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The digital workplace and its dark side: An integrative review

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ABSTRACT

An intensification of digital working driven by Covid-19 has brought into sharp focus both the beneficial nature of digital workplace technologies and their potential dark side. Research has burgeoned in this area in recent years, but an integrated view across fields, technologies, dark side effects and outcomes is lacking. There are potential insights to be gained from compiling and comparing results and theoretical approaches. Following integrative review procedures, 194 studies were analysed to understand unintended negative consequences of a range of workplace technologies across disciplines and methodologies. The results demonstrate that considerable insight has been uncovered regarding certain dark side effects, stress in particular, in relation to e-mail and smartphones. However, a broader view of how they might manifest in relation to employees' holistic digital experience of work beyond certain information and communication technologies (ICTs) is lacking, including a clear picture of objective demands of the technology with which these effects are associated. Much remains to be understood across the full range of dark side effects in relation to the digital workplace including the associations between them and how they relate to cognitive and affective outcomes. The importance of both theoretical rigour and diversity is highlighted.

1. Introduction

In 2020, the onset of a global pandemic made digital working an essential way of working for large swathes of knowledge workers in what has been referred to as 'the world's largest work-from-home experiment' (Banjo et al. 2020). A gradual shift to remote working for organisations that has already spanned decades was suddenly accelerated as digital technologies became the primary way for large numbers of workers to remain productive and connected (Ozimek, 2020). For many, it is a change that will not be reversed - not least because early data suggests improved productivity within certain industries and roles - with higher levels of remote working expected in the future (Bartik et al., 2020). The shift in work style appears to have been accompanied by a shift in attitudes, with entrenched resistance to remote working broken down for both managers and employees (Colley & Williamson, 2020). To a greater or lesser degree, remote working or, more likely, a hybrid model of remote and office working is here to stay. While digital working brings great benefits it is also acknowledged that it comes with an array of unintended negative consequences such as technology-related stress and anxiety which need to be understood in order for a model of digital work that is optimal to both organisations and employees to be achieved.

A well-developed stream of research testifies to the benefits of the workplace technologies that have enabled the shift to digital working: messaging tools, intranets, enterprise social networks, productivity suites, self-service portals, workplace mobility and, increasingly, smart technologies such as chatbots and sentiment analysis tools (e.g. Dery et al., 2017). Improved productivity, communication and collaboration, engagement and innovation as well as reduced waste have all been found to flow from the adoption of these technologies by a range of organisations (Attaran et al., 2019). Gaining such benefits, however, is not simply a matter of 'switching on' the technology. Practitioners and researchers alike point to a range of practices that are key to their success, such as clear strategy and business case, user experience design, change management, conducive organisational culture, leadership support and end-user training (e.g. Attaran et al., 2020; Hamburg, 2019).

Success for the organisation also implies success for individual workers, immersed as they are in technology as they move through the workday: catching up on news, booking and running meetings, fulfilling

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tasks and creating knowledge artefacts. For example, a greater sense of autonomy, competency and connection can result for employees (Meske & Junglas, 2020), with greater flexibility positively impacting work-life balance (Lee and Sirgy 2019). Yet the reality for many users is one of difficulty and overwhelm, with devices and applications leading to anxiety or even phobia, overload, addiction, distraction and, ultimately sometimes, to stress, exhaustion and burnout (Stich et al., 2018; Powell, 2013; Puranik et al., 2019; Sarabandi et al., 2018). Collectively these unintended, negative consequences of workplace technology have been referred to as its 'dark side', an area that is garnering an increasing amount of investigation and which Tarafdar et al. (2015, p.161) define as 'a broad collection of 'negative' phenomena that are associated with the use of IT, and that have the potential to infringe the well-being of individuals, organisations and societies.' While acknowledgement for this broad collection of negative impacts is growing, the ways in which they are associated and play out collectively is so far less clear.

These technologies afford workers considerable power and possibilities yet also come with a range of potential untintended consequences. Indeed, the very benefits afforded by these technologies can also be important drivers of the dark side effects (Tarafdar & Stich 2018, p. 266). As a result there is a need to consider technological well-being – or its inverse 'technological ill-being' (Leclercq-Vandelannoitte, 2019) - alongside facets such as productivity and efficiency. In fact, productivity gains due to remote working may come at a high price in terms of long-term work-related stress and mental illness for employees, workplace outcomes which are already thought to cost industrialised countries between US$221.13 million and $187 billion per annum (Hassard et al., 2018).

Avoiding, or at least mitigating, technological ill-being in the digital workplace requires an understanding of workers' whole experience of digital working - from logging on in the morning from whatever location they are in, to checking e-mail, to messaging from a smartphone app, to navigating multiple applications to get work done, and so on – as well as the range of negative psychological effects that can result. Over a decade of research into phenomena such as technology-related stress and anxiety furnishes valuable insights into the digital world of work and its human impacts (Sarabandi et al., 2018; Puranik et al., 2019). However, this research has rarely considered the broad sweep of digital tools and experiences that make up the working day, along with the work processes and contexts within which they are embedded (Sellberg & Susi, 2014), focusing instead on single tools or incidents. In addition, psychological outcomes have generally been studied in isolation, despite calls to look at how they may be associated (D'Arcy et al., 2014) and for their relationships to be tested (Agogo & Hess, 2018). Yet in the digital age none of us work in a single application or device, and neither is our psychological experience of doing so one dimensional; we have a broad ranging digital experience of work which needs to be understood holistically to maximise digital well-being and other outcomes such as productivity.

This integrative review takes a step towards addressing this need. Instead of speaking to individual technologies it uses the increasingly utilised term 'digital workplace' to get at workers' holistic digital experience of work (see section 1.1). Focused as it is on the digital workplace as a whole and its potential dark side effects, this review seeks to answer the question: What are the individual-level dark side phenomena associated with use of the digital workplace? Gaining such a holistic understanding involves a consideration of the technology types and attributes that are involved, the contextual and individual factors, the array of dark side effects, as well as the factors that might mediate and mitigate such outcomes. Reviews to date have tended to focus on a particular dark side effect such as technostress (e.g. Sarabandi et al., 2018), information overload (e.g. Sobotta, 2016, pp. 858–867), or interruptions (e.g. Puranik et al., 2019) or a specific subset of technology such as electronic communication (e.g. Stich et al., 2018) or ICT (e.g. O'Driscoll et al., 2010). This review builds on this work with a holistic view across dark side effects and technologies in order to identify gaps in the literature and what is known with more or less certainty. While highlighting findings and gaps related to the dark side of digital working generally, which has a heightened focused due to Covid-19, this review does not specifically address issues related to digital working during a pandemic such as working with fear or while mourning.

Nearly fifteen years on from Tarafdar et al.'s (2007) seminal paper on technostress, we might consider ourselves at an inflection point – driven by the surge in digital working during the pandemic - both for technological well-being in organisations and its serious investigation in academia: it is timely to further both understanding and evidence relating to the dark side of the digital workplace, and what organisations and individuals should do about it. As O'Driscoll et al. (2010) point out, it is critical to do so if we are to further enhance the positive impact of the digital workplace.

1.1. The digital workplace

The term 'digital workplace' has found growing traction among the business community since the 2010s (Marsh, 2018) yet the academic literature on it remains sparse (Attaran et al., 2019). It is 'a way of describing the broad set of connected technologies that employees use on a daily basis to do their jobs' and 'an integrative concept that reaches across enterprise tools' (Marsh, 2018, p. 16). These span social, mobile, analytics, cloud technologies and the Internet of Things (Dery et al., 2017) and include, for example, 'intranet, communication tools, e-mail, CRM, ERP, HR systems, calendar and other enterprise processes or tools which assist in the general day-to-day functioning of a business (Perks, 2015) as well as extending to advanced or emerging technologies that embed elements of automation and artificial intelligence into the enterprise (Baptista et al., 2020).

However, the meaning of 'digital workplace' goes beyond simply a continually evolving set of workplace technologies to a blend of physical, cultural and digital elements in the work environment (Dery et al., 2017) that lead to fundamentally new and complex configurations of human and technology relationships at work that reshape the very nature of work practices (Baptista et al., 2020; Orlikowski, 2016; Wajcman and Rose, 2011). Just as the physical workplace is much more than a collection of desks, chairs, telephones, meeting rooms and other such artefacts, so the digital workplace is more than just the multifarious technology environment that enables work. Both imply a complex set of practices that involve elements of organisational culture, ways of working, leadership approaches, human interactions with co-workers and technology and more (e.g. Baptista et al., 2020; Coetzee, 2019; Dery et al., 2017; Köffer, 2015). In this sense, the term 'digital workplace' is in contrast to the extensively used term (in academia at least, and certainly in studies in this review) 'information and communication technologies' which delineates a set of technologies. It is perhaps instructive to note the gradual decline in the use of the term 'information and communication technologies (ICTs)' and the quite distinct rise in the term 'digital workplace' over the last decade on Google Trends (see Appendix B). For the purpose of this review, the term digital workplace is understood as the broad set of technologies and practices involved in employees' digital workplace experience irrespective of physical location; it encompasses, yet also goes beyond, traditional notions of ICTs. Further discussion of the evolution of the digital workplace is beyond the scope of this review, however White (2012) provides a detailed account.

2. Methodology

2.1. Integrative review approach

Conducting an integrative review means taking an inclusive approach to the literature relating to a particular topic while also maintaining the highest standards of rigour. The approach is inclusive of both quantitative and qualitative findings (Christmals & Gross, 2017),

empirical and theoretical publications (Evans, 2007), different types of research design (Jones-Devitt et al., 2017) and varied sampling frames (Whittemore & Knafl, 2005). Done well, it is considered comprehensive, rigorous, precise, provocative, complex and challenging (Christmals & Gross, 2017; Jones-Devitt et al., 2017; Russell 2005; Souza et al., 2010; Torraco, 2016). Guidelines for conducting integrative reviews (e.g. Cooper, 1982; Whittemore and Knafl, 2005) outline five broad stages of the review which include purpose and definition, literature search, critical evaluation, analysis and synthesis, and presentation (Christmals & Gross, 2017).

An integrative review was deemed appropriate in the current study given that, despite extensive research in relation to the use of individual or small subsets of ICTs in the workplace, the wider concept of the digital workplace is, as yet, emergent (Köffer, 2015; Marsh, 2018). In addition, there is a need to look at the dark side effects of digital working in association rather than in isolation (D'Arcy et al., 2014), which at present are scattered across multiple academic disciplines and often relate to individual technologies. An integrative review is a suitable method for synthesizing the literature relating to an emerging topic or where research emerges in different fields, in order to conceptualise it in a holistic manner (Torraco, 2005) and to help to formulate an agenda for further research (Torraco, 2016). Fig. 1 provides an overview of results identified at each stage of the literature search.

2.2. Study identification and selection

2.2.1. Data sources

Suitable literature was identified by searching relevant databases, hand-searching specific journals and bibliographic searching where relevant (Booth et al., 2016). Choices of databases and journals were guided by the multi-disciplinary nature of the research focus, which encompasses information systems, human-computer interaction, business and management, and organisational psychology. Web of Science and Scopus were the primary databases used with additional checks on more specialist sources: ACM Digital, PsychInfo, and MedLine. Google Scholar was also searched in order to identify grey literature.

In addition, citation searching was conducted for the most highly cited or relevant papers retrieved via the database searches in order to identify further studies of interest to the research focus. Computers in Human Behaviour was identified as the journal with the highest number of identified papers and therefore further hand searching was conducted on this journal, with 29 papers identified overall.

2.2.2. Keywords

Keywords were identified by reviewing an initial sample of papers (n = ~10) relevant to the key aspects of the topic: digital workplace (e.g. Köffer, 2015; Marsh, 2018) and the dark side of digital working (e.g. Pirkkalainen & Salo 2016; D'Arcy et al., 2014). Keywords included, for example, 'digital work*', 'ICT', 'e-mail', 'smartphone', 'overload', 'technostress', 'strain' and 'interrupt*'. These were combined with further keywords to denote the work context (e.g. workplace, worker). See Table A.1 for further detail on keywords used.

