Abstract

Healthcare organizations are concerned about the negative effects created by IT related stress, also known under the concept of technostress. However, organizational literature suggests that stress is not always harmful and can also have positive effects on performance and innovative behaviours. While technostress darksides are acknowledged, we still know really few regarding potential positive sides. Based on activation theory, this study examines the possibility of a curvilinear relationship between technostress creators and exploratory use behaviours in the post-implementation phase, and also looks for potential moderating effects of individual characteristics (personal innovativeness with IT) and the environment (support for exploration) in healthcare. This paper aims at providing a basis for better understanding the paradoxical effects of technostress creators on IS use behaviours in a mandatory use context. We also discuss potential contributions.

Keywords: Technostress, exploration, healthcare, post-adoption.

Introduction

Several healthcare organizations invested a lot of money in IT (Chiasson & Davidson, 2004), hoping to increase their performance and to better manage increasing time constraints (Strong et al. 2014). However Information technologies (IT) have often been considered by users as increasing information load and interruptions, sometimes increasing or giving the impression to increase employees’ workload and stress by creating a perpetual sense of urgency, instead of increasing productivity (Califf et al., 2015; Ayyagari, 2011). Better understanding the role of these cognitions, regrouped under the term “technostress”, is essential for healthcare organizations to get return on investment and improve IT use performance.

Technostress is defined as the stress experienced by individuals due to the use of IT (Brod, 1984). In their research Ragu-Nathan et al (2008) have defined five technostress-creators, or techno-related factors that create stress, namely techno-overload, techno-invasion, techno-complexity, techno-insecurity and techno-uncertainty. The literature has –with some exceptions (Califf et al., 2015, Chandra et al, 2015)– most of time only considered the dark side of technostress, while completely overlooking potential positive effects. This is surprising because one part of the literature on stress, based on activation theory (Gardner & Cummings, 1988; Gardner, 1986), recognized that stress could bring positive effects in some circumstances. More precisely work demands such as time pressure and work overload have been recognized by some authors as having positive effects on work outcomes, such as performance (Kawai & Mohr, 2015; Lepine et al., 2005; Cavanaugh et al., 2000), creativity (Binnewies & Wörnlein, 2011) or proactive behaviours (Crant, 2000). Thus, using activation theory as a lens, could help to better
understand the mixed results regarding the impact of stress related to IT, and of some emotions, such as anxiety (Beaudry & Pinsonneault, 2010), on IT use behaviours.

Nevertheless, findings on stress have to be put into perspective as there has been considerable disagreements regarding the effects of stress on work outcomes such as innovation. A meta-analysis on the subject, from LePine et al (2005) concluded that individuals didn’t cope with all kind of stressors in the same way and that hindrances stressors would differ from challenge stressors. Thus, technostress creators’ effects, may be more ambivalent than previously suggested and more research is needed on this point.

Ayyagari et al. (2011) have defined work overload related to IT and role ambiguity due to IT as the two dominants stressors in the IT use context. Workload and uncertainty are also crucial antecedents of healthcare workers’ stress levels (McVicar, 2003). In this paper we decided to concentrate on the effect of two similar constructs, techno-overload - which refers to situation were IT pushes people to work longer and faster (Tarafdar et al., 2007) - and techno-uncertainty - which refers to situations where users are worried about their capacity to learn and adapt to the continuous changes and updates triggered by IT (Tarafdar et al., 2007) -, on post-implementation behaviours and more especially on exploration use behaviours.

This decision may allow us to contribute to the literature in two ways. First, by examining potential positive effects of these two constructs we try to provide a better understanding of how healthcare employees appraise and cope with technostress creators. Second, by studying their effects on technology usage, we extend current research which focus mainly on technostress consequences on work outcomes. The literature on technostress has, so far, mainly focused on the antecedents of technostress and its impact on work outcomes, such as employees’ satisfaction, innovation and performance (Chandra et al, 2015, Tarafdar et al. 2015, Tarafdar et al, 2007). However, despite active research on the field, we still know only really few regarding how technology related stressors impact post-implementation IT use behaviours, such as exploratory use behaviours, in specific contexts such as the healthcare sector. As underlined by Tarafdar et al (2010-2011) we need to know more on technostress impact on individual’s IT use behaviours and performance in particular work contexts. The healthcare sector is unique and requires to adapt IS theories to its social and technical distinctive features (Chiasson & Davidson, 2004) which turn it into an interesting environment to study.

