → Fear of missing out	0.120*	Supported
H4a: Involvement facilitation → IT insecurity	0.399***	Supported
H4b: Involvement facilitation → Fear of missing out	0.376***	Supported

Note(s): ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Table 4.
Results of the hypothesis testing

Control variable or construct	Effect
Gender (0 = male, 1 = female)	−0.038
Age (years)	−0.102**
IT experience (years)	−0.044
Education	
Undergraduate degree	0.052
Postgraduate degree	−0.011
Industry	
Services	−0.122**
Education	−0.058
ICT	−0.079*
Healthcare	−0.050
Retail and wholesale	−0.047
Construction and real estate	−0.003
Manufacturing	−0.072*
Non-profit	−0.066*
Work IT use	0.033
Work mental load	0.030

Note(s): $^{**}p < 0.01$, $^{*}p < 0.05$

Table 5. Effects of the control variables on problematic IT use

5. Discussion

This paper develops a theoretical base for understanding problematic IT use in organizations. Specifically, we explain the proximal and distal antecedents of problematic IT use in organizations. We describe below the study's implications for theory and practice.

5.1 Theoretical contributions

Our study makes three theoretical contributions. The first contribution is in theorizing and validating antecedents of problematic IT use in organizations. Prior research in non-work contexts has examined the problematic use of the Internet (e.g. Teo *et al.*, 2017), social networking sites such as Facebook (e.g. Ryan *et al.*, 2014) and mobile phones (e.g. Billieux *et al.*, 2008). Literature in the work contexts reveals two insights. First, it shows that fear of missing out can be an important antecedent factor of problematic IT use. Although the study by Rozgonjuk *et al.* (2020) did not focus on the use of work-related IT, it shows that problematic use of non-work social media applications due to the fear of missing out on personal social updates can negatively affect work-related productivity (Rozgonjuk *et al.*, 2020). Second, the literature underscores the relevance of problematic IT use in modern workplaces by highlighting its positive associations with the frequency of disruptive IT interruptions that can reduce work-related productivity (Duke and Montag, 2017). Beyond that, however, the phenomenon of problematic IT use in the organizational context is mainly underdeveloped in the theoretical sense. We tackle this critical research opportunity.

Second, in identifying proximal (individual) and distal (organizational) antecedents, we highlight the relationship of both individual and organizational factors to problematic IT use. The proximal antecedent factors of IT insecurity and fear of missing out reflect an individual's fear of falling behind in organizational IT use. The distal factors of IT use autonomy and involvement facilitation, on the other hand, reflect the organizational factors that encourage IT use. The two sets of factors together form a unique combination that leads to problematic IT use. The significance of this is that different types of conditions shape these two types of factors. The two individual factors relate to an individual's perceptions of IT use and are shaped by his/her response to the work environment. The two organizational factors relate to how the organization is perceived to support individuals in their use of IT. Decreasing either set of factors would decrease problematic use of IT. The theoretical novelty here is that tracing the antecedent factors to an individual (i.e. fear of falling behind) and organizational (i.e. encouraging the use of IT) factors can help anticipate problematic IT use. Such information is vital for the identification of actions that organizations can take to potentially reduce problematic IT use. Thus, we extend the current understanding of antecedents of problematic IT use from the non-work context, which focuses on mostly individual vulnerability as an antecedent of problematic IT use (e.g. Billieux *et al.*, 2015; Davis, 2001; Teo *et al.*, 2017; Yellowlees and Marks, 2007) and fear of missing out in relation to non-work and personal use of social media applications with potential spillover effects to work productivity (Rozgonjuk *et al.*, 2020).

Third, we find it noteworthy that both individuals' fear of falling behind and organizational factors that encourage the use of IT can contribute to problematic IT use in organizations. Fear of falling behind can be found (as a positive attribute) in achievement-oriented individuals (e.g. Wiegand and Geller, 2005), and organizational efforts to encourage the use of IT are a necessity for IT acceptance (e.g. Mazmanian *et al.*, 2013; Venkatesh and Bala, 2008). In these ways, these are favorable factors essential for individuals to perform well. Our study reveals the paradox that these positively hued factors may lead to problematic IT use. It provides a more nuanced view of the problematic IT use phenomenon by revealing that its proximal and distal antecedent factors may not be easily discounted or reduced because they embody favorable organizational conditions vis-à-vis the use of IT and employee performance.