2.2.3. Inclusion/exclusion criteria

Given that seminal papers were published in this field in 2007 and 2008 (Ragu-Nathan et al., 2008; Tarafdar et al., 2007), it was decided to include papers from January 2007 to June 2020 (when the review was conducted) that were written in English and conducted in Western countries only. For the purposes of this study, Western countries are understood as the United States, Europe, Canada, Australia, Latin America and New Zealand (Kurth, 2004). The language and geographic exclusion criteria reflect both the intent of the study, which was not to look at cultural differences in relation to dark side effects (although certain demographic characteristics are included), as well as the finite resources of the researchers. Literature included used a range of methodologies, were from a range of disciplinary backgrounds and encompassed theoretical as well as empirical papers. Samples based on working individuals were included, encompassing both small to medium size enterprises as well as larger organisations in a range of industries and countries. University students were also included where the study in question relates to the use of relevant technologies to do academic work. Digital workplace technologies focused on communication, information and productivity were included (for example, e-mail, instant messaging, HR technology, enterprise social networking, monitoring, smartphone

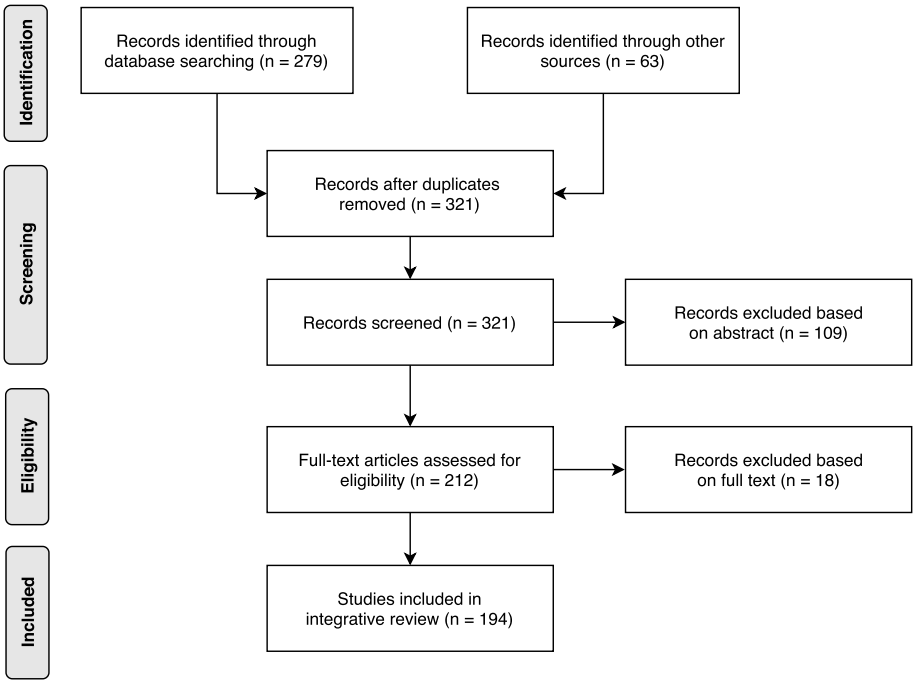

Fig. 1. Flow diagram of literature search detailing the results identified through database searching and other sources, the number of abstracts screened and full-text articles assessed for eligibility, and studies included in the integrative review.

devices). Unintended negative consequences at the level of the individual worker's experience of digital work were considered, those relating to interpersonal issues (e.g. cyberbullying) or misuse (e.g. cyberdeviancy) that are more intentional were not. Exclusion at screening and eligibility stages was typically due to papers either not relating to workplace contexts, relating to broader non-technology issues in the workplace (e.g. non-technology mediated interruptions) or being conducted in non-Western countries.

2.2.4. Review criteria

The wide range of sources included in an integrative review can make quality assessment difficult (Whittemore & Knafl, 2005). In the present study, papers were assessed for high or low relevance (n = 89 and n = 105 respectively). The theoretical foundation of included papers was also assessed based on criteria from Burgess et al. (2020), with just over a third (n = 55) of the empirical studies found to be non- or sub-theoretical (further detail is given in the results section).

3. Results and discussion

3.1. General characteristics of the studies

Out of 194 studies, 147 (75.7%) were empirical, 28 (14.4%) were reviews, and 19 (9.7%) were theoretical. Table 1 shows the methodology, method and design characteristics of the empirical studies.

113 (76.8%) of the empirical studies related specifically to workplace contexts, with the remainder conducted in student or public contexts (but related to academic or general work). Studies in the dark side literature tend to be interdisciplinary in nature due to a dual focus on workplace technology and individual psychology. Indeed, these are the dominant disciplines within this review with 56 (38.0%) of the studies located within information systems and 44 (29.9%) psychology. Table 2 shows a full breakdown of domains.

Fifty-three (36.0%) of the empirical studies were published in the time period 2007–2014, and 94 (63.9%) were published between 2015 and 2020. Fig. 2 shows the breakdown of empirical, review and theoretical papers per year for the whole period.

3.2. The technological environment and the objective demands it makes of employees

3.2.1. The technological environment

At present, our knowledge of the technological environment in which the dark side effects occur is largely restricted to either mobile devices or e-mail, or a more generalised notion of ICTs at work. 63 (42.8%) of the studies referred to ICT, IT or general technology at work,

Table 1
Frequency of study methodology, method and design of empirical studies included in review (n = 147).

Study characteristics		Number of studies (% of empirical studies)	Key findings and gaps
Methodology	Quantitative	112 (76.1%)	• Dominance of quantitative, cross-sectional, survey-based studies.
	Qualitative	21 (14.2%)	
	Mixed methods	14 (9.5%)	
Method	Survey	94 (63.9%)	• Some experimental work (principally lab).
	Interview	26 (17.6%)	
	(Quasi) experiment	20 (13.6%)	• Some in situ work (field experiments, diary and case studies).
	Diary study	10 (6.8%)	
	Case study	7 (4.7%)	• Lack of intervention studies.
	Intervention	2 (1.3%)	
Design	Cross-sectional	123 (83.6%)	
	Longitudinal	24 (16.3%)	

Table 2
Principle domains in which the empirical papers reside.

Academic domain	Number of studies (% of empirical studies)
Information systems	56 (38.0%)
Psychology	44 (29.9%)
Management or organisation studies	21 (14.2%)
Other (communication or media studies; human-computer interaction; health)	26 (17.6%)

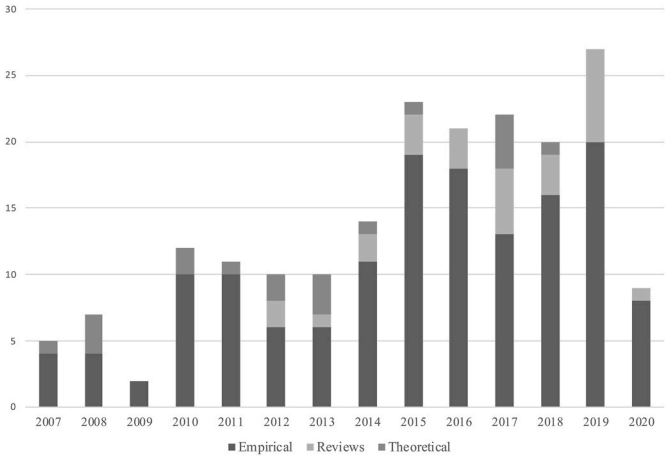

Fig. 2. Articles per year for the dark side of digital working literature from January 2007 to June 2020.

although nearly half of these further specified the technology under examination, often as mobile devices or e-mail. Overall, mobile devices and e-mail were the most studied technologies, each being the focus of 43 (29.2%) and 36 (24.4%) studies respectively. However, the range of technologies that make up the wider digital workplace have received relatively little attention in the dark side literature and this is an important gap (see Table 3).

The term ICT was used in a range of ways in the dark side literature. Sometimes in a general sense, such as IT used at work (Maier et al., 2015) or the general use of information technologies for work (Gaudioso et al., 2017). A small number of studies went into more detail. For example, Day et Day et al. (2012, p.473) specify ICT as 'any electronic device or technology that has the ability to gather, store, or send information' and Chandra et al. (2019, p.310) as 'new technologies that facilitate information flow and collaboration among employees and that incorporate all the communication networks such as enterprise systems, advanced wireless technologies, mobile communications networks, and other tools that the employees we surveyed may have used for collaboration and communication.' In other studies ICT was used to refer to a specific collection of communication tools, although the exact tools included vary. For example, laptops, cell phones, PDAs (Fenner & Renn, 2010); laptop, tablet, smartphone, e-mail, telephone, text, Skype

Table 3
The technology types considered in the dark side studies.

Technology type	Number of studies (% of empirical studies)
ICT, IT or general technology at work	63 (42.8%)
Mobile devices	43 (29.2%)
E-mail	36 (24.4%)
Computer or laptop	14 (9.5%)
Social technologies and instant messaging	13 (8.8%)
Other (e.g. e-learning, HR technology, employee performance monitoring, ERP, information security)	9 (6.1%)

(Wright et al., 2014); e-mail and smartphone (Ter Hoeven et al., 2016).

Even where a broad collection of workplace technologies was implied under the auspices of ICT, the broader human-technology 'entanglement' (Orlikowski, 2007) was rarely considered. This remained the case even when references to the technology were broader than ICT, for instance in Pfaffinger et al.'s (2020) study of the digitalisation of work, or Kluge, Hildebrandt and Ziefle's (2019) study of the digital work environment. In a novel take on technostress, Sellberg and Susi (2014) employed a Distributed Cognition perspective to take a wide-angle view of the sociotechnical environment in which technostress might occur, including the multitude of tools and interactions within the working day. Their study was something of an outlier in the literature.

3.2.2. The objective demands of the technological environment

Mitigating the dark side effects implies an understanding not only of the individual-level psychological processes that lead to stress and strain, but also the characteristics of the technological environment as a whole as well as of specific technologies that may be antecedents. While there is clear overlap to the technostressors (see section 3.3.3) the latter tend to emphasize the individual's appraisal of a technological occurrence as stressful and their inability to cope with it, rather than distinguishing between, for instance, actual and perceived overload.

Objective demands can relate to the technology environment as a whole, to specific occurrences such as the arrival of new technology and to specific characteristics of the technology such as message quantity and/or quality (see Table 4 for examples).

While the need to understand the demand stressors has received attention in some prominent studies (e.g. Ayyagari et al., 2011; Day et al., 2012; Galluch et al., 2015), it is an area that could benefit from further delineation in the literature. For example, reviewing two decades of research on computer anxiety, Powell (2013) pointed out the need to better understand the specific characteristics of technology involved. Nixon and Spector (2014) emphasize the distinction between objective environmental and perceived job stressors in their theoretical paper on the impact of technology on employee stress, health and well-being. If the demand stressors are not clearly delineated and investigated, we effectively 'throw the burden of technostress onto the users' (Sellberg & Susi, 2014, p. 200), suggesting that negative outcomes are the fault only of workers' inability to cope with technology and not also the inadequacies of the technology itself. It also obscures the levers of change by which organisational interventions might address the negative outcomes. For instance, Salanova, Llorens and Ventura (2014) highlight a range of primary, secondary and tertiary interventions that address the technological system itself (e.g. design) as well as individual employees (e.g. training, counselling) and the social system in which they operate (e.g. job redesign).

Table 4
The objective demands of digital workplace technologies (section 3.2.2) and organisational expectations (section 3.2.3) relating to them.

