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A META-ANALYSIS OF THE NEGATIVE OUTCOMES OF ICT USE AT WORK, INCORPORATING THE ROLE OF JOB AUTONOMY

Hadi Karimikia
Maynooth university, hadikarimikia@gmail.com

Harminder Singh
Auckland University of Technology, hsingh@aut.ac.nz

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Research paper

Hadi Karimikia, Maynooth University, Maynooth, Ireland, hadi.karimikia@mu.ie
Harminder Singh, Auckland University of Technology, Auckland, New Zealand, harminder.singh@aut.ac.nz

Abstract

Individuals can improve their task performance by using information and communications technology (ICT). However, individuals who use ICT may also suffer from negative outcomes, such as burnout and anxiety, which lead to poorer performance and well-being. While researchers have studied the positive outcomes of ICT use in the aggregate, the same has not been done for negative outcomes. This study uses a meta-analysis to examine the relationship between ICT use and negative outcomes, and the influence of job autonomy, or the level of discretion an individual has in conducting his/her job, on ICT use and the negative outcomes of ICT use. Job autonomy is relevant because a higher level of job autonomy allows individuals to decide how, how often, and when they will use ICT for their work. Doing so will enable them to realize the positive and negative impacts of the different technologies and thus, choose the ones that lead to the optimal level of trade-offs for themselves. The results of the meta-analysis revealed that autonomy and job control were positively associated with ICT use and diminished the negative impacts of ICT use.

Keywords: ICT, job stress, strain, burnout, job autonomy, meta-analysis
1 Introduction

Organizations use information and communications technology (ICT) to improve their handling of information. Doing so enhances their ability to manage customers, processes, knowledge, and performance, and makes organizations more effective (Mithas, Ramasubbu, & Sambamurthy, 2011; Ray, Muhanna & Barney, 2005; Tanriverdi, 2005). In addition to examining the positive outcomes of ICT use, researchers have also studied the negative outcomes when individuals interact with ICT. Examples include: i) the use of rich media by individual employees to work remotely also increases the stress they face from interruptions, making them less productive (Fonner & Roloff, 2012); ii) the use of electronic communication media by geographically distributed employees helps them to communicate asynchronously, but the lack of face-to-face interaction can make interaction difficult (Kock, Lynn, Dow, & Akgün, 2006); and iii) the use of technology to customize the production of services or to address service deficiencies may not enthuse some customers, who may prefer face-to-face interaction (Bitner, Brown, & Meuter, 2000).

While, such negative consequences of ICT use have been widely studied among individuals (Robey & Boudreau, 1999), the existing literature represents discrepant results of the negative impact of ICT use on employees’ work experiences. For example, ICT use is related to stress (Lee, Chang, Lin, & Cheng, 2014; Nam 2013), the demands, including response and learning expectations or job role overload, that ICT places on employees lead to strain, stress and burnout (Day, Paquet, Scott, & Hambley, 2012). In contrast with these findings, however, some researchers have found that the use of ICT may not result in such negative job outcomes, e.g., exhaustion, distress, or stress (Chesley 2005; Kraan et al., 2014; Sardeshmukh et al., 2012). This paper proposes that our understanding of ICT use in organizations will be well-complemented by research focusing on individual-level experiences and outcomes. Thus, the overarching goal of the paper is to summarize and integrate research on the negative work-related outcomes that employees experience when using ICT at their jobs.

The second goal of this paper draws from the phenomenon of employee discretion. The tension between the benefits and impositions of ICT use has led to employees directing their own work through attempts to make work related decisions and regain freedom in how they do their jobs (Avgar et al., 2010). Being able to decide how your job is done is referred to as “job autonomy” (Hackman & Oldman, 1976), and this paper argues that job autonomy can ameliorate the negative impacts of ICT use. Although the role of job autonomy and its related terms, such as job control, have occasionally appeared in some studies as a moderator, mediator, or predictor of ICT use and job negative outcomes, the concept tends to be included in an ancillary, as opposed to focal, role. High job control negatively buffers the relationship between high job demands and strain (Karasek, 1979), and may reduce the impact of job stressors (Jones & Fletcher, 1996). A higher level of job autonomy allows individuals to decide how, how often, and when they will use ICT for their work. However, the empirical literature does not reflect the role of job autonomy in predicting ICT use and negative job outcomes simultaneously, and there is little integration across the literature on ICT use, job negative outcomes, and job autonomy. The focal role of job autonomy will encourage employees to experiment with different technologies and to use them in different aspects of their work. In some cases, they may decide to forego the standard technologies used in their workplace and use alternatives. Trying out different technologies will enable them to realize the positive and negative impacts of each tool and thus, choose the ones that lead to the optimal level of trade-offs for themselves. Therefore, having the levels of control and autonomy over various aspects of jobs may allow employees to exert more influence over potentially stress-provoking areas of their workplace (Day, Scott, & Kevin Kelloway, 2010).

The research questions this paper asks are: 1) what is the overall impact of ICT use on employees’ negative job outcomes? and 2) what is the overall impact of job autonomy on ICT use and negative outcomes? To answer these two questions, we carry out a meta-analysis of the literature on the negative outcomes of ICT use and adoption and examine the role of job autonomy. The study has two contributions. First, the study summarizes research on the range of negative outcomes experienced by individuals when they use ICT in a work context, enabling us to assess the state of research in this field.
Second, it evaluates how job autonomy interacts with ICT use and negative outcomes relevant to employees. The next section introduces the transactional theory of stress (Lazarus & Folkman 1984), and the paper continues by using this theory to frame the prior literature on the negative effects of ICT use on individuals. We then describe the meta-analysis methodology and after presenting the results, the paper concludes with a discussion of their implications and suggestions for future research.