5.2 Practical contributions

Our study has practical implications for both organizations and individuals. Organizations and individuals alike may find it challenging to identify problematic IT use in employees, especially when much of organizational work is facilitated via the use of IT. Despite this problem, organizational guidelines to, for example, avoid IT-related multitasking while working on work-related activities and retain at least one workday per week free of online calls may help employees to keep IT use within healthy boundaries. Such guidelines may help individuals to identify behaviors such as constant email checking and associated effects such as cumulative distractions and self-reflect to take corrective actions, including not responding to disruptive interruptions and reducing time spent using IT.

Individuals may experience IT insecurity in competitive environments and in jobs that entail substantive use of IT. Organizations can take steps to reduce it by providing clear expectations for using IT for work, both during and after office hours. This can reduce unhealthy comparisons between individuals, such as vis-à-vis late-night responses to work emails and IT use patterns that increase the frequency of interruptions that reduce attention to work. Individuals who feel insecure about their IT use should be encouraged to discuss it with their peers to get a realistic perspective of the extent to which IT should be used. If they believe it is too demanding to keep up with all the new IT that is adopted, they should bring it to the attention of their superiors for appropriate mitigation.

Fear of missing out can be a serious concern in many organizational environments. Organizations should have explicit policies regarding the work-related use of IT. They should take a stand as to whether they wish to encourage or discourage instantaneous communication and whether employees should enable notifications from work-related applications and devices for immediate responses to work-related messages. In this regard, organizations should keep an eye on the lessons learned from current policy efforts to foster the healthy use of IT in organizations [6]. Organizations should thus try to encourage individuals to find a balance in which work-related IT use aligns with work objectives and does not strengthen individuals' fear of missing out. Individuals, on the other hand, should pay careful attention to their work-related use of IT devices. They should consider how much IT use is needed to carry out their work and be mindful of excessive use. They should find ways to address their fear of missing out by reducing the amount of interrupting IT notifications they receive to minimize excess screen time and scheduling their IT use to take healthy breaks from technology.

IT use autonomy and involvement facilitation are levers that both individuals and organizations cherish. However, the relationship between IT use autonomy and fear of missing out and the relationship of involvement facilitation with IT insecurity and fear of missing out highlight the complexity of managing these organizational factors so that problematic IT use is reduced. While organizations should not dismiss either of these factors, they should be alert to their role in increasing problematic IT use. For example, as organizations are promoting IT use for work, they can also frame guidelines that may reduce unwanted comparisons between individuals that manifest as fear of falling behind in IT use. These guidelines should emphasize how effective IT use for work is not a matter of the extent of use (i.e. quantity) but the efficiency of use (i.e. quality), and that the pathways to reach the latter are often personal and incomparable.

5.3 Limitations and opportunities for future research

Certain limitations apply to our study. First, we did not include a separate construct for examining potential social desirability bias (Podsakoff *et al.*, 2003). Although there is a risk that responses can be influenced by such bias [7], we reduced its likelihood in five ways: First, we used an online panel for data collection to ensure the anonymity of the respondents. Online panels are associated with less social desirability bias because the respondent can provide personal information and opinion without disclosing any identifying information (e.g. name and address) that could be easily used to trace the responses back to them (Lowry *et al.*, 2016a); Second, we ensured that respondents could take part in the study without the involvement of their employer. This helped respondents disclose information about their use of IT for work, which they might be uncomfortable sharing if the responses could be accessed by the employer; Third, the use of an online panel helped us avert any interaction between the respondent and the researcher, which can lead to social desirability issues (Lowry *et al.*, 2016b); Fourth, we framed the survey on work-related use of IT rather than problematic IT use. This can reduce social desirability because the respondent is more likely to reflect on his/her IT use more accurately when the focus of the study (i.e. on problematic IT use) is not disclosed (Nederhof, 1985); Fifth, we randomized the order of the survey items. This can reduce social desirability by decreasing the respondent's exposure to consecutively presented sensitive questions that he/she might feel pressured to respond in a socially acceptable manner (Nederhof, 1985; Podsakoff *et al.*, 2003).