Objective demands in the environment	Examples
The technology environment as a whole	The ubiquity of the technology (e.g. Mountz, 2016; Salvagno et al., 2015), constant availability/connectivity (e.g. Funtasz, 2012; Wajcman and Rose, 2011), and the pace of change (Ayyagari, 2007).
Specific technological occurrences	The arrival of new technology (Chen et al., 2009; Nach & Lejeune, 2010), discrepant IT events (e.g. de Guinea, 2016) or ICT hassles (Day et al., 2010), smartphone failures (Salo et al., 2018), and work monitoring (Rafnsdottir & Gudmundsdottir, 2011).
Specific characteristics of the technology	Message quantity and/or quality (e.g. Galluch et al., 2015; Brown et al., 2014), its interruptiveness (e.g. Tams et al., 2018; Iqbal & Horvitz, 2010), its usability or lack thereof (Ayyagari, 2007); its helpfulness (Bardoel and Drago, 2016); and its unreliability (Fischer et al., 2019).
Norms or expectations around how the technology is used	Prescriptive norms around ICT use for work (Barber & Santuzzi, 2015); normative response pressure in relation to e-mail (Brown et al., 2014); work/nonwork segregation or integration norms (e.g. Gadeyne et al., 2018; Derks et al., 2014); expectations for e-mail to be monitored in non-work time (Becker et al., 2019); role of the message sender, in terms of organisational hierarchy (e.g. Stich et al., 2015).

3.2.3. Organisational norms related to the technological environment

The norms or expectations around how the technology is used, availability beyond usual work hours, as well as message response times can also act as demand stressors. Barber and Santuzzi (2015) identified that prescriptive norms around ICT use for work is one of the best predictors of workplace telepressure (i.e. the urge to respond quickly to work-related messages); while Brown, Duck and Jimmieson (2014) found that normative response pressure helped to explain emotional exhaustion in relation to e-mail, especially where messages were ambiguous. Norms around the degree to which work and nonwork should be either segmented or integrated may also act as demands (e.g. Gadeyne et al., 2018, Derks et al., 2014) – especially when considered in concert with individual segmentation preferences (see 3.5.1). This is an issue that was heightened for many who engaged in remote, digital working during the pandemic. Becker et al. (2019) additionally found that organisational expectations for e-mail to be monitored in non-work time led to anxiety as a result of attention allocation conflict. The role of the message sender, in terms of social hierarchy, can also make a difference to associated stress with performance more negatively impacted by interruptions from supervisors than peers (Waldhauser, 2019). Thus the ways in which the organisation expects employees to use digital workplace technology in both work and home contexts can contribute to whether they experience potential dark side effects. These would benefit from further consideration in the literature, for instance, how they may relate to employees' individual work styles and preferences for using the technology (see section 3.5.1.4).

3.2.4. The physical environment

It is interesting to note that, aside from studies that specifically focus on the work-nonwork interface, the majority of studies reviewed appear to implicitly assume the physical location of work is the office. With remote and hybrid modes of working increasingly common during the pandemic and the endemic period following it, there is an opportunity for researchers in this field to improve specificity about the physical location in which digital working takes place and any differential effects experienced, for example, in the home versus in an office.

3.3. The dark side effects – key characteristics and associations

Technology-related stress is the dominant area of the dark side literature with much of it taking as a theoretical foundation Lazarus and Folkman's (1985) Transactional Model of Stress and Coping (TMSC). Dark side effects were often studied in isolation from each other. End user perceptions of technostress creators were extensively explored in the literature, while research on addictive behaviours in relation to workplace technology remains relatively sparse.

3.3.1. The dark side effects and their associations

Technostress, overload, addiction and anxiety tend to be the unintended negative consequences of digital work technology use (or dark side effects) referred to (to greater or lesser extents) in existing reviews of this literature (e.g. Pirkkalainen & Salo, 2016; D'Arcy et al., 2014; Tarafdar & Stich, 2018). However, they have not been investigated in equal measure, with technostress by far the dominant area of the

literature.

In this review, 60 (40.8%) of the empirical studies investigated technology-related stress (sometimes, but not always, referred to as technostress). Overload was the focus of 20 (13.6%) studies; anxiety of 16 (10.8%) studies; interruption or distraction of 14 (9.5%) studies; and addiction or excessive use of 13 (8.8%). 16 (10.8%) studies addressed themselves to issues at the interface of work and family (e.g. work-family conflict or spillover), occasionally in relation to another dark side effect such as stress. Some studies looked directly at negative outcomes of the human-technology interaction, such as strain and burnout, rather than the specific dark side effects that may mediate them (e.g. Estévez-Mujica and Quintane, 2018).

In terms of the associations between the dark side phenomena (see Table 5), the literature is overall rather fragmented. A portion of the literature on overload purely investigated this dark side phenomenon, but it was also fairly extensively studied in relation to and as a potential contributor to stress, particularly using Tarafdar et al.'s (2007) techno-overload construct.

Interruptions formed a largely separate stream of research with only isolated studies looking at how they potentially contribute to overload (e.g. Chen & Karahanna, 2018) and stress (e.g. Akbar et al., 2019). Addiction or excessive use was also mainly studied separately from other dark side phenomena with only isolated studies looking at how it may relate to interruptions (e.g. Marulanda-Carter & Jackson, 2012) and stress (e.g. Salanova et al., 2013). Anxiety was more extensively studied in relation to the other dark side effects: as an antecedent to maladaptive technology use behaviours (e.g. Budnick et al., 2020), as a facet of stress (e.g. Salanova et al., 2013), a mediator between certain technology use scenarios and negative outcomes (e.g. Lepp et al., 2014), and as an outcome of overload and work-family conflict (e.g. Carlotto, Guilherme Welter & Jones, 2017; Micallef & Porter, 2019, pp. 594–775).

Further research on the associations between the dark side effects is needed for a clear and holistic understanding of negative psychological effects that employees may experience when working digitally. How the various effects potentially interact with each other as well as the sequential progression from one effect (e.g. addiction) to another (e.g. stress) should be considered. It is also perhaps interesting to consider technology-related stress as a unifying lens through which to pursue this more holistic understanding, given strong links between stress and overload and tentative links to other phenomena such as addiction and anxiety.

Table 5
Empirical studies on the dark side effects and associations explored in the literature.

Dark side effect	Number of studies (percentage of empirical studies)	Associations explored
Technology-related stress	60 (40.8%)	Associations with overload, interruption and distraction, addiction and excessive use, anxiety.
Overload	20 (13.6%)	As a contributor to stress and anxiety.
Anxiety	16 (10.8%)	As an antecedent to maladaptive technology use behaviours; as a facet of stress; as a mediator between technology use scenarios and negative outcomes; as an outcome of overload and work-family conflict.
Interruption and distraction	14 (9.5%)	As a contributor to overload and stress.
Addiction or excessive use	13 (8.8%)	Associations with interruptions, stress and anxiety especially Fear of Missing Out (e.g. Budnick et al., 2020).
Work-nonwork issues (especially work-family conflict)	16 (10.8%)	Associations with stress, overload and anxiety.

3.3.2. *Theoretical and methodological approaches to stress in the dark side literature*

Of the 60 studies on technology-related stress, nearly half of them (n = 28) used the Transactional Model of Stress and Coping (TMSC; Lazarus and Folkman, 1984) as the theoretical foundation, though none looked at the complete transactional process (i.e. from stressors and right through appraisals and coping), mirroring the wider stress and coping literature (Goh et al., 2010). The dominant technostress model (Tarafdar et al., 2007) is rooted in TMSC (see section 3.3.3). Further exploration of the wider transactional process has been indicated by several authors. For instance, Califf et al. (2015) and Tarafdar et al. (2017) have suggested exploring a potential eustress sub-process of technostress. In addition, the coping aspect of the TMSC has received relatively little attention to date (see section 3.5.1.7).

Other theoretical models of stress were used to a much lesser degree within the stress studies (see Table 6). A quarter of the stress papers (n = 15) were either non- or sub-theoretical; in other words, they had no theoretical foundation or theory was only mentioned in passing (Burgess et al., 2020). By comparison, the proportion of non- or sub-theoretical papers rises to nearly a half (n = 42) for the empirical papers relating to the other dark side effects (n = 87).

The Job Demands-Resources model (JD-R) was also used by a number of other studies (n = 7) that looked at dark side effects such as overload, interruptions and anxiety, as was Conservation of Resources (COR) theory in relation to overload and work-family conflict (n = 2).

Day and colleagues (Day et al., 2010; Day et al., 2012) proposed a model of technostress based primarily on the JD-R model that set out eight ICT demands (e.g. response expectations, 24/7 availability) and two ICT supports (e.g. personal assistance, resources/upgrades support). The JD-R model enables the exploration of the dual role of the digital workplace (as both a demand and a resource) in relation to dark side effects such as stress and strain (Patel et al., 2012) as well as how the digital workplace may relate to overall work stress (Wang et al., 2017). Salanova and colleagues (Salanova, 2007; Salanova et al., 2013) also use the JD-R model as the basis for their conceptualisation of how techno-strain and technoaddiction can lead to technostress in a work context.

As a theoretical lens for the dark side literature, the JD-R model appears to offer a potentially fruitful avenue for further exploration. It enables a clear delineation to be made of the demands placed by the technology while also recognising that the digital workplace acts as a resource for employees. It additionally is recognised as a suitable basis for conducting intervention studies (Tetrick & Winslow, 2015), which are currently lacking in the dark side literature.

In terms of methodological approaches, the stress literature is dominated by survey-based studies and this is mirrored in the wider dark side literature. Schellhammer et al. (2013, p.430) in their qualitative synthesis of technostress studies, highlighted that surveys and experiments are suitable for 'testing whether a particular phenomenon

Table 6
Theories used in the empirical studies on stress (n = 60).

Stress theory	Number of studies
Transactional Model of Stress and Coping (Lazarus and Folkman 1984)	28
Person-Environment Fit (e.g. Harrison 1978)	5
Job Demands-Resources (Bakker and Demerouti 2007)	4
Cybernetic Theory of Stress (Edwards 1992)	3
Job-Demand-Control Theory (Karasek 1979)	3
Conservation of Resources (Hobfoll 1989)	2
Effort-Reward Imbalance (Siegrist 1998)	1
Input-Processing-Output Theory (Rutkowski and Saunders, 2010)	1
Stressor-Strain-Outcome Model (Koeske and Koeske 1993)	1

causes stress, but neither technique is suitable for finding what influences stress in the workplace' and called for more physiological and qualitative in-situ data to get at the underlying causes of technostress within the working day. It is a call echoed by Sellberg and Susi (2014) in their cognitive ethnography of a working day with technology woven through it. La Torre et al. (2019) also call for more multi-method studies in this area. On a different note, in his systematic review of technostress, Riedl (2012) highlighted that most research in this area uses a behavioural approach and that there is considerable further opportunity to understand how technology leads to a biological stress response in the body.

3.3.3. The nature of technostress creators

A dominant model of technostress and associated measurement instrument (Technostress Creators Inventory; (Tarafdar et al., 2007; Ragu-Nathan et al., 2008) has underpinned a strong stream of research in this area and garnered considerable support and empirical evidence (Sarabandi et al., 2018; Fischer et al., 2019). This model specifies the technostress creators as: overload, invasion, complexity, uncertainty and insecurity. In the present review, the associated Technostress Creators Inventory (TCI) was employed in 22 (36.6%) of the 60 studies of technology-related stress, although only 14 (23.3%) used it in full. Among studies that used only part of the inventory, techno-overload is the most extensively studied construct (n = 8), followed by techno-invasion (n = 6), techno-complexity (n = 4), uncertainty (n = 3), and insecurity (n = 1). As Fischer et al. (2019) highlight, this variable use of the TCI dimensions may suggest the need to revisit whether the five dimensions adequately represent the technostress construct. In relation to this, although the definitions of the constructs were updated by Tarafdar et al. (2017), see Table B.1, the TCI remains unchanged since 2007, despite the rapidly shifting workplace technology environment.

Technology-related stress – or technostress – describes the point at which the objective demand stressors (see section 3.2.2) may be translated into negative outcomes via perceptual stress, though potentially to varying extents for different individuals (see section 3.5.1). Here, five themes surfaced in terms of the sources of this perceived stress for employees: overload, interruption and distraction, invasion into nonwork life, monitoring, and the pressure and pace of digital work (see Table 7).