2 Theoretical Conceptualization

ICT has begun to influence a wider range of jobs, going beyond the automation of manual and routine tasks to complementing non-routine and analytical tasks (Autor, Levy, & Murnane, 2003). The increasing virtualization of organizational processes (Overby, 2008) has meant that members of occupations that had previously seen themselves as being immune from being replaced by computerization, such as public administration, teaching, and legal and accounting services, are less certain of that now (Hecker, 1999; Hecker, 2005; Messersmith, Garrett, Davis-Kean, Malanchuk, & Eccles, 2008). In such an environment, the negative impacts of ICT use are being felt more frequently by an increasing number of individuals (Day et al., 2010). These effects are broadly centered on the increased level of stress felt by ICT users. In this section, we begin by providing an overview of the transactional theory of stress, a widely-used framework for understanding stress.

2.1 Transactional Theory of Stress

The transactional theory of stress is a well-known framework for understanding job stress (Lazarus, 2006). Stress is viewed as a complex cognitive, affective, physiological, and behavioral process in response to stimuli that are perceived to be threatening or harmful (Lazarus, 1990; Lazarus, 2006). This theory implies that stress is not directly created by environmental conditions, but instead depends on how an individual perceives and interprets threatening or challenging situations, and determines how to respond to those situations. The potentially harmful stimuli are called “stressors” (Jex & Yankelevich, 2008) and the response of individuals to these stimuli in the literature is termed “strain”, “distress”, and “work exhaustion”. Examples of stressors are workload, interpersonal conflict, lack of personal control, and organizational constraints. The transactional theory of stress has been widely used to conceptualize negative job outcomes perceived by employees, such as work stress, strain, distress, and work exhaustion (Crawford, Lepine, & rich, 2010; Boswell al., 2004; Elliot, Chartrand, & Hakins, 1994; Fox & Stallworth, 2010; Webster, Beehr, & Love, 2011). Individuals react differently to stressful events, because of their unique motives and beliefs (Lazarus & Folkman 1984, 1987; Lazarus, 1990). Jex and Yankelevich (2008) state that stressors are positively associated with employee strain, and more specifically with maladaptive psychological, physical, and behavioral responses in employees. The psychological strain variables that have been frequently investigated are distress and work exhaustion (Boswell, Olson-Buchanan, & LePine, 2004). Distress is the result of a negative perception of the demand placed on a person and occurs if the levels of stress exceed the person’s physical and psychological capacity (Selye, 1964; Selye, 1987). Psychological distress describes moods and emotions that occur intentionally, and have no specific referents (Bagozzi, 1999; Frijda, 1986). Psychological distress encompasses evaluative components, (e.g. “good-bad” and “like-dislike”), the presence of symptoms associated with depression, such as sadness, restlessness, and nervousness (Beaudry & Pinsonneault, 2010; Chesley, 2005), or emotional states experienced by individuals, such as boredom, fatigue, and anxiety (Carayon-Sainfort, 1992; Day et al., 2012; Eastin, Glynn, & Griffiths, 2007). Work exhaustion or job burnout is defined as the physical, emotional, and mental exhaustion characterized by physical depletion, feelings of helplessness and hopelessness, emotional drain, and the development of negative selfconcept and attitudes toward work, life, and people (Pines & Aronson, 1981). Burnout is caused by long-term involvement in demanding situations (Kilpatrick, 1989; Leiter & Maslach, 2003; Leiter & Schaufeli, 1996; Lu, Barriball, Zhang, & While, 2012; Moore, 2000a, 2000b; Zhang, Wang, Wu, Zhu, Bu, You, Liu, Zheng, Fang, Lu, lv, Ma, & Wanget, 2014).
A key underlying cause of work stress for employees is a changing work environment (Jex & Yankelevich, 2008). Work environments have changed in numerous ways over the past decades since information and communication technology (ICT) emerged; for example, the boundaries of employees’ roles (Day et al., 2012) have shifted, as well as the flexibility in how they do their work (O’Driscoll, Brough, Timms, & Sawang, 2010). Employees have been exposed more frequently to new ways of accomplishing tasks, making it likely that they will experience one or more of these: changes in their workload, increased time pressure, physical and psychological conflicts, or heightened uncertainty beyond their capabilities (O’Driscoll et al., 2010; Thomee, Harenstam, & Hagberg, 2012). Drawing upon transactional theory, Day et al. (2010) argue that the extent to which the new work conditions that ICT imposes are perceived as taxing and exceeding employees’ resources will determine how intensely employees view ICT as being negative and harmful. Therefore, it is likely that the use of ICT and the related physical and psychological efforts employees expend on tackling ICT-caused changes will lead to negative job outcomes, such as strain or stress. Thus, this meta-analysis uses transactional theory to examine the effects of technology use on employees’ experiences of negative job outcomes.