Second, we addressed problematic IT use with a self-reported survey. Alternative research designs, such as observations and experiments, could be utilized to measure actual IT use. Third, we acknowledge a concern that the use of online panels can reduce researchers' control over the data collection process (Lowry *et al.*, 2016a). However, we ensured our control over critical steps of data collection by following recommended methodological steps (e.g. Stich *et al.*, 2019), such as – including attention check questions in the survey; administrating the structure, layout and the content of the survey ourselves and providing the survey panel firm with detailed instructions on pre-screening criteria and data collection procedures (e.g. the panel ensured that all respondents were working in either part- or full-time positions before inviting them to take the survey).

The findings of the study can be extended in a number of ways. As a starting point to investigate the problematic use of IT in organizations, we considered two proximal and two distal antecedents. Future research can consider additional factors in the organizational IT use environment, such as fear of failure (Andreassen *et al.*, 2013) or interpersonal aspects of IT use that include fear of rejection and need for approval (e.g. Vaghefi *et al.*, 2017). Second, the examination of causal configurations (e.g. via Qualitative Comparative Analysis (QCA)) that lead to problematic IT use is another interesting area of future research. Third, future research could examine problematic use of specific workplace IT applications for social networking, such as the use of Twitter or Yammer for work purposes. Fourth, studies can examine the downstream implications of problematic IT use in organizations, such as organizational commitment and use continuance. Fifth, we encourage researchers to identify mitigating interventions for problematic IT use.

5.4 Conclusions

To conclude, this study shows how problematic IT use can be explained by the interplay of proximal factors related to the individual and distal factors related to the organization. As contemporary workplaces increasingly face the threat of maladaptive IT use-related phenomena such as problematic IT use, researchers and practitioners need to consider the associated complexities. We hope this paper is a timely attempt to foster progress in this direction.

Notes

1. In addition to "excessive" use, problematic IT use can also refer to "prohibited" use and "risky" use (Billieux *et al.*, 2015; Turel and Qahri-Saremi, 2016; Yellowlees and Marks, 2007). Prohibited use describes inappropriate IT use that violates company policy (Pitichat, 2013). Risky use describes dangerous and potentially illegal IT use, such as texting while driving (Schwebel *et al.*, 2006). Each kind is a distinctive phenomenon and is expected to have different antecedents, outcomes and theoretical framings; thus, each should be studied separately (Yellowlees and Marks, 2007; Thatcher *et al.*, 2008). We study problematic use as "excessive" use.

2. Researchers have commonly drawn from pathological IT use scales to measure problematic IT use (Kuss *et al.*, 2014). This is due to the understanding that problematic IT use can manifest in the same way as pathological IT use, that is, in the form of excessive IT use and associated symptoms (Caplan, 2002; Elhai *et al.*, 2017; Kuss *et al.*, 2014; Weinstein and Lejoyeux, 2010).

3. https://www.surveygizmo.com/surveygizmos-panel-services/

4. The incomplete data were due to the answer option, "No response". This option was included for each survey statement to identify and minimize potential non-attitude reporting (Krosnick *et al.*, 2012).

5. In terms of the control variables, the standardized loadings of the indicators measuring work IT use (WITU) construct all met the 0.707 threshold: WITU1: I use this IT to support my work activities (0.823***); WITU2 I use this IT in my work (0.916***); WITU3 I use this IT to accomplish my work tasks (0.876***). In addition, the standardized loadings of the indicators measuring the work mental load construct all either met or were very close to the 0.707 threshold: WOML1: My job requires a great deal of attention and concentration from me to do my work (0.758***); WOML2: My job requires a lot of precision (0.716***); WOML3: My job requires continual thought (0.641***).

6. One such example is the "right to disconnect from email" initiative in France: https://www.theguardian.com/money/2016/dec/31/french-workers-win-legal-right-to-avoid-checking-work-email-out-of-hours

7. Social desirability bias was not addressed in any of the problematic IT use studies that we reviewed (Articles described in Appendix 1). One of the reviewed studies by Kim and Davis (2009) addressed optimistic bias. It is described as an individual's perception that negative events are unlikely to occur to them. This was not an issue in the study.