3.3.3.1. Overload. The sense of overload for employees in relation to workplace technologies was apparent in the literature. It can result from the array of system features, the amount of information or communication as well as the level of interruptions outside of regular work hours (Karr-Wisniewski & Lu, 2010; Tams et al., 2020). Ragu-Nathan et al. (2008) described it as feeling forced to work faster or harder due to technology. Overload can involve cognitive and affective disturbances when recalling unpleasant memories of past technology use (Saunders et al., 2017) or encountering new technologies (Rutkowski & Saunders, 2010).

For the most part, to date, it has been studied in relation to e-mail and the way in which e-mail is (mis)used (e.g. Sumecki et al., 2011; Pignata et al., 2015) and associated feelings of being overwhelmed (e.g. Grevet et al., 2014). There is an opportunity to further understanding of a wider conception of overload as it relates to information and communication flowing via a variety of channels including but not restricted to e-mail (e.g. intranets, enterprise social networks) and the quantity of the applications or application features available (e.g. proliferation of tools, complex feature sets). This is captured in Karr and Lu's (2007) idea of 'technology crowding' and warrants further empirical exploration.

Overload was related to a range of job demands such as role ambiguity and conflict (Delpechitre et al., 2019) and negative outcomes such as job strains and tensions (Harris et al., 2013; Carlson et al., 2017) and work exhaustion (Chen and Karahanna 2018). Overload can also lead employees to be less likely to adopt or use the technology itself (Tams et al., 2020; Rutkowski & Saunders, 2010).

Table 7
Technostress creators identified in this review.

Technostress creators	Key findings and gaps
Overload	Much studied technostress creator with a clear link to stress but mainly in relation to e-mail only. Further research needed on the full range of ways that overload may manifest (e.g. in relation feature or application proliferation etc.).
Interruption and distraction	Linked to but distinct from overload, the interruptiveness of technology is suggested as a source of technostress, as is its distracting nature. Cognitive and affective costs to individuals of such interruptions and distractions warrants further exploration along with the best ways to deal with them in order to minimise such costs.
Invasion into non-work life	Extensive research in the work-family conflict literature evidences the stressful impact of the technology-mediated invasion of work into non-work time.
Monitoring	Linked to but distinct from invasion into non-work time, employee monitoring technology is suggested as a source of stress for employees. This area needs further research and increases in the use of such tools during the pandemic suggest some urgency around this need.
Pressure and pace of digital work	The constantly changing technology environment within organisations has been found to exert a stressful effect on employees (e.g. learning new tools, working faster). Further research may help to draw out a clearer picture of the contributing elements in the digital workplace.

3.3.3.2. Interruption and distraction. The interruptiveness of certain digital workplace technologies appears to be a stressor that is linked to, yet distinct, from overload. In their integrative review of work interruptions, Puranik, Koopman and Vough (2019) identified the cognitive, self-regulatory and affective pathways via which interruptions can lead to both performance and well-being outcomes, including stress, anxiety and exhaustion. Interruptions is a nuanced area with both positive and negative effects depending on a range of factors such as interruption relevance and task complexity (Waldhauser, 2019; Addas & Pinsonneault, 2015, 2018). However, though interruptions can at times benefit work performance there may be a price to pay in terms of work exhaustion (Chen & Karahanna, 2018) and higher perceived mental workload and stress (Tams et al., 2018); and in some cases they are also detrimental to performance, fragmenting work episodes for knowledge workers (Wajcman and Rose, 2011) and causing tasks to take longer to complete (Marulanda-Carter & Jackson, 2012). Interestingly, Akbar et al. (2019) found that e-mail interruptions can lead to the use of more anger words in messages, an indication of the emotional consequences.

There is also some acknowledgement in the literature, though more evidence is needed, of the potentially distracting nature of certain technologies and the toll this might take for end-users. Being distracted by technology can become a habitual response (Aagaard, 2015) that contributes to stress (Ortbach et al., 2013). This can vary considerably across individuals based on, for example, preference for multi-tasking (Li et al., 2011) and cognitive control (Mark et al., 2016b). It is interesting to note that simply reducing or turning off sources of distraction such as e-mail notifications may not be the answer as this can lead to users self-interrupting in order to gain awareness of information and maintain a sense of emotional equilibrium, which may lead to higher cognitive and task performance costs (Iqbal & Horvitz, 2010; Katidioti et al., 2016; Mark et al., 2015). The cognitive and affective costs of certain types of technology-mediated interruptions and distractions, the potential solutions available to individuals to deal with them in a way that minimises stress, and how both costs and solutions might vary across individuals are all areas warranting further exploration.

3.3.3.3. Invasion into nonwork life. Another important stressor relates to the conflict that arises at the boundaries between work and the rest of

life due to workplace technologies (see section 3.4.1.2). Tarafdar et al. (2007) characterise this as techno-invasion, the blurring of work-life boundaries and a sense of invasion due to constant connectivity. Extensive research elucidates this stressor including elements such as the pressure to remain connected and available outside of working hours (e.g. Leclercq-Vandelannoitte, 2019), technology-mediated interruptions into non-work time (e.g. Chen & Karahanna, 2018), and the ensuing disruption of home life due to increased reachability (e.g. Ortbach et al., 2013).

3.3.3.4. Monitoring. As well as acting as a stressor through invasion of non-work life, technology can also induce stress through its intrusion into people's working lives. This can take the form of monitoring of employees' work as well as the ways in which they use technology at work. Tarafdar et al. (2017) touch on this in their updated definition of techno-invasion in which they include monitoring as a source of privacy invasion. However, the invasion into personal life may be a distinct construct from intrusion into the daily work life due to monitoring. The latter is characterised by an invasion of privacy (Ament & Haag, 2016) and reduced autonomy (Reinke et al., 2016). Monitoring can contribute to job tension (Carlson et al., 2017), stress (Patel et al., 2012), lower perceptions of monitoring fairness (McNall & Stanton, 2011), and a poorer psychosocial work environment (Rafnsdóttir and Gudmundsdottir, 2011). In a systematic review on the effects of employee monitoring, Backhaus (2019, p.548) identified 'mild adverse effects' on job outcomes including stress and strain as a result of employee monitoring. Further research on the effects of employee monitoring is clearly indicated, especially as an increase in the use of such technologies has been reported during the Covid-19 pandemic and beyond, with potentially deleterious effects on employee well-being (Brown, 2020).

3.3.3.5. Pressure and pace of digital work. The pressure and pace of digital work is also evident as a stressor. We see this in (Tarafdar et al.'s (2007)) techno-complexity construct, which focuses on the effort required to learn and understand new technologies, and techno-uncertainty construct, which focuses on the unsettling effect of constant upgrades and changes to technology. It involves the high work pace driven by technology (e.g. Sellberg and Susi 2014), the various pressures it involves (e.g. Hoppe, 2011; Kim & Hollensbe, 2018), and the unpredictability of its demands (e.g. Ter Hoeven et al., 2016). Feelings of overwhelm and overload can arise in response to the constant pressure to adopt new technologies (e.g. (Chen et al., 2009); Nach & Lejeune, 2010; Rutkowski & Saunders, 2010). The literature may benefit from a re-conceptualisation of this area of technostress (e.g. looking across techno-complexity, techno-uncertainty and other elements) in order to understand the key aspects of the pressure and pace of digital work that lead to stress for employees.

3.3.4. Anxiety in relation to digital workplace technologies

Findings from the 16 (10.8%) studies that focused on anxiety, in one form or another, suggest that it can play several important roles in relation to the dark side effects: as antecedent, mediator and/or outcome (see Table 8). However, as with addiction, only around half of the anxiety studies were in a specific workplace context.

While most of the identified studies look at specific computer anxiety, a couple explore a more general state anxiety, finding that it may play a role in translating the effects of workplace technology and related norms into negative outcomes. State anxiety was found to mediate between cell phone use and satisfaction with life (Lepp et al., 2014) and between organisational expectations for e-mail monitoring in non-work hours and negative health impacts (Becker et al., 2019).

Computer anxiety (CA) is defined as "a feeling of being fearful or apprehensive when using or considering the use of a computer" (Leso & Peck, 1992, p. 469) and it may be more strongly related to trait than state anxiety (Beckers et al., 2008). It can also be described as "technology-induced stress" (Parayitam et al., 2010, p.347), potentially manifesting in response to an external stimulus an individual perceives as stressful, at the point where the uneasiness caused moves from subconscious tension to conscious anxiety (Saadé & Kira, 2007). CA is most often measured among the present studies using items from Heinssen et al. (1987). It has been found to be detrimental to working within the digital workplace through its relationships to less positive attitudes about the technology (Korobili et al., 2010), lower job satisfaction and higher stress (Parayitam et al., 2010), and poorer team performance (Fuller et al., 2016). At its most severe, CA might contribute to technophobia (Agogo & Hess, 2018) though this was not explored in any of the empirical studies in this review.

Table 8
Ways in which anxiety manifested in relation to digital workplace technologies.

Types of anxiety	Key findings and gaps
Generalised anxiety	General state anxiety may mediate between the technology and negative effects but further research is needed.
Computer or techno anxiety	Anxiety specifically relating to use of computers or technology more generally is found to be related to negative outcomes for individuals including stress. The levers by which such anxieties may be reduced warrants further investigation.
Information anxiety	Information overload can lead to information anxiety for some individuals, though how and for whom needs further interrogation.
Fear of missing out (FoMO)	Anxiety can also relate to separation from the technology in some form, especially where individuals' experience emotional attachment to it. Research is so far sparse in this area.

A few of the studies explore a related techno-anxiety construct (Salanova, 2007; Salanova et al., 2013) which focuses on anxiety as a facet of technostrain (alongside fatigue, scepticism and inefficacy) and is more agnostic towards technology than the CA construct (Revilla Muñoz et al., 2017). Carlotto et al. (2017) found that, in Brazilian ICT professionals, work-family and family-work conflict was predictive of techno-anxiety; while Revilla Munoz et al. (2017) found that, for high school teachers, a course to increase ICT problem resolution skills helped to reduce it. In their qualitative study, Pfaffinger et al. (2020) identified a generalised digitalisation anxiety that is most often triggered by uncertainty in relation to the process of digitalisation. Notwithstanding the intervention study by Revilla Munoz et al. (2017), the levers of change by which computer and more general techno or digitalisation anxieties may be reduced warrants further investigation.

While CA and techno-anxiety are concerned with feelings of uneasiness or apprehensiveness with regard to the technology itself, the related construct of information anxiety is concerned with the volume of information conveyed via the technology. The latter is defined by Bawden and Robinson (2009, p.6) as "a condition of stress caused by the inability to access, understand, or make use of, necessary information". Micallef and Porter (2019, pp. 594–775) identified the principle cause of information anxiety in the workplace as information overload, with certain job roles more prone to experience it. However, the extent to which information overload leads to information anxiety may depend on the level of control individuals feel that they have over the flow of information (Papić et al., 2012).

In the present literature, anxiety is generally an experience that occurs in relation to a perceived or objective overload of technology and/or information; however it is worth noting that several studies show that it can also arise in relation to separation from the technology in some form, particularly where there is a sense of emotional attachment to the technology as well as high usage of it. This is the realm of Fear of Missing Out (FoMO) and is important to include here for its potential relationship to maladaptive technology dependence and use behaviours (see section 3.3.5). For instance, FoMO and device attachment can lead to greater anxiety among smartphone users (Rosen et al., 2017). Budnick, Rogers and Barber (2020) investigated FoMO from a workplace

perspective - defining it as 'pervasive apprehension that, relative to other employees, one might miss valuable career opportunities when away or disconnected from work.' (p.1) – and finding it predictive of message checking behaviours and burnout.

Further research is needed, in the workplace domain in particular, to understand how anxiety manifests in relation to digital working as well as how it relates to various aspects of the experience such as the devices and applications, the flow of information and communication, and the level of being connected to or disconnected from the environment. Questions also remain about how it may relate to behaviours involving either avoidance and resistance of the digital workplace at one extreme, and maladaptive or excessive use at the other. There is an opportunity more widely to further understanding of how the various dark side effects, including anxiety, link to end-user behaviours in relation to the technology, and whether these are maladaptive in nature.

