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Digital Frugality for Managerial Tasks: Three-way Interaction Effects of Redundancy of Software on Techno-stressors

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DIGITAL FRUGALITY FOR MANAGERIAL TASKS: THREE-WAY INTERACTION EFFECTS OF REDUNDANCY OF SOFTWARE ON TECHNO-STRESSORS

Research in Progress

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Abstract

In this research, we study how non-frugal organizational IT practices can affect employee well-being in completing managerial tasks. Building on the conservation of resource theory, we will examine a three-way interaction effect of the redundancy of required skills, required resources, and obtained results on technology-driven stressors. Data was collected from 357 managers to analyze the proposed three-way interaction effect for techno-overload, techno-complexity, techno-invasion, techno-insecurity, and techno-uncertainty. This article highlights the importance of being frugal – that is, acknowledging and diminishing redundancy among ICT assets and usage within organizations - for reducing technostress among employees.

Keywords: Redundancy, technostress, techno-stressors, frugality.

1. Introduction

Ever increasing usage of information and communication technologies (ICTs) in the organizational context and the role of technology characteristics induce strain effects on employees, leading to technostress (Ayyagari et al., 2011). Such technology-driven stress is associated with an increased workload (in terms of time and effort), the feeling of lack of skills and knowledge, blurred work-home boundaries, being disturbed by constant updates and upgrades, and the resulting job insecurities due to increased prolonged use of ICTs for work purposes (Ragu-Nathan et al., 2008; Tarafdar et al., 2007).

Despite the growth of the adverse effects of ICTs, technostress is somewhat less analyzed than the ICT benefits (Tarafdar et al., 2015). Technostress can be a challenge for employees who experience long-term consequences such as burnout (Srivastava et al., 2015) and diminishing organizational commitment (Ragu-Nathan et al., 2008). It can also be detrimental to organizations, as technostress can mean decreases in performance (Srivastava et al., 2015) and productivity (Tarafdar et al., 2011).

Prior studies on technostress have mainly focused on the role of technological antecedents (e.g., Ayyagari et al., 2011). However, along with technological characteristics, redundancy among ICTs can also influence the technostress of employees. For instance, redundancy can mean recruiting additional cognitive efforts, resources, and skills while arriving at the same result. Recently researchers started to

emphasize that to go beyond the circular economy, organizations and individuals can switch to frugal, sober consumption by reducing the consumption of material objects, digital technologies, and energy (e.g., The Shift Project, 2019). DeYoung (1986) defined *frugality* as the cautious use of resources and avoidance of waste. In the digital context, *digital frugality* implies not having multiple software or devices that provide a similar function (such as a computer and a notepad; Microsoft Teams and Skype) but only one (Guillard, 2021). Such an approach requires recognition of redundancies in ICTs' functions. However, current research has yet to account for the existence and effect of redundancies in organizations.

Studies on frugality, specifically frugal IT innovation, underline the enabling role of IT in developing frugal innovation capabilities (Ahuja and Chan, 2014; Ng et al., 2018; Watson et al., 2013). Frugal IT innovation refers to developing IT products and services focusing on affordability, simplicity, and sustainability aspects to remain light on IT assets; eventually, this would increase innovation and performance and develop frugal innovation capabilities at the organizational level (Ahuja & Chan, 2016). Besides the enabling role of IT for frugality and IT to be frugal, the effect of non-frugal IT practices, not being light on IT assets, on employee wellbeing is the focus of this paper.

Early studies focused on the role of frugal behaviour, such as consumer behaviour during online shopping (e.g., Bansal and Zahedi, 2010), and distinguished it from both price and value consciousness (Lastovicka et al., 1999). As stated by Ahuja and Chan (2014a), frugality is a unique characteristic that needs further investigation in IT-related behaviors. However, such behavior needs to be supported and encouraged within organizational settings through protocols and tools. For organizations to adopt frugal consumption practices, they need employees to incorporate them while understanding how employees use provided resources and capabilities. Furthermore, redundancy of ICTs can come in various forms, such as requiring similar skills (involving abilities, talents, and knowledge), using similar resources (organizational resources such as human or financial capital, or assets such as hardware and software), and obtaining similar results (refers to how the results differ from one ICT usage to another; Rindfleisch and Moorman, 2001). Thus, redundancy refers to the functional overlapping of ICTs in this study, and a thorough analysis of the effects of redundancy is needed to shed light on their role in technostress.