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Appendix 1

Overview of key literature

The literature review was conducted as follows. First, we aimed to identify studies on problematic IT use from major IS journals. Specifically, we searched for the AIS basket of eight journals (including Management Information Systems Quarterly (MISQ), Information Systems Research (ISR), Journal of Management Information Systems (JMIS), Journal of the Association for Information Systems (JAIS), European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Journal of Information Technology (JIT) and Strategic Journal of Information Systems (JSIS)) by going through the title and the abstract of each issue, tracing back from the latest issues in 2019 until 1995. We chose not to search within older issues, as we did not identify references tracing to before 1995. Thus, it was unlikely that further articles would surface for problematic IT use. Second, we extended our literature review to a keyword search in relevant databases (such as Google Scholar and IEEE Xplore). The search did not initially indicate relevant articles in the context of organizational use of IT. Therefore, we further extended the review with "excessive IT use" as derived from the theoretical definition of problematic IT use. This enabled us to identify literature that is relevant for problematic IT use. This step also pointed out many research articles on IT addiction, which were excluded from the review (see section 2.1). We identified only one article that was related to the context of organizational IT use. We finally analyzed each article in detail by capturing (1) the focal technology focus, (2) the potential antecedent factors, (3) the type of antecedent factors in terms of proximal and distal perspectives, (4) the outcomes and (5) the context. The overview of the key literature is presented in Table A1.

Table A1. Literature review of problematic IT use

Article	Technology	Type	Antecedents (+positively associated, – negatively associated)	Proximal and distal factors		Outcomes	Context	
				Proximal	Distal		Non-work	Organizational
Anderson *et al.* (2017)	Internet	Review of 29 articles	Individual, contextual and activity-related factors	–	–	Problematic IT use symptoms	–	–
Bianchi and Phillips (2005)	Mobile	Empirical	Extraversion (+), low self-esteem (+)	–	–	Problematic mobile use symptoms	X	
Billieux *et al.* (2008)	Mobile	Empirical	Urgency (+)	–	–	Problematic IT use symptoms	X	
Billieux *et al.* (2015)	Mobile	Theoretical	Low self-esteem (+), anxiety (+)	–	–	Problematic IT use symptoms	–	–
Buckner *et al.* (2012)	Internet	Empirical	Conscientiousness (–)	–	–	Excessive IT use		X
Caplan (2003)	Internet	Theoretical and empirical	Preference for online social interaction (+)	–	–	Cognitive and behavioural symptoms	X	
Davis *et al.* (2002)	Internet	Empirical	Procrastination (+), impulsivity (+), social rejection (+)	–	–	Problematic IT use symptoms	X	
Elhai *et al.* (2017)	Mobile	Review of 23 articles	Depression severity most common determinant	–	–	Problematic IT use symptoms	–	–
Elhai *et al.* (2020)	Mobile	Empirical	Fear of missing out (+), Process use (+)	–	–	Problematic IT use symptoms	X	
Han *et al.* (2017)	Internet	Empirical	Network-related maladaptive cognition (+)	X	–	Problematic IT use symptoms	X	
Hussain *et al.* (2017)	Mobile	Empirical	Conscientiousness (+), emotional stability (+), age (+)	–	–	Problematic IT use symptoms	X	
Kim and Davis (2009)	Internet	Empirical	Low self-esteem (+), anxiety (+), 7-positive activities (+)	–	–	Problematic IT use symptoms	X	
Lee *et al.* (2012)	Facebook	Empirical	Deficient self-regulation (+)	–	–	Generalized problematic Internet use symptoms	X	

(continued)