2.2 Negative Work-Related Outcomes of Technology Use

Information technology is ubiquitous in organizations today, and used in various functions and processes (Cooper & Zmud, 1990; Morris, Venkatesh, & Ackerman, 2005; Saga & Zmud, 1993). In addition to examining the positive outcomes of ICT use, a large number of studies have revealed that ICT use in the workplace can have negative impacts on employees. ICT use reinforces the impression among employees that they need to work harder and faster, contributing to a perception that they are overloaded with work (Chesley, 2010; Tarafdar et al., 2011). In such a situation, employees may find it difficult to recognize the useful aspects of technology, which, in turn, results in them experiencing stress. For example, frequently checking email at work causes employees to experience stress (Kushlev & Dunn, 2015). Employees who use laptops or mobile devices to carry out work-related activities usually report work-related stress (Goldfinch, Gauld, & Baldwin, 2011; Nam, 2013). IS research on the negative effects of the technology use has also paid attention to psychological distress and strain. For example, Beaudry and Pinsonneault (2010) considered the array of emotions, such as anger, anxiety, excitement, and happiness, that employees experience in response to ICT artefacts. Strain describes how much employees feel overwhelmed by the use of ICT at work (Chesley, 2014). Examples of psychological strain include user error, user frustration and aversive stress reactions (Coyle & Gould, 2002, Konradt, Christopfersen, & Schaeffer-Kuelz, 2006; Otter & Johnson, 2000). Stress, strain, and distress can be created by work overload, role ambiguity, and role conflict (Goldfinch et al., 2011; Tarafdar et al., 2014; Tarafdar et al., 2015). Employees feel overloaded at work when their job demands exceed their limits (Leiter et al., 2003) and have to do too much in too little time with too few resources (Moore & Love, 2005). Technologies have been found to increase work overload; for example, email systems can distract employees from their work because they are afraid of missing important information that they would be accountable for if they do not respond to emails or check for them frequently (Barley, Meyerson, & Grodal, 2011). Role ambiguity and role conflict can also create stress, and may be the result of adoption of technology. For example, the adoption of sales force automation technologies (SFA) may increase the ambiguity of employees’ roles, making them more complicated (Rangarajan, Jones, & Chin, 2005). Role conflict occurs when employees have to decide between using their time to learn a new ICT system and carrying out their routine duties. Technology alters employees’ normal tasks, and if something wrong occurs, it is difficult for them to undo and return to essentially the same conditions in the original tasks to make a new decision. Role ambiguity depends on the extent to which employees increase the effort they spend learning how to integrate technology into their routine tasks, and how to confront the uncertainties associated with the process of learning technology (Day et al., 2012; Zigurs & Buckland, 1998). Work overload, role ambiguity, and role conflict are also related to employee burnout or work exhaustion (Leiter & Maslach, 2003, 2009; Leiter & Schaufeli, 1996; Moore, 2000a). Work exhaustion, both emotional and physical, has been studied in several occupations, such as physicians, technologists, social service workers, and teachers (Kilpatrick, 1989; Leiter & Maslach, 2003; Leiter & Schaufeli, 1996; Lu et al., 2012; Moore, 2000a; Zhang et al., 2014). The intensive use of technology has also been found to
be positively related to burnout, in the form of exhaustion, reduced personal accomplishment, and de-personalization (Schaufeli, Keijsers, & Miranda, 1995). Schaufeli et al. (1995) found that nurses working at intensive care units (ICUs) where technology was used more intensively were more likely to experience burnout symptoms.

### 2.3 Managing the Negative Outcomes of ICT Use

While the use of technology has been found to be positively linked to increases in employees’ distress, strain, and stress, this effect can be ameliorated if employees receive freedom to decide the best ways to match the new ICT to their routine tasks (Beaudry & Pinsonneault, 2010; Day et al., 2010; Konradt, Christophersen, & Schaeffer-Kuelz, 2006; Messersmith, 2007; Nam, 2013; Sauter, Gottlieb, Jones, Dodson, & Rohrer, 1983). Strain or stress can be managed by enhancing the extent to which employees have a great deal of discretion, job control, and autonomy in making job-related decisions to get their work done. Jex & Yankelevich (2008) assert that job-related discretion are influential in reducing negative job outcomes. Drawing on various models proposed in the literature, such as the job demand-control model (Karasek, 1979), the effort-reward model (Siegrist, 1996), and job demands-resources model (Bakker & Demerouti, 2007), job control (e.g., skill discretion and decision latitude) and job resources (e.g., autonomy) are the most important resources that reduce the impact of stress creators on employees’ negative job outcomes (e.g., strain). Autonomy, job control, and job-related decision making can be used as facilitators to encourage employees to engage in using technologies and to buffer the relationship between technology use and negative job outcomes (Day et al. 2010; Day et al. 2012).

#### 2.4 Autonomy

Autonomy is “the degree to which the job provides substantial freedom, interdependence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out” (pg. 258, Hackman & Oldham, 1976). Other terms related to autonomy include job control (Day et al., 2012) and decision latitude (Korunka & Vitouch, 1999), which refers to the breadth of possibilities of decisions regarding action steps, the content of goals and plans, and time frames (Zapf, 1993), and empowerment, which refers to sharing power or giving more responsibility and autonomy to subordinates (Kirkman & Rosen, 1999). A lack of autonomy affects employees’ job attitudes and causes them to experience work overload and burnout (Lee, Song, Cho, Lee, & Daly, 2003; Maslach & Jackson, 1981; Moore, 2000b; Pines & Aronson, 1983).