Moreover, knowing more about healthcare employees exploratory use behaviours would be of particular interest as technology exploration is considered as crucial to reach benefits from IT on the long term (Maruping & Magni, 2015; De Guinea & Webster, 2013). Even if technology use is compulsory in healthcare, employees don’t always use IT to the same extent (Lanham et al. 2012). Thus, it is important to understand how technostress creators entice or constraint exploration of the technology.

Hence, we raise the following research question:

**What are the impacts of techno-overload and techno-uncertainty on users’ technology exploration behaviours, in the healthcare domain?**

In seeking to link technostress and IT usage at the individual level, we first draw upon activation theory (Gardner, 1986; Gardner & Cummings, 1988) and try to examine the possibility of a curvilinear relationship between technostress creators and exploration of the technology. In addition, based on recent findings of the innovation, information systems and stress literatures, we suggest that the extent to which individual will respond with exploration behaviours may depend on two main conditions. The first one, is the moderating effect of personal innovativeness with IT. The second one, is the moderating effect of social factors such as social support for exploration.

**Theoretical Background and Hypotheses Development**

Stress in the work domain results from an imbalance between the demands the employees have to face, and the resources or control they have over the situation (Karasek, 1979; Demerouti et al., 2001). In the stress literature, activation theory (Gardner & Cummings, 1988), states an inverted U-shape relationship between stress and performance, where an increase in job demands is beneficial for performance up to a certain level. Above this point the employees are completely overwhelmed and unable to deal with the
demands, which decreases their performance, while far below this point they see no interest in pushing their limits (Gardner & Cummings, 1988). In fact, individuals like to maintain stable routines and rarely change their behaviour without a good reason to do so (Janssen, 2001; Ohly et al., 2006). Thus, an intermediate to slightly high level of stress appears as the optimal option to increase performance and to entice innovative behaviours.

Several studies on organizational stress, have confirmed the existence of an inverted U-shape relationship between challenge stressors (such as time pressure or related constructs) and various employees' responses (e.g. (Janssen, 2001; Ohly et al., 2006)). However, the literature on the effect of hindrance stressors is sparser. While most of the literature on the subject prone a negative effect on performance and innovation, some researchers found a curvilinear relationship between role stress (role conflict and role ambiguity) and respectively performance and innovative performance (Wang & Hsu, 2014; Leung et al., 2011). Thus, Gilboa et al. (2013) in their review on the effects of hindrance stressors call for studying the potential curvilinear effects of other role stressors, such as role-overload.

**Technostress and IT Use**

Even if research has not directly examined the relationship between technostress creators and exploration of the technology by users, it has shown that emotions linked to stress, such as anxiety, could be both positively and negatively related to IT use (Beaudry & Pinsonneault, 2010). This suggests that the relationship between strain and IT use may not be linear. On the same vein, we could expect a nonlinear relationships between some technostress creators, which are responsible for strain, and exploratory use behaviours.

In line with the literature on stress at work, the IS literature has recognized the multiple facets of stressors and disruptive events related to IT, and has underlined that they could be appraised as challenges or as hindrances (Beaudry & Pinsonneault, 2005). Regarding the literature on technostress, Ragu-Nathan et al. (2008) defined techno-overload as a construct similar to role overload and techno-uncertainty as a construct similar to role ambiguity. As role overload and role ambiguity have consistently been acknowledged as hindrance stressors (Lepine et al., 2005; Cavanaugh et al., 2000), we can reasonably consider techno-overload and techno-uncertainty as hindrance techno-stressors.

Technology exploration deals with the extent to which users seek innovative ways to use the technology, in order to accomplish their tasks (Maruping & Magni, 2015). It involves experimentation, learning and adaptation (Liang et al., 2015). However, it really focuses on the innovative part of the behaviour. Thus, it is more specific than concepts such as Adaptive System Use (Sun, 2012) which are cyclical processes, including both exploitation and exploration.