Article	Technology	Type	Antecedents (+positively associated, – negatively associated)	Proximal and distal factors: Proximal	Distal	Outcomes	Context: Non-work	Organizational
Li *et al.* (2010)	Internet	Empirical	Temperamental effortful control (+), sensation seeking (ns), maladaptive cognitions (+)	X	X	Problematic IT use symptoms	X	
Marino *et al.* (2018)	Facebook	Review of 56 articles	Self-esteem (–), personality factors and gender	–	–	Problematic Facebook use	–	–
Rozgonjuk *et al.* (2019b)	Mobile	Empirical	Social smartphone use (+), non-social smartphone use (+), intolerance of uncertainty (via mediation)	–	–	Problematic smartphone use	X	
Rozgonjuk *et al.* (2020)	Social media	Empirical	Fear of missing out (+)	–	–	Problematic social media use	X	X
Shi *et al.* (2011)	Internet	Empirical	Internet self-efficacy (+), sensation seeking (+), need for cognition (–)	–	–	Problematic Internet use symptoms	X	
Spada (2014)	Internet	Review	Genetic, personality and individual differences common determinants	–	–	Problematic IT use symptoms	–	–
Teo *et al.* (2017)	Internet	Empirical	Maladaptive cognitions (+)	X	X	Problematic IT use symptoms	X	
Thatcher *et al.* (2008)	Internet	Empirical	Interactive features (+), online procrastination (+)	–	–	Problematic IT use symptoms	X[a]	
Turel and Qahri-Saremi (2016)	Facebook	Empirical	Cognitive-emotional preoccupation (+), cognitive-behavioural control (–)	–	–	Problematic Facebook use	X	
Weinstein and Lejoyeux (2010)	Internet	Review	Low self-control, sensation seeking	–	–	Problematic IT use symptoms	X	
Wolniewicz *et al.* (2018)	Smartphone	Empirical	Fear of missing out (+), fear of evaluation (+), negative affect (+)	–	–	Problematic smartphone use	X	
Yellowlees and Marks (2007)	Internet	Review	History of impulse control (+), psychopathological disorders (+)	–	–	Problematic IT use symptoms	–	–
Zhang *et al.* (2015)	Internet	Theoretical and empirical	Effortful control (–), sensation seeking (+), anger/frustration (+), maladaptive cognitions mediating	X	X	Problematic IT use symptoms	X	

Note(s): [a]Non-work-related Internet use in organizations

Table A1.

Appendix 2
Indicator descriptions

Table A2. Constructs and indicators of the study

Construct and indicator description	Mean	SD	Loading
Problematic IT use (PITU)			
"Excessive degree of IT use that creates psychological, social and behavioral difficulties in a person's life" (Beard and Wolf, 2001; Andreassen *et al.*, 2013; Weinstein and Lejoyeux, 2010)			
PITU1 I have made unsuccessful attempts to reduce excessive time spent using my work IT	2.88	1.23	0.682***
PITU2 Others complain about my excessive work IT use	2.30	1.33	0.824***
PITU3 I often fail to get enough sleep because of my excessive work IT use	2.26	1.38	0.869***
IT insecurity (ITIS)			
"The extent to which an individual feels threatened about losing his or her job to other people with a better understanding of new IT" (Tarafdar *et al.*, 2007)			
ITIS1 I feel a constant threat to my job security due to new IT.	2.20	1.31	0.827***
ITIS2 I have to constantly update my skills to avoid being replaced	2.79	1.32	0.720***
ITIS3 I am threatened by coworkers with newer IT skills	2.22	1.29	0.869***
ITIS4 I do not share my knowledge with my coworkers for the fear of being replaced	2.10	1.28	0.828***
ITIS5 I feel there is less sharing of knowledge among coworkers for coworkers for the fear of being replaced	2.38	1.33	0.788***
Fear of missing out (FOMO)			
"Perception that an individual has of being at risk of missing out on important work-related information if they do not use IT enough" (Rutherford, 2001; Andreassen *et al.*, 2012)			
FOMO1 I get anxious when I do not know what people are up to online	2.40	1.32	0.842***
FOMO2 sometimes, I wonder if I spend too much time keeping up with what is going on online	2.83	1.30	0.710***
FOMO3 I keep checking my work IT in order to know what is happening online	2.93	1.32	0.704***
IT use autonomy (ITUA)			
"The degree of control the individual has over the content, timing, location, and performance of IT use for work" (Wallace, 1995)			
ITUA1 I feel in complete control over how I use IT at work	3.58	1.15	0.779***
ITUA2 how I use IT at work is completely up to me	3.31	1.26	0.923***
ITUA3 there is nothing that prevents me from using IT at work the way I want	3.23	1.26	0.844***
Involvement facilitation (INFA)			
"Organizational factors that encourage employees to use and experiment with new IT" (Ragu-Nathan *et al.*, 2008)			
INFA1 Our employees are encouraged to try out new IT	3.74	1.10	0.679***
INFA2 Our employees are rewarded for using new IT	3.11	1.27	0.817***
INFA3 Our employees are consulted before the introduction of new IT	3.26	1.33	0.715***

Note(s): ***$p < 0.001$

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