Most researchers have reported that a lack of job control are positively associated with technology use (Ahuja & Thatcher, 2005; Kraan et al., 2014; Sardeshmukh, Sharma, & Golden, 2012). For example, professionals who perceive no control over the conditions, processes, procedures, or contents of their work are less keen to use electronic medical records (EMR) (Walter & Lopez, 2008). Conversely, employees whose managers or work environments support autonomy are more confident about continuing to use the Internet or computers than employees who work within environments that are more controlling (Roca & Gagné, 2008). Much research has concluded that a lack of autonomy is problematic for employees experiencing work stress when adopting new software or dealing with current ICT systems. At the same time, employees with greater autonomy may have lower levels of work stress: they may find it easier to set aside time to learn the features of newly-adopted applications or new technology upgrades, or be able to use ICT-based flexible work options (Day et al., 2012; Esmaeilzadeh & Sambasivan, 2012; Kraan et al., 2014; Sambasivan, Esmaeilzadeh, Kumar, & Nezakati, 2012). Research on autonomy has also shown that negative job outcomes that results from technology use are mitigated when employees have freedom in their work-time schedule, access to adequate resources, and control over work-related tasks (Ahuja & Thatcher, 2005; Chesley, 2014; Salanova, Llorens, & Cifre, 2013). Autonomy has also been found to reduce the negative impacts of technology use on employees, such as work exhaustion, work overload, psychological distress, role ambiguity, role conflict, and psychological strain (Ahuja & Thatcher, 2005; Day et al., 2012; Kraan et al., 2014; McKnight, Phillips, & Hardgrave, 2009; Shen & Gallivan, 2004). Kraan et al. (2014) view perceived autonomy as a standardization mechanism, which can modify and control the effects of computer use on employees’ work stress. Higher
autonomy enables employees to arrange a more proportionate division of work, use less coercive methods, and organize tasks to ameliorate the negative effects of computer use. Autonomy also supports learning about technology, encourages a healthy environment, and undermines work stress when new features are introduced. When ICT professionals are provided with autonomy, they carry out their work independently, resulting in a lower incidence of work exhaustion (Ahuja et al. 2007). Likewise, autonomy interacts with the level of work overload, so that employees with greater autonomy do not feel overburdened in having to find novel ways to use ICT (Ahuja & Thatcher, 2005).

2.5 Summary

ICT use has been linked to a range of negative outcomes in a variety of work contexts, as discussed above. The growing prevalence of ICT indicates that these negative outcomes will be experienced by more individuals over time. The increased incidence of such negative outcomes may dampen the potential advantages that organizations may gain from their ICT investments. It is thus worth assessing the overall strength of this effect using a meta-analytic assessment. Therefore, the goals of this study are to provide a meta-analytic review of the negative outcomes of ICT use and to examine the impact of job autonomy on the ICT use and negative job outcomes. Doing so will bring together two different streams of research on ICT use in the workplace. Examining the overall progress that has been made in this field would also help to suggest directions for future study.

3 Methodology

A set of meta-analyses were utilized to synthesize the findings from prior research on the negative outcomes that individuals experience when using technology at work. Meta-analysis is a quantitative approach for aggregating findings from individual studies that study similar research questions (Hunter & Schmidt, 2004). Compared to a narrative review of a field, the advantage of meta-analysis is to reconcile conflicting results across studies to understand the strength of the variables’ underlying relations and causalities (Hunter & Schmidt, 2004). Meta-analysis has been used by information systems scholars to review topics as diverse as ICT-business strategic alignment (Gerow, Grover, Thatcher, & Roth, 2014), ICT turnover intentions (Joseph, Ng, Koh, & Ang, 2007), ICT innovation adoption (Lee & Xia, 2006), IS implementation success (Sharma & Yetton, 2003), and firm-level ICT payoff (Kohli & Devaraj, 2003). By combining results across studies, meta-analysis also “rescues” data-sets that would normally not be considered for analysis because they had a small sample size or insignificant results that did not warrant publication in a journal (Rosenthal & DiMatteo, 2001). Meta-analysis is useful because it helps overcome methodological issues, such as sampling error and poor reliability of measures, which may have dampened the relationship between the variables being studied. This meta-analysis followed Hunter and Schmidt’s (1990) recommendations and the study was conducted in line with these steps: 1) Identifying and selecting relevant studies, 2) Coding variables from the samples, and 3) Performing the statistical meta-analysis.

3.1 Literature Search

Our goal was to identify empirical studies on the impacts of technology use on negative job outcomes, including stress creators (role ambiguity, role conflict, and workload), burnout (exhaustion, depersonalization, and reduced personal accomplishment), psychological distress, and strain. We also searched for studies on ICT use and negative job outcomes to find out how job autonomy (including its related terms) influenced either ICT use or work-related negative job outcomes, as well as the relationship between ICT use and negative job outcomes. Following established practice in prior meta-analytical studies (Dulebohn, Bommer, Liden, Brouer, & Ferris, 2011; Jackson et al., 1985; Podsakoff, Podsakoff, Mackenzie, Maynes, & Spoolma, 2014), the literature search process began by searching electronic databases, such as ScienceDirect, JSTOR, Scopus, Web of Science, Springer Link, EBSCO Host, ACM Digital Library, IEEE Explore, Google Scholar, and Emerald. This was done from March 2015 to March 2016. The keywords used to search for “ICT use” were: information technology use, information and communication technology use, and information technology adoption, while the keywords used for
negative outcomes were: role ambiguity, role conflict, workload, exhaustion, depersonalization, reduced personal accomplishment, psychological distress, stress, and strain. For job autonomy, these search terms were used: autonomy, decision latitude, discretion, job control, and empowerment. These search procedures yielded a total of approximately 208 relevant studies.

3.2 Study Selection

To make our review robust, certain criteria were used to exclude irrelevant studies from the initial pool. First, studies that used non-employee respondents were also excluded, as this study focuses on ICT use at work. Second, qualitative and conceptual studies were dropped from the pool. Third, studies that examined the negative impact of ICT use but did not measure ICT use specifically (such as Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008; Tarafdar et al., 2007; Tarafdar et al., 2011) were excluded. Studies were included in the meta-analysis if their data collection instrument had at least one item that measured the extent of technology use. Fourth, studies that only focused on physical discomfort, such as the quantity of sleep (such as Lanaj, Johnson, & Barnes, 2014) or the state of an individual’s physical health (such as Mino, Shigemi, Tsuda, Yasuda, & Bebbington, 1999), were omitted. Finally, studies were included in the meta-analysis only if they reported their sample size, the reliability or composite reliability indices, and correlation coefficients, and included a correlation matrix. In addition, attempts were made to overcome the “file drawer problem” by sending a request for unpublished manuscripts on this topic to IS World, a popular mailing list for IS academics. Two studies were received after making that request, but they were not relevant to this study as they were not quantitative studies. The final sample consisted of 55 journal papers and two conference papers.