3.3.5. *Addictive behaviour in relation to digital workplace technologies*

Views are mixed on whether addictions to aspects of our technological world such as smartphones or the internet qualify as clinical addictions. Nevertheless, the compulsive, habit-forming nature of many technologies are causing considerable concern (HM Government, 2019) and there is a growing stream of research on, for example, problematic internet use (PIU) within the public sphere (e.g. Bisen & Deshpande, 2018).

Research into digital workplace technology addiction is at an early stage with just 13 (8.8%) of the empirical studies in this review considering facets of addictive behaviours (if not full-on addiction) such as excessive, compulsive, problematic or maladaptive use. Only half of these studies used a specific workplace context, while the remainder related to work but in an academic or broader work/life context. Some studies drew a parallel between addictive behaviours in relation to workplace technologies and workaholism (e.g. Quinones et al., 2016). Salanova, Llorens and Cifre (2013) articulated a specific 'technoaddiction' construct which they see working in a similar way to workaholism and define as 'using ICT excessively and compulsively with feelings of anxiety and fatigue' (p.13). In this view, either anxiety and resistance or addiction and over-identification in relation to technologies can lead to technostress (Salanova et al., 2014; Kakabadse et al., 2000).

Addictive behaviours were investigated in relation to a number of technologies used for work: cell phones (Duke & Montag, 2017; Roberts et al., 2015; Volkmer & Lermer, 2019; Zhitomirsky-Geffet & Blau, 2016), e-mail (Marulanda-Carter & Jackson, 2012), internet (Quinones et al., 2016), mobile social networking technology (Bata et al., 2018) and ICTs for study (Cerretani et al., 2016). In relation to e-mail, Marulanda-Carter and Jackson (2012) found that 12.2% and 15% of their participants were e-mail addicts based on clinical and behavioural characteristics, respectively. Bata et al. (2018) highlighted that a competitive psychological climate inside the organisation can intensify aspects of maladaptive technology dependence behaviours.

Qualitative studies emphasized the potential toxicity of such addictive behaviours. Leclercq-Vandelannoitte (2019) found a link between excessive use of IT and a state of ill-being, highlighting 'excessive connectivity dependence' and 'addictive behaviours and associated increased stress' (p.352). Paasonen (2015) found dependency and addiction to be major themes for students in relation to devices and applications they use for both academic work and leisure, to the extent that the author described them as 'prosthetic extensions' (p.708). Primecz et al. (2016) pointed out that employees can become addicted to the technology, blurring the boundaries between work and life to an extent that can create a 'modern slavery' (p.79). Funtasz (2012, p.1234) in a study of managers' use of Blackberries, however, concluded that the source of the addiction may be 'worker personality' rather than the device itself, likening the device to the needle rather than the heroin.

Addiction in the digital workplace is therefore indicated as a valuable area for further research including understanding how it intersects with work addiction and aspects of computer anxiety, as well as particular facets of the technological environment it relates to and how it is associated with other dark side effects, in particular stress and coping.

3.4. *The outcomes of the dark side effects*

Sarabandi, Carter and Compeau (2018) identified six major psychological and behavioural outcomes resulting from technostress in the literature: end-user and job satisfaction, organisational and continuance commitment, as well as productivity and performance. This review of the dark side literature extends this list to include nine outcomes (see Table 9). There is considerable variation in which outcomes are included in the empirical studies and how often, as well as how they are operationalised.

Six cognitive and affective outcomes were identified within this review in relation to the felt experience of stress experienced as a result of the dark side effects: strain, burnout, job satisfaction, end-user satisfaction and well-being. Four behavioural outcomes were also identified, signalling the way that employees may respond to this felt experience and the resulting impacts for the organisation: productivity, performance, organisational commitment and turnover intention. The literature would benefit from greater clarity on whether cognitive and affective and/or behavioural outcomes are being investigated and why, as well as how one may lead into the other (e.g. how strain may lead to

Table 9
The outcomes of the dark side effects.

Outcomes of dark side effects		Number of studies (% of empirical studies)	Key findings and gaps
Cognitive and affective outcomes	Strain	11 (7.4%)	• Six cognitive and affective outcomes and four behavioural outcomes identified. More consistency in operationalisation and clarity about use is needed. • Strain and burnout (especially emotional exhaustion) as key cognitive and affective outcomes that capture the felt experience of stress and other dark side effects. • More understanding needed of how momentary experiences of stress translate to strain and longer-term burnout and other outcomes. • Greater understanding needed of well-being and health outcomes as a result of dark side effects. • End-user satisfaction impacts as a result of dark side effects need further exploration especially given its effect on adoption and performance. • Clearer delineation between performance and productivity constructs (avoiding interchangeable use of these terms).
	Work-family conflict	16 (10.8%)	
	Burnout	26 (17.6%)	
	Job satisfaction	7 (4.7%)	
	End-user satisfaction	6 (4.0%)	
	Well-being	7 (4.7%)	
Behavioural outcomes	Performance	11 (7.4%)	
	Productivity	11 (7.4%)	
	Organisational commitment	7 (4.7%)	
	Turnover intention	5 (3.4%)	

burnout and any resulting impacts on performance).

Looking across these outcomes it is interesting to note the emotional impact the dark side effects can have for employees, as evidenced in the potential for negative affect that runs through the constructs of strain, burnout, satisfaction, and well-being, in particular. This aligns with the wider workplace stress literature, in which negative affect is thought to be a mediator between perceived job stressors and employees' emotional reactions to them (Nixon & Spector, 2014).

3.4.1. Cognitive and affective outcomes

Strain (of which work-family conflict might be considered a facet) and burnout are the primary ways in which the individual's felt experience of stress and other dark side effects is studied. Both imply longer term reactions and effects that follow from the perception of stress, with strain generally characterised as the individual's psychological, physiological or behavioural response to stress (Cooper et al., 2001) involving poorer cognitive functioning and affective states (Bhagat et al., 2010); and burnout as a state of exhaustion reached as a result of persistent stress and strain (Sonnentag & Frese, 2003).

3.4.1.1. Strain. Strain was considered in 11 (7.4%) of the empirical studies identified in this review, although there was considerable variation in how it was operationalised and measured across them, making it hard to compare findings. While psychological strain may be considered as a mediator between stress and outcomes (Gaudioso et al., 2017), the present set of studies included it as an outcome. Some studies focused on strain purely from a psychological stance (e.g. (Harris et al., 2013); Stich et al., 2019), while others also included physical or physiological aspects of strain (e.g. Day et al., 2012; Galluch et al., 2015). Salanova, Llorens and Cifre (2013) articulated a specific 'technostrain' construct in which individual workers 'feel a combination of high levels of anxiety, fatigue, scepticism and inefficacy related to the use of ICT' (p.2). Aspects of overload and interruptiveness (both actual and perceived) were particularly associated with strain for workplace technology users (e.g. Harris et al., 2013; Galluch et al., 2015; Stich et al., 2019; Soucek & Moser, 2010). Reinke et al. (2016) helpfully distinguished between acute and chronic experiences of strain, emphasizing the difference between a momentary experience of stress and that which is accumulated at the end of the working day, and beyond.

3.4.1.2. Work-family conflict. Work-family conflict may act as a mediator of dark side effects (see section 3.4.3) but in the assembled literature it tends to be studied more as an outcome. 16 (10.8%) of the studies described work-nonwork issues arising due to technological affordances such as hyperconnectivity (Obushenkova et al., 2018; Olund, 2016). Issues that arise at the work-nonwork interface is a major area of study in its own right (Beigi et al., 2019) and figured here as a facet or manifestation of the strain sometimes incurred in the worker–digital workplace interaction (Gaudioso et al., 2017). These studies highlighted the conflict that can occur between work and family or life more generally due to, for example, technology-enabled out of hours work (Wright et al., 2014), the prolonged hours and the inability to leave the office behind (Evenstad, 2018), employee and manager expectations to stay connected beyond the workplace (Obushenkova et al., 2018), and the intensity of smartphone use for work (Derks & Bakker, 2014). It may be fruitful to further investigate how different technological demands and dark side effects potentially relate to work-family conflict.

3.4.1.3. Burnout. Twenty-six (17.6%) of the empirical studies included burnout (or a dimension of burnout) as an outcome of technology-related stress, overload and interruptions. Eleven of these focused specifically on (Maslach and Jackson's (1981) emotional exhaustion construct, thereby getting right to the core of the burnout experience and the associated sense of feeling fatigued and over-extended (Maslach et al., 2001) as a result of the interaction with workplace technologies. Cognitive and physical (as well as emotional) aspects of burnout were considered in a few of the studies using other burnout measurements (e.g. Moore, 2000; Shirom & Melamed, 2006).

An association between technostress and burnout was clearly indicated in a number of the papers (e.g. Srivastava et al., 2015; Maier et al., 2015; Weinert et al., 2013). E-mail (e.g. quantity, quality) and associated user behaviours (e.g. overuse, misuse) were also implicated in burnout (e.g. Brown et al., 2014; Reinke & Chamorro-Premuzic, 2014; Estévez-Mujica and Quintane, 2018) as were technology-mediated interruptions (e.g. Chen & Karahanna, 2018; Ter Hoeven et al., 2016). Pressures relating to use of work-related technology in non-work time were also suggested as important predictors of burnout (e.g. Barber & Santuzzi, 2015; Derks & Bakker, 2014; Ferguson et al., 2016). Other factors leading to burnout that were indicated in this review were ICT demands (Day et al., 2012), smartphone use (Derks et al., 2014), workplace FoMO (Budnick et al., 2020), and obsession with work technology (Primecz et al., 2016). Researchers may wish to consider some of these factors in parallel to understand their relative impact on strain and burnout.

Although burnout figured prominently among the outcomes examined in the assembled literature, its ultimate manifestation in the form of psychological and health problems was little considered. Negative impacts to employee health were identified due to employees' own tendency to respond quickly to messages (Barber & Santuzzi, 2015) as well as organisational expectations to monitor e-mail (Becker et al., 2019); in the latter case, the effects can also cross-over to the health of the employee's spouse or partner. Stadin et al. (2016) also found that ICT demands were associated with lower self-rated health (although less so than job demands or effort-reward imbalance). There is clearly more to be understood about how momentary experiences of technology-related stress may translate into strain and longer-term burnout, as well as impacts on employee health.

3.4.1.4. Job and end-user satisfaction. Job and end-user satisfaction, in other words employees' positive affective states and cognitive evaluations of them (Chin & Lee, 2000; Judge et al., 2001), were included in 13 (8.8%) of the studies. Job satisfaction has been found to be negatively correlated with psychological strain (Cooper et al., 2001). It was found in 7 (4.7%) of the studies to be negatively associated with aspects of technostress and using technology to work in non-work time and resulting work-life or -family conflicts that may arise (e.g. Carlson et al., 2017; Florkowski, 2019; Wright et al., 2014) highlighted that such impacts can go beyond the worker to negatively affect their spouse's job satisfaction.

End-user satisfaction with technology, measured in 6 (4.0%) of the studies, was negatively impacted by the experience of the technostress creators, though this can be moderated by the technostress inhibitors (e.g. Tarafdar, Ragu-Nathan, & Ragu-Nathan, 2011; Chen et al., 2009; Tu et al., 2008; see section 3.5.2.1) and mindfulness (Ioannou & Papazafeiropoulou, 2017). Fuglseth and Sorebo (2014) also demonstrated how this diminished end user satisfaction in turn impacts on intentions to continue using the technology. Given that end-user satisfaction has been found to be an important factor in employees' acceptance of workplace technologies and ultimately in job performance (Wang & Zhang, 2015), this particular outcome certainly warrants further research.

3.4.1.5. Well-being. Well-being (either subjective or psychological) was not extensively studied in the literature to date, with only 7 (4.7%) of the studies looking directly at the impacts to it due to dark side effects. In terms of subjective well-being, negative affect was found to be increased where there is pressure to be available via mobile technology in non-work time (Lutz et al., 2020) and where smartphone use becomes problematic (Horwood & Anglim, 2019); and decreased where e-mail checking or phone interruptions are limited to specified times during the day (Kushlev & Dunn, 2015). In terms of psychological well-being, a

sense of mastery of one's environment and acting autonomously within different social settings were both negatively associated with maladaptive technology behaviours (Horwood & Anglim, 2019; Kushlev & Dunn, 2015; Kushlev et al., 2016); negative impacts were found for social connection and meaning in the latter two studies.