By addressing the research gap on redundancy in ICT use, the present work is an attempt to extend the work on technostress and highlight the need for digital frugality by investigating the three-way interaction effect of the redundancy of required skills, required resources, and obtained results on techno-stressors. Although technostress has been thoroughly investigated from the technological antecedents aspect (e.g., Ayyagari et al., 2011) and is often analyzed based on a single type of ICT, the redundancy aspect of ICTs has not been treated in technostress literature from a task perspective. How the redundancy of required resources and redundancy of required skills moderate the relationship between the redundancy of obtained results from software and technostress is the ultimate empirical question this paper addresses. Thus, by incorporating the redundancy factor, this study aims to expand the technostress literature and better understand underlying factors leading to employee stress while guiding organizations and individuals wishing to reduce technology-driven stress and align sustainable ICT use.

2. Theoretical framework and hypotheses development

Our research builds on the conservation of resource theory (COR; Hobfoll, 1989). According to the resource conservation principle of COR, individuals' main goal is to preserve and protect their existing resources, such as objects/tools, work conditions, personal resources (e.g., skills and personal traits), and energy, while avoiding unnecessary resource expenditure (Hobfoll et al., 2018). Thus, an additional effort required to deal with extra demands with multiple software, which does not result in increased work output but the same results, is an example of resource exertion. Thereby, redundancy in software conditions would lead to technostress as the individual feels that his/her resource is being invested with no resulting gain. Our research model is depicted in Figure 1.

Prior studies demonstrate the potential of ICTs to induce technostress (Ragu-Nathan et al., 2008). The factors that drive technostress are defined as technostress creators and structured into five key stressors in the literature (Tarafdar et al., 2010). Techno-invasion illustrates the intrusive effect of ICTs that blur the line between personal and work boundaries. Techno-overload relates to circumstances where individuals feel forced to work faster and longer due to ICTs. Techno-complexity is the stress caused by the perception of lacking adequate skills and the need to invest time and effort in learning ICTs due to the complexity of these technologies. Techno-uncertainty refers to the short life cycles of ICTS that constantly force users to adapt and educate themselves. Techno-insecurity is felt when users feel threatened by the development of ICTs, such as fear of losing their job or being replaced. These stressors were found to be related to specific technology characteristics such as usability, intrusiveness, and pace of change (Ayyagari et al., 2011). However, these results are based on a single ICT, and employees often use several applications to complete their tasks, with the potential for overlap in usage and results. Thus, an understanding of the effect of multiple applications on techno-stressors is rather missing.

The redundancy of obtained results

While many software products have complementary aspects, organizations often implement several that have overlapping functionality. For instance, based on a recent survey, businesses, on average, use more than three apps for chatting, with 66% reporting using both Slack and Microsoft Teams (Mio Industry Trends, 2019). This also holds true for other solutions, such as customer relationship management (e.g., Staub et al., 2021) and online communities (e.g., Wimelius et al., 2021). The IT architecture of organizations often matures into a portfolio of ICTs through acquisitions or renewals, resulting in partly or entirely overlapping functionality among applications (Wimelius et al., 2021). A fast-paced environment with multiple applications provided by the organization can be challenging from the employees' perspective, as they need to be able to seamlessly understand and choose among the alternatives. This creates a requirement to not only store and easily recall which capability can be found in each application, but also their unique (or not) features, functions, and interfaces (e.g., location of the features). Additionally, each application undergoes updates and changes in interfaces and features. This constant memory recall and increased complexity build a cognitive load on users that can eventually lead to technostress.

Prior studies have found that overlapping functionality among systems can be confusing for end users and lead to decreased usage of any one of the systems (e.g., Fedorowicz et al., 2014). This is also a problem during software purchase: overlapping offerings cause confusion among clients as they create difficulty in understanding the vendor's core offerings and even difficulty identifying the appropriate application or feature for specific functionality (Staub et al., 2021). Thus, if several software products provide similar functions and yet lead to the same outcome, employees will be required to use additional cognitive resources, leading to strain effects and greater stress over time. For all these reasons, then, we predict:

Hypothesis 1: The redundancy of obtained results for managerial tasks is positively related to techno-stressors.

The redundancy of required resources

The frugality strategy, in general, aims to reduce resource and energy inputs while improving living conditions, such as reducing stress, to improve employees' working conditions (O'Neill et al., 2018). Prior studies focusing on sustainability have also favored increasing resource efficiencies across various sectors (Santarius et al., 2022). In the case of digital frugality, the resources include all the organizational IT resources, such as hardware and software. Santarius et al. (2022) suggested that resource efficiency can be attained by using ICTs to meet one's existing needs with the fewest possible resources. Thus, using several software packages may require different resources that employees need to put in additional efforts, like knowing each resource (such as interface, constraints, technical limitations, and associated organizational usage regulations/protocols) and sometimes coordination of multiple resources. Likewise, operating multiple resources would potentially require additional attention for interoperability, data accuracy, and assuring processes while minimizing errors (Wimelius

et al., 2021). Resources may not be all equally accessible to all employees in terms of usage, even if they potentially provide the same results. Considering all these additional cognitive loads, the effect of the redundancy of obtained results on techno-stressors would be more substantial if different resources are required to complete a task. Thus, we predict:

Hypothesis 2: The redundancy of required resources moderates the relationship between the redundancy of obtained results and techno-stressors for software usage in managerial tasks, such that the positive relationship is stronger to the extent that different resources are required.