**Techno-overload and IT Exploration**

Exploration is most of the time an extra-role behaviour. In this context employees need to be sufficiently motivated to exit exploitation and start exploring the technology (Liang et al., 2015). Thus, under situations of low techno-overload there are few chances that individuals start looking for new ways of using the technology, because they are not empowered to do so. This is particularly true in healthcare where employees' priority is the patients (Jensen & Aanestad, 2007). Hence, in this context, even if low overload could free up user resources to explore the technology (Sun, 2012), employees tend to prefer investing extra-time in taking care of the patients than in IT use or administrative tasks (Jensen & Aanestad, 2007). In case of low techno-overload, levels of technology exploration would stay low.

On the contrary, following activation theory, moderate levels of techno-overload might be optimal to increase exploration of the technology. In fact, users in situation of overload implement coping strategies (Gilboa et al., 2013). In healthcare, optimizing the workflow is essential (Strong et al, 2014). Moreover, in this context of technology mandatory use, exploration aims at increasing productivity (Maruping & Magni, 2012) and, can appear as the solution to decrease overload created by IT. Henceforth, exploration is necessary for users to find the features that match their work needs ( Thatcher et al., 2011). For these reasons, we suggest that in case of medium to moderately high techno-overload, levels of technology exploration would be high.

Finally, high levels of techno-overload, by increasing individuals workload, have been determined as detrimental for performance, (Tarafdar et al., 2015). On the same vein, extremely high levels of techno-overload will decrease exploration behaviours. In this situation, the users would be completely...
overwhelmed by the increasing demand and unable to cope with it, by investing time in exploration. This will also be reinforced by the fact that exploring the technology takes time (Maruping & Magni, 2012) and healthcare workers often have difficulties to find a compromise between workload and patients’ satisfaction (Strong et al. 2014).

Based on the above findings we suggest that:

H1a There will be an inverted U shape relationship between techno-overload and technology exploration such that intermediate or moderately high levels of techno-overload will be associated with the highest technology exploration.

Techno-uncertainty and IT Exploration

Lanham et al. (2012) showed that physicians’ perception of uncertainty could have an impact on the way they used the technology. Under situations of low techno-uncertainty there are few chances that healthcare employees start exploring the technology. In fact, if the technology stays the same, without any particular update requiring adaptation or learning, they tend to think they don’t need to upgrade their knowledge. This is particularly reinforced by the fact that time for patients is most of the time already limited in healthcare (Oroviogoechea et al., 2008). In this context, exploration can seem a waste of time. Above all, healthcare employees are used to follow formal procedures and routine activities (Hanseth & Bygstad, 2015). For these reasons, low-level of techno-uncertainty would lead to low levels of exploration behaviours.

On the contrary, following activation theory, a moderate level of techno-uncertainty would entice users to explore the technology in order to adapt, learn and stay updated. In fact, the frequent updates keep IT users stimulated to adapt their work styles (Hung et al., 2014) and to explore new ways of being more efficient with the technology. Above all, healthcare technologies tend to reinforce the interdependence between employees (Edmondson et al., 2001). This interdependence requires people to coordinate. Thus, healthcare employees know they will have to adapt to the changes and updates coming. The uncertainty related to IT coming changes, entice them to explore IT in order to still be able to perform well. In case of moderate techno-uncertainty, levels of exploration would be high.

Finally, too much techno-uncertainty is detrimental for performance (Tarafdar et al., 2015) and will probably discourage exploration of the technology. In fact, in professional contexts with time pressure, such as healthcare, technology use, and behaviours such as IT exploration are goal directed behaviours (Burton Jones & Grange, 2012). Thus, users engage in exploration when they expect this behaviour will allow them to increase their performance (Magni et al., 2010). However, results from exploration are not always immediate (Burton-Jones & Straub, 2006) and if technology changes and updates are too frequent, users will consider they won’t have time to benefit from their exploratory use behaviours, which will decrease their propensity to explore the technology.