Turning the construct on its head, technological ill-being was the focus of (Leclercq-Vandelannoitte's (2019)) case study of a large automotive company, which she described as 'an expression of the tension between an individual's social attributes and aspirations when using modern IT and a system of norms, rules, and values imposing constraints on him or her.' (p.339). The study identified a lack of awareness and acknowledgement of technological ill-being as a real issue and risk within the organisation. This may help to explain the overall lack of focus on well-being within the dark side literature.

3.4.2. Behavioural outcomes

3.4.2.1. Performance and productivity. Twenty-two (14.9%) of the studies show that both performance (n = 11) and productivity (n = 11) were impacted, mostly negatively, by the dark side effects. However, no consistent definitions were used for these two terms, nor were clear distinctions made between them; they were sometimes used interchangeably. They are much debated terms more widely but, at a simple level, employee productivity generally refers to an employee's outputs relative to resource inputs, while employee performance relates to the employee behaviours involved in meeting agreed goals and standards (Bataineh, 2017; Murphy, 1990).

Lower self-assessed productivity was associated predominantly with technostress among these studies (e.g. Tarafdar et al., 2011; Tarafdar et al., 2010). Relationships were also found with technology overload and crowding (Karr & Lu, 2007; Karr-Wisniewski & Lu, 2010), smartphone use (Duke & Montag, 2017; Kushlev et al., 2016), more time spent on e-mail (Mark et al., 2016), and online multitasking (Mark et al., 2016b).

Individual performance (both related to a particular task and overall) was looked at in a number of studies in relation to technology-mediated interruptions, with a mixture of positive and negative findings. Interruptions were found to be detrimental to performance where they are incongruent or irrelevant to the current task (Addas & Pinsonneault, 2015, 2018) and where they lead to a sense of overload (Chen & Karahanna, 2018). Delpechitre, Black and Farrish (2019) found negative effects on salespeople's performance due to overload dimensions. Academic performance was found to be impacted negatively by sources of technostress (Qi, 2019) and higher use of ICT (Cerretani et al., 2016).

3.4.2.2. Organisational commitment and turnover intention. Organisational commitment was measured in 7 (4.7%) of the studies, though continuance commitment (i.e. the extent to which employees feel they need to stay with the organisation) only in one (Ragu-Nathan et al., 2008). Organisational commitment represents the employee's sense of emotional attachment to the organisation as well as being willing to put themselves out or expend effort on its behalf (Maier et al., 2015; Stich et al., 2019). The influence of the dark side effects on this construct were found to be negative overall and mediated by: work stress (Stich et al., 2019), work exhaustion (Maier et al., 2015), job tension (Carlson et al., 2017), and work-family conflict (Ferguson et al., 2016). Tarafdar et al. (2011) showed a negative association of technostress creators with organisational commitment, while Ragu-Nathan et al. (2008) found a positive association for the technostress inhibitors. This construct also had a negative impact on turnover intentions (Carlson et al., 2017; Ferguson et al., 2016). The employee intention to leave the organisation was included in 5 (3.4%) of the studies and overall found to be more likely when dark side effects of technology are experienced.

3.4.3. A note on mediation

Knowledge of the mediators that translate the dark side effects of technology into the psychological and behavioural outcomes is limited at present. Indeed, many of the studies focus on specific aspects rather than the process as a whole. There are examples in the literature of the mediating effects of work-family or work-life conflict (Gaudioso et al., 2017; Tams et al., 2020; Ferguson et al., 2016); cognitive factors such as mental workload and exhaustion, inhibitory deficits, self-regulation and mindfulness (Issa & Bahli, 2018; Tams, 2017; Tams et al., 2018; Volkmer & Lermer, 2019; Whelan et al., 2017); appraisals of stressors such as overload (Brown et al., 2014; Román et al., 2018; Chen & Karahanna, 2018); affective states such as anxiety (Becker et al., 2019); and high dependence on technology (Karr-Wisniewski & Lu, 2010).

3.5. Moderating the dark side effects

At the individual level, a range of individual differences (e.g. personality, age), personal resources (e.g. computer self-efficacy) and coping mechanisms (e.g. seeking support) have been found to moderate the relationship between the dark side effects and the psychological and behavioural outcomes (see Table 10). Personal resources include characteristics that enable coping such as optimism, self-efficacy, resilience and low neuroticism. While their importance in the organisational stress literature has been increasingly recognised, it is not always clear whether they act as mediators, moderators, or antecedents (Krohne 2002; Schaufeli & Taris, 2014, pp. 43–68). Organisational factors such as training, end-user involvement, and leadership style have also been shown to act as moderators.

3.5.1. Individual factors

3.5.1.1. Personality. The influence of personality on technostress was explored in 8 (5.4%) studies with findings suggesting differential effects for individual personality traits within the Five Factor Model (McCrae & Costa, 1987) on technology-related stress, overload and addiction. Srivastava, Chandra and Shirish (2015) found differential moderating effects for certain personality traits on the relationship between technostress and work burnout/engagement; for instance, agreeableness was found to positively moderate between technostress creators and burnout, while neuroticism was found to negatively moderate their relationship to engagement (and was strongly related to burnout). Neuroticism was also found to be associated with e-mail overload (Reinke & Chamorro-Premuzic, 2014) and shorter online focus duration (Mark et al., 2016b), to make individuals more stressed when batching e-mails (Akbar et al., 2019), and to contribute to smartphone addiction in young people (Zhitomirsky-Geffet & Blau, 2016). It was also positively correlated with computer anxiety (Powell, 2013). Conscientious individuals also suffer e-mail overload (Reinke & Chamorro-Premuzic, 2014) and may tend towards checking e-mail constantly rather than batching it (Mark et al., 2016), although in her review Waldhauser (2019) suggested they may actually be more resistant to reacting to e-mail alerts.

Reinke and Chamorro-Premuzic (2014) suggested that individuals with more positive self-evaluations are less likely to feel overloaded by e-mail, and that this construct is a better predictor of overload than individual personality traits such as neuroticism and conscientiousness. Polychronicity, or preference for multitasking, is also implicated, with those high in the trait experiencing less ICT-related overload (Saunders et al., 2017) and little impact from interruptions on satisfaction with multi-tasking or perceived task complexity (Li et al., 2011).

3.5.1.2. Age. Age is considered as a substantive variable in 11 (7.4%) of the studies. A number of them found that older workers experience less technostress, perhaps due to greater job experience (Kluge et al., 2019; Ragu-Nathan et al., 2008; Tarafdar et al., 2011; Berg-Beckhoff et al.,

Table 10
Individual and organisational moderators of the dark side effects.

Factors that moderate the dark side effects on psychological and behavioural outcomes.		Number of studies (% of empirical studies)	Key findings and gaps
Individual factors	Personality	8 (5.4%)	• Just under half of the empirical studies include individual or organisational factors that may moderate the dark side effects. • Individual differences of personality, age and gender can act as moderators. • Individual preferences for work style and technology use need further investigation, with findings so far suggesting they moderate individuals' experience of the dark side effects. • Mixed results for computer self-efficacy with further research needed, with digital literacy also suggested as a potentially fruitful area of investigation. • Early-stage research into mindfulness gives positive indications for it as a potential moderator. Much remaining to be understood about how cognitive factors may mediate and moderate dark side effects. • Coping is a distinctly underserved area in the literature. • Positive indications for proactive organisational actions provide support and foster digital literacy and innovation, but further research needed. • Opportunities to explore aspects of organisational climate and leadership as well as job autonomy as potential moderators.
	Age	11 (7.4%)	
	Gender	8 (5.4%)	
	Work and technology preferences	10 (6.8%)	
	Computer self-efficacy	7 (4.7%)	
	Mindfulness and other cognitive factors	8 (5.4%)	
	Coping	5 (3.4%)	
Organisational factors	Technoinhibitors (literacy facilitation, technical support provision, involvement facilitation, innovation support; Ragu-Nathan et al., 2008, Tarafdar et al., 2011)	9 (6.1%)	
	Organisational climate and leadership	5 (3.4%)	
	Job autonomy	2 (1.3%)	

2017). However, older workers may struggle more with technological complexity (Marchiori et al., 2019), find interruptions more stressful (Tams 2017; Tams et al., 2018), and perceive organisational social media as more distracting (Walden 2016). Tams et al. (2018) explore the moderating effect of age on the interruption-stress relationship via mediators of computer self-efficacy, computer experience and inhibitory effectiveness, finding that older workers may have lower levels of these factors. Both older and younger workers suffer with emotional and cognitive overload in relation to IT (Rutkowski & Saunders, 2010), with older people tending to experience more feature overload in relation to mobile phones and younger people tending to experience more information and communication overload (Saunders et al., 2017). Ayyagari's (2007) study of technostress found a stronger relationship for younger workers between work-home conflict and strain. In their review of ICT use and burnout across age groups, Berg-Beckhoff et al. (2017) found that associations between ICT use and stress and burnout were strongest for those classed as middle-aged (35–45 years), perhaps due to work-family or career progression issues.

3.5.1.3. Gender. Eight (5.4%) studies included gender as a substantive variable. There was no, or only a negligible difference, between men and women for smartphone addiction (Duke & Montag, 2017) or excessive use of ICT (Cerretani et al., 2016). Men experienced more technostress than women for general ICT use (Ragu-Nathan et al., 2008; Tarafdar et al., 2011) as well as when working under Electronic Performance Monitoring technology (Rafnsdottir & Gudmundsdottir, 2011). Marchiori, Mainardes and Rodrigues (2019) found that women reported more techno-complexity and techno-uncertainty, while men reported more techno-overload and techno-invasion. Ayyagari (2007) found a strong relationship between the extent of technology presenteeism and the amount of work-home conflict for women.

3.5.1.4. Work and technology preferences. Individuals' preferences for style of working and use of technology have been found to moderate the outcomes in 10 (6.8%) studies. The extent to which an individual prefers to either segment or integrate their work and nonwork lives may make a difference. For instance, Gadeyne et al. (2018) found that a higher integration preference may moderate the effects of work-related computer use in non-work time on work-family conflict.

Technology preferences may also play a part, although this area is not extensively investigated. For instance, the extent to which the available technology aligns with desired use (Stich et al., 2017) and personal values (Hennington et al., 2011) are found to moderate dark side effects on psychological and behavioural outcomes. The extent to which technology is central to an individual's role (Ayyagari, 2007), perceived positively (Wright et al., 2014), as business critical (Sumecki et al., 2011), and used intensively by them (Salanova et al., 2013) are important in determining whether dark side effects are experienced.

3.5.1.5. Computer self-efficacy. Computer self-efficacy (sometimes referred to as computer confidence) is identified as both a moderator and antecedent of stress in the technostress literature (La Torre et al., 2019). It is described as 'an individual's ability to apply his or her computer skills to a wider range of computer related tasks.' (Compeau & Higgins 1995, p. 128). It is sometimes viewed as a correlate of computer anxiety (Powell, 2013). 7 (4.7%) of the empirical studies included it as a substantive variable, primarily as a moderator. Tams, Thatcher and Grover (2018) found it moderated the relationship between technology-mediated interruptions and stress (as did computer experience), while Qi (2019) found it did not moderate between mobile technology use and technostress but was directly predictive of technostress. Issa and Bahli's (2018) study also found evidence for computer self-efficacy as an antecedent of technostress. A number of other studies included related concepts such as the confidence to overcome smartphone failures (Salo et al., 2018) and competence in handling

technology (Hoppe, 2011), finding them to be significant moderators of stress and strain due to technology use.