The redundancy of required skills

Skills are often considered highly interrelated to resources. For instance, Piccoli and Ives (2005) identify IT capabilities as technical skills, IT management skills, and related assets. Bhatt and Grover (2005) further differentiate IT capabilities as valuable, competitive, and dynamic. Different software packages may require not only different resources but also different skills, and some cannot be used without appropriate skills. This is especially demanding for employees when digital technologies force organizations to not only continuously develop new digital skills but also to occasionally renew their digital infrastructures based on technology advancements to stay competitive (Nambisan et al., 2017). For employees, this requires additional efforts, such as continuous learning and expanding their knowledge and skill sets. The perceived redundancy of obtained results from different ICTs usage for work, when coupled with the redundancy of required resources along with the redundancy of required skills, will jointly increase techno-stressors. Thus, we predict:

Hypothesis 3. There is a three-way interaction effect of the redundancy of obtained results, required skills, and required resources for software usage in managerial tasks on technostress, whereby the positive relationship between the redundancy of obtained results and techno-stressors is strongest when the redundancy of required skills and the redundancy of required resources are different.

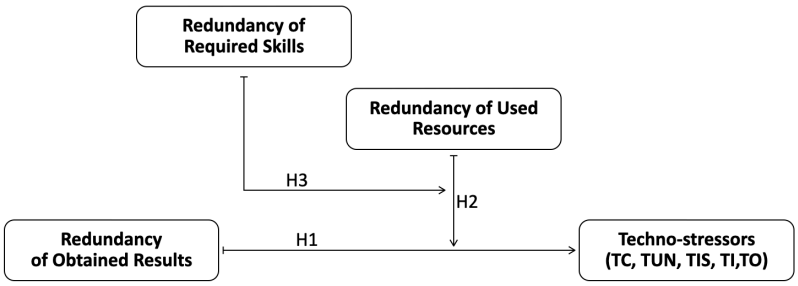

Figure 1. Conceptual model.

3. Proposed Research Methodology

3.1. Sampling and Data Collection

Data were collected through an online self-reported questionnaire using a time lag between the measurement of the predictors and criterion variables. The target population was adult working professionals with managerial positions residing in the UK who use ICTs to complete their day-to-day work tasks. To identify respondents, we used the services of a reputable platform, Prolific. Platform members were screened based on the above target population criteria and then invited to participate in the survey. A large number of respondents from this platform allowed us to access participants from several industries and people from different backgrounds and organizations while protecting their anonymity. To determine our appropriate sample size, we conducted an a priori power analysis using

G*Power (Faul et al., 2007). Our analysis indicated that in order to detect a small to medium effect size (f^2 = .02 to .15) with α = .05 and power of 0.8 in a linear multiple regression model with three tested predictors, we would require a sample of 77 to 550 participants. We also employed a time-lagged design, therefore, aimed for an initial N of 400, considering respondent attrition and allowing for the removal of some problematic data responses. A sample of 357 questionnaires was collected after missing data and incomplete responses were removed. Our participants were full-time employees, mainly from the United Kingdom (91.6%), with an average age of 42 years old. Two hundred twelve participants (59.4%) were female, while 145 (40.6%) were male. This slight over-representation of females in the sample reflects the gender distribution in the prolific platform where we collect the data. The demographic characteristics of the respondents are presented in Table 1.