Based on the above findings we suggest that:

H1b: There will be an inverted U shape relationship between techno-uncertainty and technology exploration such that intermediate or moderately high levels of techno-uncertainty will be associated with the highest technology exploration.
Influence of Personal Innovativeness with IT

Personal innovativeness with IT (PIIT) reveals a person willingness to try out new technologies (Agarwal & Prasad, 1998). Specifically it reflects a person readiness and tendency to engage in innovative behaviours with the technology. It is based on the concept of cognitive styles (Kirton, 1976) but is adapted to the specific context of IT use. PIIT does not always show a direct effect on exploration (Thatcher et al., 2011).

Some authors underline personal innovativeness with IT’s role, in healthcare workers IT acceptance and use (Wu et al., 2011. This paper tries to extend previous research by looking for a potential moderating effect of PIIT on the inverted U shape relationship between techno-overload and technology exploration. Based on activation theory, we suggested that users experiencing intermediate levels of techno-overload should be more likely to try to improve their use to be more efficient, and thus would tend to explore the technology. Nevertheless, individuals differ in their energy to take corrective actions and cope with problems. Innovative people are, according to the Innovator-adaptor theory, more prone to take risks and like to try to change and improve things (Kirton, 1976). Therefore, they should respond with increased exploration to intermediate techno-overload.

On the contrary people with a low level of PIIT are more likely to be risk averse. Most of the time low innovative people don’t like to challenge the status quo and to go out of the beaten track. They will tend to stick to the norms and to the official way of doing things (Zhou, 2003). As exploration has been acknowledge as a risky behaviour (Thatcher et al., 2011), low innovative people should be less likely to answer with increased exploration to intermediate techno-overload.

Based on the above discussion we suggest that:

\[ H2: \text{Personnel innovativeness with IT will moderate the inverted U shape relationship between techno-overload and technology exploration such that users who score high on personal innovativeness with IT will exhibit higher level of technology exploration in response to intermediate to moderately high techno-overload, than those who score low.} \]

Influence of Perceived Support for Exploration

The IS literature has often underlined the role of contextual variables such as support, in influencing exploration and innovative technology use behaviours (Maruping & Magni, 2015; Maruping & Magni, 2012; Nambisan et al., 1999) but also in helping to inhibit technostress effects (Tarafdar et al., 2015; Tarafdar et al., 2011). In healthcare, team and leader support for innovation are powerful predictors of innovation (West et al., 2003). On the same vein, we can expect that support for exploration is an important factor in the likelihood that users’ respond to techno-overload with exploration of the technology.

We define support for exploration as the extent to which colleagues and supervisors encourage employees to explore the technology. We suggested earlier that users experiencing intermediate levels of techno-overload would answer by exploring the technology. However, the degree to which they answer with exploration might depend on the extent to which exploration is welcomed and rewarded (Liang et al., 2015). It is important to remember that healthcare is a highly regulated and procedural environment (Goo et al., 2015). Thus, healthcare workers often feel pressured to conform to the norm.

Exploration is based on experimentation (Goo et al., 2015) and results from exploration are difficultly predictable (Burton-Jones & Straub, 2006). In these conditions, support for exploration provides the necessary encouragement and reassure users by suggesting that risky behaviours, like exploration, and potential failures resulting (Liang et al., 2015), are accepted and valued. In healthcare, employees often work together and nurses receive an education that entices them to respect others suggestion and opinions. In this context, they really value their colleagues and supervisor opinions and suggestions, when making decisions related to innovation (Hung et al., 2014). Thus, while users in context were support for exploration is high, are encouraged to start and pursue exploration, users in context of low support for exploration might not persist in their exploratory efforts. In fact, they might consider it as an illegitimate behaviour, too risky to be handled.

Based on the above discussion we suggest that:
**H3:** Support for exploration will moderate the inverted U shape relationship between techno-overload and technology exploration such that users who receive high levels of support will exhibit higher level of technology exploration in response to intermediate to moderately high techno-overload, than those who receive low support.

**Proposed Research Method**

**Data Collection**

The study will take place in French and Italian nursing homes. In this sector healthcare IT use is critical and pressured (Kohn et al. 2000) which add to the challenges of nursing which is consistently recognized as a stressful occupation (Lee & Akhtar, 2011). As explained in the theoretical part, healthcare workers keep some degree of freedom in the way they use the technology (Lanham et al., 2012). Thus, this context provides a rich setting to study the impact of techno-overload and techno-uncertainty on exploratory use behaviours.