The somewhat mixed results for computer self-efficacy suggest that further research is needed to understand how an individual's belief in their ability to use technology works as an antecedent and/or a moderator of technostress and other dark side effects. Furthermore, it may be fruitful to look at how neighbouring constructs of digital literacy and personal innovativeness with IT (neither of which are considered in the literature so far) might operate as moderators, especially given the indications for literacy facilitation and innovation support as organisational moderators (section 3.5.2.1). Poor digital literacy has been found to be detrimental to adoption of digital workplace tools as well as making employees' experience of digital tool adoption more stressful (Marsh, 2018; Wadhwa, 2017).

3.5.1.6. Mindfulness and other cognitive factors. Several studies (n = 4) have examined the construct of mindfulness as a potential moderator of technostress. Mindfulness (rooted in Buddhist psychology) has been found to be associated with lower mobile phone use and higher consequent well-being (Volkmer & Lermer, 2019), and to mitigate technostress (Pflügner & Maier, 2019). IT mindfulness (rooted in information processing) has also been found to mitigate technostress (Ioannou & Papazafeiropoulou, 2017) and mediate between interruptions and performance in such a way that there is a positive effect (Addas & Pinsonneault, 2018).

A range of other cognitive factors may also play a part in moderating or mediating the dark side effects and resulting outcomes. These include internet cognitive failure and deficient self-regulation (Whelan et al., 2017), control of one's attention (Mark et al., 2016b), memories of past cognitive and emotional overload in relation to IT use (Saunders et al., 2017), inhibitory effectiveness (Tams et al., 2018) and attention impulsivity (Roberts et al., 2015). Much remains to be understood about the way in which cognitive characteristics such as mindfulness and attention control or impulsivity either transmit or mitigate the dark side effects.

3.5.1.7. Coping. The area of individual coping is thought underserved in the technostress literature (e.g. Pflügner & Maier, 2019) and this is borne out by this review. Five (3.4%) of the technostress studies examined individual coping strategies, although using different frames. In the commonly used TMSC, coping describes cognitive and behavioural efforts aimed at dealing with environmental stressors that follow on from an appraisal of the stressors themselves followed by available resources (Galluch et al., 2015; Gaudioso et al., 2015; de Guinea, 2016).

Pirkkalainen et al. (2019) found that reactive coping behaviours (distress venting and distancing from IT) help reduce the negative effect of technostress creators on productivity, while proactive ones (IT control and positive reinterpretation) strengthen IT users' ability to cope. Gaudioso, Turel and Galimberti (2015 and 2017) found work exhaustion due to certain technostressors was increased by maladaptive coping strategies (e.g. disengagement, venting) and reduced by adaptive ones (e.g. dealing directly with the problem, asking for technical support). de Guinea (2016) found that when users experienced a discrepant technological event they adopted engagement coping strategies to try to resolve them, but switched to disengagement coping if they felt they had no control. Galluch, Grover and Thatcher (2015) explored techniques of coping via changing how they used the technology (method control) as well as being able to remove themselves from it (resource control). The former helped moderate the relationship between perceptual overload and strain (but increased the link from perceptual conflict to strain), while the latter moderated between perceptual conflict and strain (but increased the link from perceptual overload to strain). They suggested that sometimes the best way to mitigate strain is simply to step away from the ICT environment. Overall, there is much yet to be understood about how coping resources and strategies might reduce negative outcomes due to dark side effects.

A number of further studies highlighted strategies that can help reduce negative impacts, although they did not explicitly talk about the coping process. These include strategies to optimally manage e-mail (e.g. Camargo, 2008; Jerejian et al., 2013; Pignata et al., 2015), time (e.g. Fenner & Renn, 2010), and work-life boundaries (e.g. Mountz, 2016; Cecchinato et al., 2015; Olund, 2016).

3.5.2. Organisational factors

A number of organisational aspects have been found to act as moderators between the dark side effects and outcomes. These relate in particular to the specific mechanisms in place to support employees to use technology, but also to the climate of the organisation, leadership style, and characteristics or features of the technology itself.

3.5.2.1. Technoinhibitors. Nine (6.1%) of the studies looked at organisational mechanisms that may help moderate the dark side effects, referred to collectively as the technoinhibitors. Ragu-Nathan et al. (2008) found evidence for three technoinhibitors: literacy facilitation, technical support provision, and involvement facilitation. A number of studies in this review found support for these inhibitors (Fuglseth & Sorebo, 2014; Tarafdar et al., 2010; Tu et al., 2008) with a further mechanism of innovation support (i.e. ways in which the organisation encourages workers to experiment and learn) added by Tarafdar et al. (2011). In the same vein as involvement facilitation, in their review articles both Backhaus (2019, pp. 548–553) and Moore (2019) touched on the importance of involving workers in the process of implementing, respectively, employee monitoring systems and artificial intelligence.

Sarabandi, Carter and Compeau (2018) found that evidence so far suggests that the inhibitors reduce strain primarily by acting directly on the technostressors (rather than moderating their relationship to strain). Florkowski (2019), focusing on the specific organisational area of Human Resources and the related technology, found evidence for governance involvement (i.e. in system planning and decision-making), top management support, and innovation climate (i.e. experimentation is encouraged) all having a negative relationship to technostress. Other studies found evidence for ICT support (Day et al., 2012), an e-mail training intervention (Soucek & Moser, 2010), and a workshop aimed at improving psychological resources (Chen et al., 2009) as inhibitors of the dark side effects. Evidence so far suggests a good level of support for the technoinhibitors as helping to moderate the dark side effects, lending encouragement to organisational efforts to educate and support workers around the digital workplace.

3.5.2.2. Organisational climate and leadership. Aspects of organisational climate and leadership that can act as resources were also explored in 5 (3.4%) studies. Budnick, Rogers and Barber (2020) investigated the influence of an organisational climate that is perceived as family supportive, finding that it decreases FoMO and message checking (although it did not help reduce burnout); this is in contrast to the potentially detrimental effect of a competitive environment (see section 3.3.5).

Leadership may have a role to play, with transformational leadership found to be a job resource that can help reduce technostrain (Salanova et al., 2013), top management support for HR technology helping mitigate HR technology-related stress (Florkowski, 2019), and the quality of exchange between leaders and employees moderating the relationship between some types of technology overload and work-family conflict (Harris et al., 2013). The hierarchical level of a message or interruption sender can also make a difference to its negative impact (e.g. Stich et al., 2015). The little research so far available in this area indicates that organisational climate and leadership warrant further exploration as potential dark side effects moderators. Specifically, it may be fruitful to understand the different outcomes engendered by, for example, different types of organisational culture (e.g. market, adhocracy) and leadership (e.g. transformational,

authoritarian).

3.5.2.3. Job autonomy. Although only 2 (1.3%) of the empirical studies identified in this review look at the potentially moderating effect of job autonomy (i.e. individual freedoms to carry out the work as one deems fit) on the dark side effects, it may warrant further investigation. In their meta-analysis of 55 studies looking at negative outcomes of workplace technology, Karimikia and Singh (2019) identify that job autonomy helps to mitigate stress, strain and exhaustion. Tams et al. (2020) found that giving workers control over how and where they do their work, as well as what tasks their job encompasses, has been found to reduce perceived interruption overload; while, according to Salanova, Llorens and Cifre (2013), a lack of job autonomy contributed to technostrain. Indeed, beliefs and perceptions around the extent to which one has control of technology demand stressors may play an important role in employees' emotional responses and reactions to them as well as any resulting negative outcomes such as strain (Nixon & Spector, 2014).

3.5.3. Technology as a resource

By their nature, the papers included in this dark side review tended to focus on the demands exerted by the technology (as covered in section 3.2.2) but it is worth noting that the technology itself can be a resource and a few of the studies touch on this perspective. Salanova, Llorens and Ventura (2014) highlight technological resources at task level (e.g. increasing autonomy), at technology level (e.g. enabling social networks), at organisational level (e.g. healthy HR practices) and at an extra-organisational level (e.g. private-work life support). Carlson et al. (2017) identified that while technology overload and monitoring can lead to job tension, technology job autonomy (i.e. ways in which it helps workers attain goals and work independently) can lead to job engagement. In a similar vein, Ter Hoeven et al. (2016) find that while using technology to communicate can be demanding due to its unpredictability and interruptions, it can also act as a resource insomuch as it enables workers to be accessible to colleagues and communicate efficiently. In addition, factors such as the way in which the technology is designed so as to reduce cognitive load (e.g. Tams & Hill, 2017) as well as the degree to which it is suitable to the task the employee is working on (e.g. Ayyagari et al., 2011) can impact whether it acts as a demand or resource.

Further exploration of the ways in which technology acts as a resource was beyond the scope of this review. A review of the 'light side' of digital working would capture these facets in more detail and further research may also be needed to uncover ways in which technology can be a means of reducing and managing stress as well as being a source of stress (Wadhwa, 2017).

5. Conclusions

In this article, we presented an integrative review of the literature on the dark side of digital working. It is, to the best of our knowledge, the first integrative review conducted across the dark side of the digital workplace. Employees inside of organisations work with a broad range of technologies in order to fulfil tasks and meet goals, yet the literature tends to narrowly focus on certain ICT technologies.

The review brought together literature in order to identify a range of technologies studied in relation to the dark side effects. The objective demands and perceptual demands that these technologies make on employees, often previously conflated, were distinguished. Five dark side effects were identified within the literature: technology-related stress, overload, anxiety, interruption and distraction, addiction and excessive use. Further research is needed into the associations between these dark side effects as well as how these relate to cognitive and affective outcomes. Future research may benefit from considering the range of individual differences and organisational characteristics compiled here that are found to moderate dark side effects and may obscure findings if not measured and accounted for. More generally, having identified a great deal of sub- or non-theoretical studies, we highlight the importance of a theoretical basis to studies in order to help formulate policy and predict changes in outcomes over time.

While certain ICTs are undoubtedly central to the dark side of digital working, they cannot be considered as proxies for employees' overall digital work experience. Notions of digital work and the digital workplace go much further both in terms of a wider set of digital platforms and experiences along with the work practices with which they are intertwined (see section 1.1). Just as a workers' experience of the physical workplace and any associated risks or hazards cannot be understood through their narrow interactions with desks, photocopiers or meeting rooms; neither can the experience of the digital workplace and any unintended negative consequences be understood from only their isolated use of e-mail, smartphones, or instant messaging.

Coverage of the objective demands of this technological environment – including organisational expectations relative to its use - is rather sparse (see section 3.2). In this respect, delineation between objective stressors and perceptual stress is often lacking, other than in a small number of notable examples (e.g. Day et al., 2012), effectively implying that dark side effects are an end-user problem rather than one that occurs at the intersection of technologies and humans. It also obscures whether intervention is needed at the level of ameliorating the technology itself (i.e. how it is designed, implemented, communicated and supported), or helping individuals build resilience in the face of aspects of the technological environment that they find psychologically challenging. In addition, as highlighted in section 3.2.4, there is also an opportunity for greater specificity about the physical location in which digital work takes place and any related differences in how the dark side effects play out. This need is heightened by the post-pandemic emphasis on hybrid working across offices, homes, and third locations such as cafés or libraries.

Technology-related stress is by far the most studied of the dark side effects; by contrast, addictive behaviours have received little attention, despite their potentially toxic effects in relation to worker well-being. Organisations tend to concern themselves with lack of adoption of enterprise technologies – understandably, as this can constrain the value of their technology investments – however, excessive or maladaptive use should also be considered an area of potential concern that may, over time, harm worker well-being and thereby constrain optimal outcomes being realised for the digital workplace. Associations between the various dark side effects are explored in the existing literature to some extent, particularly in terms of the contribution of overload and interruptions to stress, as well as the interplay of anxiety with various other effects. However, much remains to be understood about the way that the various dark side effects may be associated; for instance, any linkages between perceptions of stress, feelings of anxiety and addictive behaviours.

In the dominant technology-related stress (or technostress) literature, the Transactional Model of Stress and Coping (TMSC) is the main theoretical frame, although a range of other stress theories are used, most notably perhaps Job Demands-Resources theory. With a quarter of the stress studies classed as sub- or non-theoretical – a proportion that rises to nearly a half for the empirical studies overall - attention needs to be paid to theoretical rigour in this literature. Greater use of a range of other theories in the dark side literature would also contribute to the theoretical diversity in this domain.