		Gender	
		Female	Male
Age	25 - 34	64 65.3%	34 34.7%
	35 - 44	76 57.1%	57 42.9%
	45 - 54	52 62.7%	31 37.3%
	≥55	20 46.5%	23 53.5%
Tenure	< 2	50 59.5%	34 40.5%
	2 - 11	123 59.1%	85 40.9%
	12 - 21	30 60%	20 40%
	22 - 31	5 55.6%	4 44.4%
	≥32	4 66.7%	2 33.3%

Table 1. Demographic characteristics (N=357)

3.2. Measures

In order to develop our list of managerial tasks for which we were interested in redundancies among ICTs, we started with a list of front-line management (FLM) tasks and responsibilities adapted from Hale (2005). Given that Tengblad (2006) concluded that "new work practices are gaining ground without replacing old work practices" (p. 19), we kept Hale's (2005) original list intact, but added the following new task items identified in the literature: communicating up, down, and vertically in the hierarchy (Mantere, 2008; Gjerde and Alvesson, 2020); meetings with higher managers, subordinates (Manetre, 2008; Tengblad, 2006); resolve conflicts among workers, motivate workers to change or improve their performance (Pederson et al., 2013). With this updated and merged list, we then ran a pilot study with 100 managers, where each participant was asked how often they engage in each of the tasks using software or application for work, employing the following response scale: At least daily, at least weekly, at least monthly, several times a year, never. Looking at the items with the most "at least

daily" responses, we categorized them into five common managerial tasks performed via digital technologies, used in our main study.

The rest of the measures were derived from prior-validated scales, modified to the study context, and administered in English. Items in the questionnaire were measured based on their original scale, using five, seven, and ten points. Techno-stressors, also called technostress creators, were derived from the original scale of Ragu-Nathan et al. (2008) that captures several IT-related stress-creating conditions by constructs such as technology-complexity (TC), technology-uncertainty (TUN), technology-insecurity (TIS), technology-invasion(TI), and technology-overload (TO). Redundancy was adapted from Rindfleisch and Moorman (2001) and presented as a redundancy of obtained results, used resources, and required skills. We averaged each type of redundancy across the five task types for each participant. We also incorporated control variables such as gender, age, techno-savviness, neuroticism, and tenure (in years). Neuroticism, being prone to negative emotions and reactions to a stimulus, has been presented as a personality trait that influences the perception of technostress (Maier et al., 2006).

3.3. Data Analysis

For data preparation and hypothesis testing, we will use the IBM SPSS Statistics 28 software. The context of the study is the potential redundancy of multiple software to complete a specific managerial task. Therefore, we expect the direct stress effect to arise from the cognitive resources invested in choosing a tool amongst several that give the same end result. If we consider the example of a direct effect of skill redundancy, for example, we would not expect a similar effect without the presence of the redundancy of results: having access to several tools that give different outputs but require the same skills would actually lower technostress, potentially. To test the main effects of redundancy of obtained results on techno-stressors (H1) and the moderating role of redundancy of required skills and redundancy of required resources on the relationship between redundancy of obtained results and techno-stressors (H2, H3), we will conduct a hierarchical regression analysis (Aiken and West, 1991). We will analyze three-way interaction for each type of technostress creator, techno-stressors, namely technology-complexity (TC), technology-uncertainty (TUN), technology-insecurity (TIS), technology-invasion(TI), and technology-overload (TO) (Ragu-Nathan et al., 2008). All continuous variables will be centered prior to creating the interaction terms are created to reduce non-essential multicollinearity. In our analysis, we will first enter age, gender, techno-savviness, neuroticism, and tenure (in years) as control variables, then the main effect variables. This will be followed by two-way interactions and, finally, three-way interactions where appropriate (H3). We will also perform additional analyses, such as Dawson and Richter's (2006) slope difference test, to study the direction and significance of any two and three-way interaction effects. We will also run post hoc analyses to examine the other direct and two-way interactions.

4. Conclusions and Expected Contributions

This study aims to demonstrate that using several software programs to perform desired tasks to attain the same result can lead to technology-driven stress for employees. Thus, a frugal consumption approach in terms of software usage by employees can lead to reduced technostress. The potential findings of this study contribute to the technostress literature in several ways. First, it analyzes the role of redundancy and redundancy types on techno-stressors that have yet to be explored in detail. Thus, this study is also among the foremost to introduce redundancy as an antecedent to be treated in technostress literature.

Such an analysis also provides valuable insights into managing technostress processes and achieving sustainable ICT usage. If IT architecture provides overlapping functionalities, it often becomes demanding for employees to distinguish between the different applications. Therefore, organizations need to ensure their systems' coherency and distinct added value to reduce employee technostress. Organizations should develop a comprehensive and exhaustive picture of all offerings for their employees and establish processes to continuously attain and retain the coherency of their offerings to employees as part of their IT governance. Also, by identifying how redundancies affect each type of techno-stressor for employees, organizations can adopt countermeasures to diminish the adverse

effects while supporting positive strategies. Management can also introduce tools or protocols to control and measure redundant usage behavior. While this study focuses on redundancies in software, future studies can focus on the hardware aspect that can aim for sustainable ICT usage by needing fewer devices to be produced and used to perform the desired tasks.

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