3.3 Coding Variables

A meta-analysis was conducted using the formulae developed by Hunter et al., (1982) for a total of 12 constructs: seven negative job outcomes (Table 2), three autonomy-related constructs (Table 3 & 4), and two constructs for ICT use. The two constructs for ICT use were: overall ICT use and specific ICT use. “Overall ICT use” incorporates studies that did not specifically name the type of ICT that was used (Ahuja & Thatcher, 2005; Ayyagari, Grover, & Purvis, 2011; Beam, Kim & Voakes, 2003; Chesley, 2014; Compeau & Higgins, 1995; Fuglseth & Sorebo, 2014; Schaufeli et al., 1995). “Specific ICT use” was used to classify studies which indicated the use of a particular ICT, such as “computer”, “email”, “mobile phone” (devices that receive or transmit voice calls and text messages only), “internet”, “smartphone” (internet-connected devices with high-resolution touch screens), “Electronic Data Processing” (EDP), and “Video Display Terminal” (VDT). To clarify the role of autonomy, we searched the sample of studies for papers that also investigated the role of autonomy. Among the 55 studies in the sample, we identified 141 relationships between the use of various technologies and negative job outcomes, and 46 relationships where autonomy affected the level of technology use among employees. Within these 46 relationships, autonomy’s role differed: it acted as a moderating, mediating, independent, or control variable. Before analyzing the data, we excluded variables that were studied only once, and were thus understudied and did not fit the criteria for running a meta-analysis (Joseph et al., 2007), such as discretion and empowerment. One variable, EDP use, was found only in one study but it was retained because data had been collected from three samples in the same study (Korunka & Vitouch, 1999). For each study, the following information was collected: sample size, the reliability of constructs (as reported using Cronbach’s alpha) and correlation(r) or standardized regression coefficient (β) for each pair of relationships. The variety of terms related to negative job outcomes, such as strain, distress, and work exhaustion, are conceptualized in the literature as individual responses to stressful situations; given that, stress is regarded in this study as a complex rubric rather than a simple variable (Lazarus et al., 1985). Therefore, stress refers to the operation of many variables which reveal processes of how individuals cognitively, affectively, and behaviorally respond to ICT-caused changes. Job autonomy is also similarly considered to be a rubric variable that encompasses the operation of job control and decision latitude (Hackman & Oldham, 1976). In this study, ICT use is studied as both overall ICT use and specific ICT use, autonomy as employees’ own efforts, initiatives, and decisions towards ICT use, and
stress as any individual responses to stressful situations caused by ICT use. Therefore, work stress is composed of seven negative job constructs, and the autonomy-related constructs are autonomy, job control and decision latitude.

3.4 Analyzing Data

To analyze the data, we used the Comprehensive Meta-Analysis software (Borenstein et al., 2009). A corrected population correlation $\rho$ was estimated for each pair of relationships, based on the reported correlation coefficients $r$ or standardized regression coefficients $\beta$ and sample size. Following Hunter and Schmidt (2004), we corrected correlations for sample error and for measurement error. First, we used the index of reliability of independent and dependent variables to compute the artefact multiplier ($A$) for each study: $A = \sqrt{r_{xx} \sqrt{r_{yy}}}$, where $r_{xx}$ represents the reliability coefficient for the independent variable, and $r_{yy}$ represents the reliability coefficient for the dependent variable. Second, according to Hunter and Schmidt (2004), the corrected observed correlation for measurement error ($r_c$) can be calculated by: $r_c = r/A$, where $r$ is the correlation between the independent and dependent variables reported in studies and obtained from the strength of the relationship between each pair of independent and dependent variables, $A$ represents the artifact multiplier, and $i$ refers to different studies. Third, we calculate the sample size weights that take into account both sample sizes ($N$) and artifact multipliers ($A$) across studies: $W_i = N_i A_i^2$, where $N$ is the sample size of each study, $i$ demonstrates the different studies, and $A$ is the artifact multiplier for each study. Finally, we determined the population estimate corrected ($\rho$), computing the corrected observed correlation ($r_c$) and weighted sample size ($W$) to account for sampling error and measurement error for each pair of variables. The formula for $\rho$ is: $\rho = \frac{\sum W_i r_c}{\sum W_i}$, where $W$ is the weighted sample size of each study, $i$ refers to the different studies and $r_c$ is the corrected observed correlation for measurement error for each study.

4 Results

The results of the meta-analyses are presented on Tables 1, 2, 3, and 4. All tables report the sample size, the number of studies, population correlation ($\rho$), the 95% lower and upper confidence intervals and p-value. Table 1 demonstrates the impact of overall ICT use on work stress and the effect of autonomy on both ICT use and work stress. Using Cohen’s (1992) guidelines on effect size intervals, the meta-analysis results supported a significant relationship between ICT use and work stress as well as between autonomy and ICT use and work stress. The average magnitude of the correlations of ICT use and work stress reflected a small effect size ($\rho = 0.07$). The relationships between autonomy and ICT use yielded a positive small size ($\rho = 0.12$) and the relationships between autonomy and work stress showed a negative effect size ($\rho = -0.02$).