Tarafdar et al.'s (2007) model of technostress rooted in TMSC has furnished considerable insight, anchoring the literature and presenting clear evidence for the stressful potential of aspects of the digital workplace. Nevertheless, findings from this review suggest it may now be timely to revisit technology-related stress from broader/alternative perspectives that may lie outside of this particular stream of research. Five themes were identified here from across this literature in terms of the ways in which employees perceive stress in relation to technology (see section 3.3.3): overload, interruption and distraction, invasion into

nonwork life, monitoring, and the pressure and pace of digital work. These align to a considerable extent with the dominant technostress model, but with some differences in content, categorisation and emphasis. For instance, monitoring of employees in the digital workplace is suggested as a conceptually distinct stressor from the invasion of work into nonwork life due to technology. Also, the pressure and pace of digital work is emphasized, bringing together elements of complexity and uncertainty from the existing model.

In terms of outcomes, the toll that the unintended negative consequences of digital workplace technologies can take on employees is spelled out clearly among the findings (see section 3.4). By bringing together research across the various dark side effects, six cognitive and affective outcomes (strain, work-family conflict, burnout, job satisfaction, end-user satisfaction and well-being) and four behavioural outcomes (productivity, performance, organisational commitment and turnover intentions) were identified. Across these outcomes, the emotional impact for workers, in particular, is apparent; the felt experience of the dark side effects is characterised by emotional exhaustion and negative affect, potentially eroding positive sentiments towards the organisation over time. There is much variation in which outcomes are included in dark side studies, as well as how they are defined and operationalised. The literature is overall weak in terms of specifying what mediates between the dark side effects and these outcomes with many studies having only looked at isolated aspects of the process. It also lacks intervention studies to understand the ways in which organisations can help reduce negative outcomes for employees.

Results from this review point to six individual factors (personality, age, gender, work and technology preferences, computer self-efficacy, mindfulness and other cognitive factors, and coping) that can act as moderators between the dark side effects and negative outcomes (see section 3.5.1). Coping is an area of weakness in the literature with much yet to be learned about how coping resources and strategies might help reduce negative outcomes. The study of mindfulness as a moderator of the impact of the dark side effects is an emergent area with early work in both Buddhist and cognitive psychology suggesting further potential. It is perhaps surprising, especially given positive indications for organisational interventions to encourage digital literacy and innovativeness with IT, that neither have been explored at an individual level.

A number of organisational factors are also indicated in this review as helping to reduce negative outcomes in the digital workplace. There is evidence for active mechanisms such as supporting workers to gain digital skills and involving them in technological change for mitigating these outcomes; as well as indications of how cultural climate and leadership style may either moderate or exacerbate them. Though not the focus of this study, the technology itself can act as a resource rather than a demand, something that a further review into the 'light side' of the digital workplace might throw further light on.

At a time when the intensity of digital working, driven by the pandemic, has increased considerably, the findings of this review underline the need for attention to be given to furthering our understanding of the way that the dark side of digital working manifests within employees' holistic digital experience of work, the outcomes or harms that may follow, as well as the mechanisms by which individuals and organisations might moderate them.

A number of limitations should be noted when considering this review. Firstly, although leading papers on integrative reviewing were consulted and identified procedures followed, challenges in ensuring the rigour and consistency of this approach to reviewing are acknowledged (Hopia et al., 2016). Secondly, the inclusion of both quantitative and qualitative studies precludes any meta-analysis and a narrative approach to synthesis was used.

Notwithstanding these limitations, this review makes an important contribution to the dark side literature by synthesizing relevant studies from across disciplines, methodologies and theories; as well as across psychological effects and technology types. Shifting the lens from ICT to digital workplace presents challenges for researchers in terms of both the breadth of its definition as well as lack of consensus around how it is defined. It nevertheless offers a rich potential avenue for future research that speaks to employees' holistic digital work experience rather than small subsets of technologies. In taking this approach, researchers may wish to consider the objective demands of this wider environment and the ways that these exert an influence on and are perceived by employees. As workplace technologies become ever slicker and more attractive, the area of worker addiction to and excessive use of them certainly warrants further investigation; as do the associations between the various dark side effects.

Theoretical directions are also indicated, not least that research in this area needs to be conducted on firm theoretical foundations in order to enable successful predictions to be made and interventions to be designed. This review indicates that Job Demands-Resources model may act as a useful theoretical foundation not only for the further study of stress but also the wider array of dark side effects. It also enables a clear delineation of the objective demands of the technology as well as both individual and organisational resources. Understanding how technology may act both as a demand that can lead to health impairment, as well as a resource that can have motivational effects may ultimately be more helpful than the notion of eustress which, while bringing theoretical completeness to technostress studies from a TMSC perspective, is not considered a helpful concept in the workplace in mainstream definitions of workplace stress. For instance, the UK Health and Safety Executive (2019, p.3) distinguish between pressure which can be motivational and stress as 'an adverse reaction to excessive pressure'. From this perspective, the notion of positive stress is not deemed helpful, and may even be dangerous, in a workplace setting.

More insight is needed on how the outcomes of dark side effects unfold for employees over time as well as how negative cognitive and affective outcomes may translate into impaired health. Researchers will need to branch out from predominantly survey-based methodologies to address this particular gap.

The integrative perspective taken in this review reveals new insights about the progress made and gaps remaining across the dark side literature. For researchers, it suggests areas for further exploration, particularly by shifting the focus from individual technologies and dark side effects to a more inclusive digital workplace focus. These are summarised in Fig. 3. For organisations, it highlights the need to be vigilant to the potential unintended negative consequences of digital working in order that these can be properly understood and minimised through improvements to the technology itself and related norms and practices, as well as interventions to help individuals cope and even flourish in the increasingly prevalent digital world of work. Indeed, given the widespread shift toward hybrid working post-pandemic, it may be time to elevate the attention given to the dark side effects, as well as the language used to describe them. Unintended negative consequences sound unfortunate; whereas psychosocial hazards and harms have the ring of important workplace issues. Findings from this review suggest that the potential impact of the psychosocial harms that emanate from digital working on employees' well-being and performance should be afforded serious and sustained management attention alongside other physical and psychosocial risks at work.

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Declaration of competing interest

None.

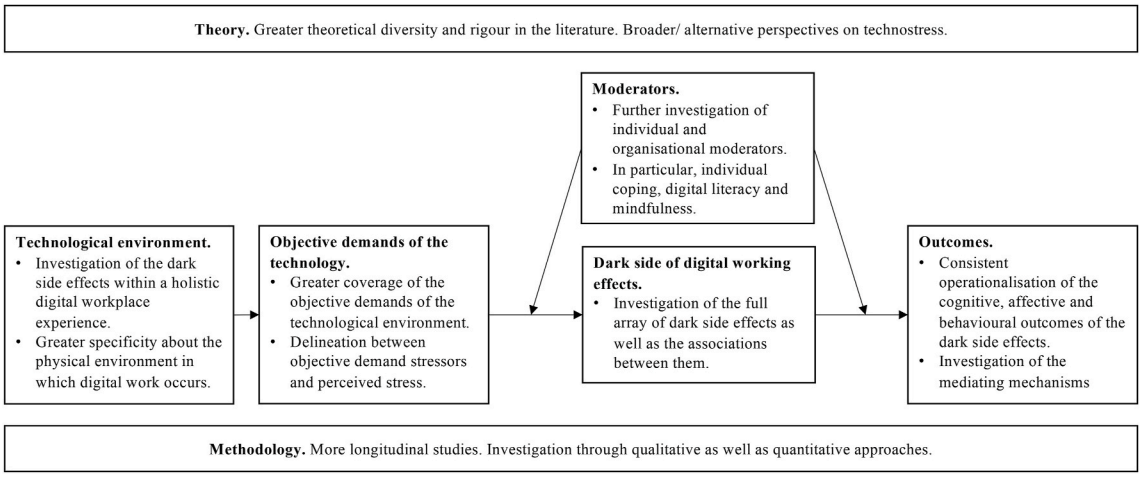

Fig. 3. High-level overview of the research opportunities across the dark side of digital working literature.

Appendix A

While each database search mechanism differed to some extent in the structure of the searches, the following elements were looked at across them. Terms within research areas (e.g. digital workplace) were combined using the OR operator; combinations of terms between research areas (e.g. digital workplace and work context) were combined using the AND operator.

Table A.1
Keywords and categories used for database searching

Research area	Keyword combinations
Digital workplace	• "digital work*" • "information and communication technolog*" or ICT • "information technolog*" • "information systems" • "knowledge management system" or KMS • "document management system" or DMS • intranet • "unified comm*" • email OR e-mail • "instant messag*" • mobile or smartphone • "enterprise social network*" or ESN • technolog* • "enterprise collaboration" • alert • notificat* • "productivity suite" • self-serv* • teleconf* • workflow • BYOD • "employee portal" • workflow
Individual-level psychological harms	• "dark side" • overload • technostress or techno-stress • anxiety • isolation • addict* • distract* • interrupt* • burnout • technophob* • stress • strain • invasion • insecurity • alienat* • infomania • psychological effect
Work context	• workplace

(*continued on next page*)

Table A.1 (*continued*)

Research area	Keyword combinations
Categories or disciplines	• workforce • staff or employee or worker or teleworker or homeworker or manager or student • Psychology • Management and business • Computer science including information systems and human-computer interaction

Appendix B

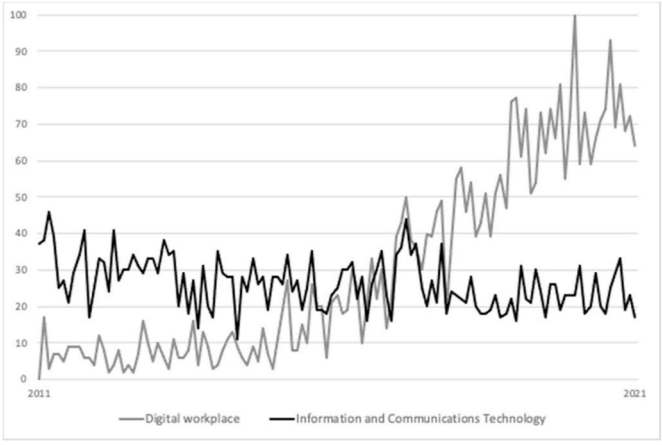

Figure B.1. Google Trends comparison for 'digital workplace' and 'information and communications technology' search terms for the period 2011–2021. *Note: Google describe the numbers on the vertical axis as representing the term's popularity with 100 as the peak of popularity for the term. The term 'information and communication technology' was at its peak in 2004.*

Appendix C

Table B.1
Tarafdar et al. (2017) add to the original descriptions (Ragu-Nathan et al., 2008) of the five technostress creators (although the TCI remains the same).

	Ragu-Nathan et al. (2008, p.427)	(Tarafdar et al. (2017, p.9)
Overload	Users are forced to work faster and longer due to ICTs.	The need to meet information security requirements as well as the expectations of others when using applications such as social media, plus dealing with excessive information and features.
Invasion	Employees can always be reached and feel they should be constantly connected, leading to blurring of work-life boundaries and a sense of invasion.	To the pressure to be constantly connected and reachable, the expectation of immediate response is added, along with the privacy invasion of surveillance and monitoring.
Complexity	Users feel their computer skills are inadequate as a result of the complexity of the ICTs, forcing them to spend time and effort to learn them.	Adds that this need to learn new ICTs is constant, that associated policies may be hard to understand, and that the user may face 'too many interruptions, complications, and hassles in using IS'.
Uncertainty	Users are unsettled by constant changes and upgrades to ICT leading to uncertainty and needing to constantly learn new ICTs.	As well as the speed of change, the lack of communication about technology changes and lack of control over related policies.
Insecurity	Users feel their jobs are threatened due to automation or colleagues with better ICT skills.	Only mentions insecurity due to others knowing more about new technologies.

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