Respondents will be caregivers and administrative staff of the nursing homes. They will be asked to complete a hand-delivered questionnaire regarding their IT use. Participation will be on a voluntary basis.

**Measures**

Wherever possible we will use or adapt existing scales, whose validity and reliability have been proven. Items will be translated from English to French and Italian following a back-translation procedure to avoid any translation mistakes (Brislin, 1980). All the constructs will be measured using a seven-likert scale ranging from “strongly disagree” to “strongly agree”.

**Techno-overload.** Techno-overload will be measured using three items adapted from Ahuja & Thatcher (2005).

**Techno-uncertainty.** Techno-uncertainty will be measured thanks to four items adapted from Tarafdar et al. (2007).

**User technology’s exploration.** Technology exploration will be measured thanks to three items from Liang et al. (2015).

**Support for exploration.** Perceived support for exploration will be measured thanks to five items built on the Perceived Organizational Support for Creativity scale (Zhou & George, 2001).

**Personal innovativeness with IT.** Personal innovativeness with IT will be measured thanks to four items from Agarwal and Prasad (1998).

**Control variables.** Gender (Maruping & Magni, 2012), age (Ahuja & Thatcher, 2005, Liang et al., 2015) and experience (Magni et al., 2010) have often been considered as impacting exploratory use behaviours or similar concepts. To reduce the risk that these variables confound the relations studied in this research we will control for their potential effects. Psychological safety has also been acknowledged as having a potential effect on learning and innovative behaviours (Edmonson et al., 2001). Thus we will control for its effect using six items from Edmonson (1999).

**Data Analysis**

First, we will conduct a confirmatory factor analysis to test the reliability and validity of the measurement model.

Second, since the independent variables are continuous, we will conduct hierarchical regression analysis to test the hypotheses (Cohen & Cohen, 1983). Before forming the cross-product for testing the interaction effects we will follow Aiken and West (1991) advises and will mean-center the independent variables. Doing so will allow to reduce possible non-essential multicollinearity. Regarding the test of the hypothesized curvilinear (inverted U-shape) relationship between techno-overload and exploration we will use a three step procedure (Janssen, 2001): first we will enter our control variables (age, gender and education) into a regression equation, second we will add techno-overload, and the interaction term, third we will include techno-overload squared and its interaction term with perceived support for exploration (techno-overload² X perceived support for exploration). We will follow the same procedure to test the potential moderating effect of personal innovativeness with IT, replacing perceived support for exploration by personal innovativeness with IT (techno-overload² X personal innovativeness with IT).
Expected Contribution and Conclusion

This paper aims at responding to the unanswered question of whether all technostress creators have negative consequences for IT use behaviours on the post-adoption stage. By using activation theory (Gardner & Cummings, 1988) this study might contribute to a better understanding of the role of technostress creators and address the gap regarding their potential ambivalent role (Nastjuk & Kolbe, 2015) on IT use behaviours.

Overall, these findings may extend the linear negative relationship between technostress and outcome variables reported by Tarafdar (2015). If the curvilinear effects of techno-overload and techno-uncertainty are confirmed, these would also provide a convincing case for the need to explore potential curvilinear effects of other technostress creators on IT use behaviours. A confirmation of the role of techno-overload and techno-uncertainty on exploration use behaviours would be of particular interest. While knowing more and more on the effect of technostress creators on work outcomes, we still know really few regarding their concrete effects on post-adoption IT use behaviours. Moreover, if the moderated effects are confirmed this could provide a good starting point to explain the complex relationships between technostress creators and IT use behaviours. This would also call attention on the role of support and other contextual variables on individual system use behaviours.

Regarding practice, this research could help healthcare managers to better understand the circumstances under which techno-overload and techno-uncertainty have a positive versus negative influence on IT exploration. Thanks to that, healthcare managers will be able to motivate employees to explore the technology when necessary, by playing on time pressure or workload and by increasing/decreasing the frequency and number of updates of the technology. These two levers can be particularly useful in the healthcare context, where levels of underutilization and resistance to the technology are often high (Lapointe & Rivard, 2005, Kane & Labianca, 2011). We hope this study will entice researchers to extend the research on the role of IT related stress on subsequent use behaviours.
References