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>N</th>
<th>K</th>
<th>$\rho$</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT Use</td>
<td>Work Stress</td>
<td>35337</td>
<td>34</td>
<td>0.07***</td>
<td>0.031 0.103</td>
<td>0.000</td>
</tr>
<tr>
<td>Autonomy</td>
<td>ICT Use</td>
<td>28188</td>
<td>19</td>
<td>0.12***</td>
<td>0.093 0.225</td>
<td>0.000</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Work Stress</td>
<td>24189</td>
<td>10</td>
<td>-0.02***</td>
<td>-0.083 0.038</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*K is the number of samples for which reliability estimates were available; N is the total number of respondents across the K samples. p<0.05*, p<0.01**, p<0.001***

Table 1. Overall ICT Use, Autonomy, and Stress
4.1 Overall Technology Use and Different Negative Job Outcomes

Table 2 shows the relationships between ICT use and distinct negative job outcomes. The variable “ICT use” was created by grouping studies on specific technologies with studies that did not mention any particular technology, such as studies on “ICT use” or “ICT systems use”. The results indicate that ICT use is significantly correlated with stress ($\rho = 0.20$, $p$-value $= 0.000$), workload ($\rho = 0.15$, $p$-value $= 0.000$), and role conflict ($\rho = -0.50$, $p$-value $= 0.000$). However, although the relationship between ICT use and stress and workload is positive, the relationship between ICT use and role conflict is negative. For other negative job outcomes, the meta-analysis showed that the effects were ambiguous, as the confidence intervals for each of them included zero.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>N</th>
<th>K</th>
<th>$\rho$</th>
<th>95% Confidence Interval</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT Use</td>
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<td>0.106 0.291</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Strain</td>
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<td>-0.03</td>
<td>-0.093 0.148</td>
<td>0.652</td>
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<tr>
<td></td>
<td>Distress</td>
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<td>12</td>
<td>0.11</td>
<td>-0.007 0.234</td>
<td>0.065</td>
</tr>
<tr>
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<td>Burnout</td>
<td>2011</td>
<td>7</td>
<td>0.14</td>
<td>-0.126 0.390</td>
<td>0.298</td>
</tr>
<tr>
<td></td>
<td>Workload</td>
<td>7276</td>
<td>15</td>
<td>0.15***</td>
<td>0.076 0.215</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Role Ambiguity</td>
<td>2544</td>
<td>5</td>
<td>-0.14</td>
<td>-0.442 0.195</td>
<td>0.418</td>
</tr>
<tr>
<td></td>
<td>Role Conflict</td>
<td>1639</td>
<td>3</td>
<td>-0.50***</td>
<td>-0.568 -0.434</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 2. Overall Technology Use and Negative Job Outcomes

4.2 Different Types of Technology Use and Negative Job Outcomes

Except for the relationship between EDP use and stress, and VDT use and distress, all of the technologies had a positive effect on negative job outcomes. However, only the use of email, internet, VDT, and smartphones were significantly related to negative job outcomes. The meta-analysis results indicated that the average magnitude of the correlations of computer use showed a small effect size across studies with stress, psychological distress and workload, and did not support a significant relationship between computer use and stress, psychological distress, and workload. Email use was found to have a highly significant relationship with stress ($p$-value $= 0.000$), and yielded a small effect size with stress ($\rho = 0.28$). Also, email use had a significant relationship with distress ($p$-value $= 0.009$) and workload ($p$-value $= 0.012$), and reflected a small effect size with distress ($\rho = 0.10$) and workload ($\rho = 0.28$). The relationships between internet use and both independent variables, stress and strain, were significant ($p=0.008$ and $p=0.001$), with a small effect size ($\rho = 0.26$ and $p=0.18$), respectively. Smartphone use was strongly related to stress ($p$-value $= 0.000$), with a large effect size ($\rho = 0.87$), while its relationship with burnout ($\rho = 0.42$, $p$-value $= 0.003$) and workload ($\rho = 0.36$, $p$-value $= 0.009$) was significant and had a medium effect size. Analyzing the effect of relationships that different IS systems have on negative job outcomes, only VDT use yielded a significant relationship with workload ($p$-value $= 0.006$), and reflected a medium effect size ($\rho = 0.38$).
4.3 Autonomy

Table 3 depicts the effect of autonomy-related constructs on ICT use. Overall, autonomy and job control are positively related to ICT use, whereas decision latitude is negatively associated with ICT use. However, while autonomy’s effect on ICT use was positive but significant ($\rho=0.22$, p-value=0.00), the link between job control and ICT use was small and not significant ($\rho=0.07$, p-value=0.637). In contrast to these two constructs, the relationship between decision latitude and ICT use was negative and significant ($\rho=-0.23$, p-value=0.035).

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>N</th>
<th>K</th>
<th>$\rho$</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Control</td>
<td>ICT Use</td>
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<td>1</td>
<td>0.07</td>
<td>-0.222</td>
<td>0.354</td>
</tr>
<tr>
<td>Autonomy</td>
<td>22717</td>
<td>5</td>
<td>$0.22^{***}$</td>
<td>0.137</td>
<td>0.305</td>
<td>0.000</td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>608</td>
<td>1</td>
<td>$-0.23^{**}$</td>
<td>-0.426</td>
<td>-0.017</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Table 3. Autonomy and Technology Use

Table 4 shows that the different autonomy-related constructs were negatively related to all of the undesirable job outcomes, except for the weak positive relationships between decision latitude and stress ($\rho=0.27$), and autonomy and workload ($\rho=0.05$). Autonomy was significantly related to all negative job outcomes, except workload: stress ($\rho=-0.04$), strain ($\rho=-0.20$), distress ($\rho=-0.21$), exhaustion ($\rho=-0.37$), and role ambiguity ($\rho=-0.31$). Apart from an insignificant relationship with workload, job control was significantly related to all negative job outcomes and had a medium effect on strain ($\rho=-0.37$), distress ($\rho=-0.49$), exhaustion ($\rho=-0.36$), and role ambiguity ($\rho=-0.40$).

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>N</th>
<th>K</th>
<th>$\rho$</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.207</td>
<td>0.333</td>
</tr>
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<td>-0.058</td>
<td>0.022</td>
<td>0.000</td>
</tr>
<tr>
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<td>$-0.37^{***}$</td>
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<td>-0.232</td>
</tr>
<tr>
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<td>2242</td>
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<td>$-0.20^{***}$</td>
<td>-0.174</td>
<td>-0.066</td>
<td>0.000</td>
</tr>
<tr>
<td>Job Control</td>
<td>Distress</td>
<td>244</td>
<td>1</td>
<td>$-0.49^{***}$</td>
<td>-0.597</td>
<td>-0.367</td>
</tr>
<tr>
<td>Autonomy</td>
<td>2242</td>
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<td>$-0.21^{***}$</td>
<td>-0.262</td>
<td>-0.157</td>
<td>0.000</td>
</tr>
<tr>
<td>Job Control</td>
<td>Exhaustion</td>
<td>244</td>
<td>1</td>
<td>$-0.36^{***}$</td>
<td>-0.484</td>
<td>-0.221</td>
</tr>
<tr>
<td>Autonomy</td>
<td>417</td>
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<td>$-0.37^{***}$</td>
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<tr>
<td>Job Control</td>
<td>Workload</td>
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<td>-0.12</td>
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<td>Job Control</td>
<td>Role Ambiguity</td>
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<td>-0.265</td>
</tr>
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<td>Autonomy</td>
<td>1072</td>
<td>1</td>
<td>$-0.31^{***}$</td>
<td>0.369</td>
<td>-0.249</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 4. Autonomy and Negative Job Outcomes
5 Discussion

This paper clarifies the effect of ICT use on employees and the negative challenges and experiences they deal with by incorporating the power of multiple primary empirical studies via a meta-analysis. Also, this study provides an insight into the multi-functionality role of job autonomy in which job autonomy appears as a motivator to further increase the use of ICT and an inhibitor to ameliorate the negative impacts of ICT use. Our findings show the extent to which technology use has a negative impact on employees, the different consequences that may occur, and how autonomy influences the occurrence of these effects. The results are discussed in the following sections in detail.

5.1 Impact of ICT use on work stress and the role of autonomy

This study shows that using ICT creates work stress and supports those streams of studies which have discussed that the ICT use is related to negative job outcomes, such as strain, distress, or work exhaustion (Day, Paquet, Scott, & Hambley, 2012; Lee, Chang, Lin, & Cheng, 2014; Nam 2013). When the results are aggregated across all of the different technologies used by employees, the results of the meta-analysis indicate that ICT use was significantly correlated with stress, workload, and role conflict. In terms of the specific types of ICT, our meta-analysis found that “computer use”, “e-mail use”, “Internet use”, and “smartphone use” were related to negative job outcomes, but that “mobile phone use” was not.

5.2 Autonomy

One of our study objectives was to measure the effects of autonomy on how employees would use technology. Our meta-analysis supported previous studies that found a positive relationship between autonomy and ICT use (Chesley, 2014; Wang, Liu, Feng, & Wang, 2014). Autonomy and job control are positively associated with ICT use, and negatively correlated with stress, strain, distress, work exhaustion and role ambiguity. This indicates that autonomy and job control, which provide employees with more required resources or flexible work schedules, encourage individuals to use their ICT to the extent that they consider appropriate, after taking into account its potential negative impacts. This result contrasts fascinatingly with decision latitude, which is negatively correlated with ICT use and positively correlated with stress. This may indicate that employees who have freedom in decision-making may somehow be constrained by the presence of systems, which may enforce work routines different from what they prefer, leading to stress.

6 Implications and future research

Researchers have studied the negative effects of ICT use on employees (Tarafdar et al., 2007; Thomée, Dellve, Harenstam, & Hagberg, 2010; Thomée et al., 2012), and how these effects reduce employees outcomes, such as technology-enabled behavioral performance and innovation (Tarafdar et al., 2014, 2015). By meta-analyzing the findings from 57 studies, our research has shed further light on the impact of ICT on negative job outcomes (such as strain, psychological distress and work exhaustion) and stress creators (such as work overload, role ambiguity and role conflict). Before offering implications and potential avenues for future research, we present the limitations of our research.
First, this meta-analytic study relied on the statistical results of many other studies to arrive at its findings. It is thus dependent on the quality of the prior studies. While we carried out the precautionary practices recommended for meta-analyses to avoid any possible biases, it is worth keeping in mind this intrinsic inadequacy of the meta-analytic method. Similarly, we did not include the results of case studies because of the requirements of meta-analysis. Second, when selecting the sample, we did not specify any time period between the use of ICT and the occurrence of negative outcomes. The reason was that very few studies reported the time lag between the use of an ICT and when the negative outcomes were assessed. While some outcomes, such as an increased workload and exhaustion, may appear quickly after the introduction of an ICT, others, such as stress and burnout, may only manifest themselves after a certain time period. Thus, it is possible that the specific pattern of negative outcomes found in each study would have been affected by the gap between the use of the ICT and the measurement of negative outcomes. Third, the changing nature of ICT, reflected in the variety of technologies studied (from VDTs to smartphones), reflects how ICT use has expanded from workplaces to family and other non-work contexts. While the study has aggregated results from studies over the past three decades, individuals are using technology more intensively and frequently now than in the past, and this may make it difficult to identify the source of the negative outcomes. For example, are negative outcomes more closely related to the use of ICT for managing family and personal activities, or for work routines? The general quickening in the pace of work and non-work life (Sonnentag, 2005) and the blurring of work-life boundaries (O’Driscoll et al., 2010) makes it difficult to disentangle the role of ICT use in exacerbating negative outcomes, such as stress and burnout.

We divide our implications into two domains: individual and organizational. At the individual level, the results of our research indicate a need for further research into possible individual-level moderators to examine how effect sizes vary with attributes of particular samples. This list of attributes should include work roles, since individual users are known to hold negative views of an ICT when the technology makes it difficult for them to perform their duties (Beaudry and Pinsonneault, 2005). This make it likely that the level of ICT-related negative outcomes may be related to the salience of an individual’s role as an ICT user, and the consistency between that role and the individual’s work role. When individuals for whom both roles are equally important encounter situations where there is no response consistent with either role, they may experience stress, which harms their performance (Piszczek, Pichler, Turel and Greenhaus, 2016). Conversely, since ICT use is related to self-esteem (Gonzales and Hancock, 2011) and social self-concept (Gil-Or, Levi-Belz, and Turel, 2015; Jackson, von Eye, Fitzgerald, Zhao, and Witt, 2010), situations which point to clear responses may increase individual users’ perception of themselves and reduce negative outcomes. Thus, the relationships identified in our study may be more likely in certain contexts than others. As the digitization of work processes increases (Overby, 2008), understanding the match between an individual’s work and ICT user roles becomes crucial for managing the level of negative outcomes they experience. Future researchers could also examine how these relationships differed when users participated in the implementation of an ICT, as that experience has been found to make them more satisfied with their ICT (Carayon & Karsh, 2000). Notions of organizational justice (Colquitt, Conlon, Wesson, Porter, & Ng, 2001) and equity (Joshi, 1991) could be applied to better understand the link between participation and the manifestation of negative outcomes from ICT use.

Our study proposed that autonomy would act as an inhibitor to neutralize the negative side effects of technology. Research on ICT use, the negative outcomes of ICT use, and autonomy indicates that further investigation in this domain is necessary to extricate the competing effects of ICT. For example, ICT may make individual users more autonomous while also increasing their workload and their dependence on the technology (Carayon & Karsh, 2000). This combination of consequences is potentially exacerbated if we view individual users as social actors, who draw on resources, such as relationships in professional and social networks, to overcome negative outcomes when they are encountered (Lamb & Kling, 2003). The increased autonomy brought about by ICT implies a decrease in the need to interact with others while performing one’s job duties, weakening the existence of such networks and their role as organizational ballast. Future researchers could draw on the job demand-control (Karasek, 1979), the effort-reward (Siegrist, 1996), and the job demands-resources models (Bakker & Demerouti, 2007) to
examine the relationship between ICT use, autonomy, and negative job outcomes. This point to a further direction for research: integrating the positive and negative outcomes of ICT use to examine how they complement or offset the motivation to continue using an ICT. Researchers could investigate whether user satisfaction and perceived usefulness can co-exist with stress, increased workload, and role conflict. If so, how do individuals reconcile these opposing outcomes? Are there any common predictors for these outcomes? The findings of this study and future research in this area will be useful for designers of ICT systems. Designers will receive guidance as to how they can design systems not just to achieve the desired outcomes, but also avoid the undesirable ones (O’Driscoll et al., 2010). At the organizational level, our findings motivate the need for more empirical research on the tension between individual and organizational responses to the deployment of new technologies. The results of this study point to the prevalence of negative outcomes from ICT use among individuals. Since outcomes such as increased workload may predict the extent to which individuals resist new systems (Laumer, Meier & Weitzel, 2016), future researchers should pay greater attention to the role of individual users in impeding the potential value that can accrue to organizations from the implementation of new systems. Such research can draw on studies of ICT use and system success (e.g. Sabherwal, Jeyaraj & Chowa, 2006), which link use-related and system-related constructs to system success, and extend the nomological network to include negative outcomes of ICT use. One critical aspect would be to examine the accumulative impact of individually-felt negative outcomes. Marakas and Hornik (1996) view resistance as a means through which users express their disquiet with a potentially flawed system. Given that the enactment of ICT use by interdependent individuals can be conceptually aggregated into collective system use (Burton-Jones & Gallivan, 2007), can the negative outcomes of individual ICT be summed in the same way, perhaps as “collective resistance”? This involves examining the conceptual nature of collective ICT-related negative outcomes: is it global, shared or configurational, following the multilevel language of Kozlowski & Klein (2000)? Another avenue of research could be whether ICT-related negative outcomes form part of the switching costs from existing systems, which have been found to increase user resistance (Kim & Kankanhalli, 2009; Polites & Karahanna, 2012). This is particularly relevant as organizations are beginning to use digital technologies to dramatically reshape their business strategies in terms of the scope, scale, speed, and sources of business value creation (Bharadwaj, el Sawy, Pavlou, & Venkatraman, 2013).

7 Conclusion

This meta-analytic study supports the link between technology usage and negative job outcomes. As the technologies used in organizations have changed from VDTs to smartphones, these negative effects have occurred in parallel with improvements in work outcomes. Job autonomy may possibly be able to mitigate the negative impacts of ICT use, but more research is needed to investigate the relationship. The study’s results point to the need to develop a more integrated nomological network of the outcomes of ICT use, incorporating both negative and positive outcomes, across both individual and organizational levels. This will contribute towards our collective understanding of the impact of ICT in organizations.

References


