The Effects of Techno-Stress in the Role Stress Context Applied on the Proximity Manager Performance:
Conceptual Development and Empirical Validation

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ABSTRACT

The ubiquitous use of ICT can create "techno-stress." The purpose of the research is to examine the case of the specificity of the techno-stress phenomenon of local managers. The authors develop their research questions on the factors that create the techno-stress and the role stress of the proximity manager. How do the creators of techno-stress influence the performance of the proximity manager? Techno-stress creative factors of the managers have been adjusted thanks to the factorial analysis. The authors believe that 1) the role stress of local managers can be explored by ambiguity and role proximity, and 2) the creator of techno-stress negatively influences the performance of the managers of proximity by role stress.

INTRODUCTION

Since 2005, rapid growth in access to information and communication technologies (ICTs) has been observed[1]. According to the International Telecommunication Union, this trend reflects that international institutions that "consider information and communication technologies as the integration of telecommunications, computer, multimedia, and audiovisual technologies."

Opting for a new ICT, or NICT, is often a process of change and innovation (Bobillier-Chaumon, 2009). For two decades, this change has been permanent—that is, the growth of communication tools is exponential, indicating a state of a continuous change. Some companies are continuing this trend by developing and applying their own ICT portfolio.

Managers are currently facing the challenge of ICT diversification both from a managerial perspective and also because of their role as an intermediary between employees and the organization. On the other hand, we are interested in different ICTs, such as massagers (personal or corporate), software packages or application software, voice communication (e.g., Skype and WhatsApp), and digital social networks (e.g., Twitter and LinkedIn).

The purpose of our research is to examine the specificity of "techno-stress" experienced by proximity managers (PM)[2]. To better understand the problem, we develop the following research questions:

Research question I. What are the factors that create techno-stress and role stress among PMs?
Research question II. How do the creators of techno-stress influence the performance of PMs?

First, we decipher the factors that influence the PM's techno-stress and role stress. Then, we examine the mechanism thereof by identifying the mediating effect of role stress between techno-stress creators and PMs' performance. To better reflect the research questions and establish our questionnaire, we begin by conducting a preliminary survey of telecommunications carriers in Canada[3].

LITERATURE REVIEW AND THEORY

Phenomenon of Techno-Stress

ICT "designates tools for which the processing capabilities of computer processors are coupled with communication technologies" (e.g., telematics, electronic messaging, groupware, communicating office automation, Internet, and intranet) (Autissier et al., 1997). In reality, a large number of companies deviate from this original vision of ICT. Autissier and Lahlou (1999) call this phenomenon the "informational inflation of information and communication technologies." We can observe this phenomenon through temporal notions (Metzger, 2004), urgency (Aubert, 2004), and techno-stress (Tarafdar et al., 2007) if the information overload is a quantitative measure to define a mass mobilization of ICT that aims to perform tasks. The mixing effects of several modes of communication lead to the *millefeuille effect* (Kalika et al., 2007). As Steward Brand[4] notes, "Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road."

Ayyagari et al. (2011) claim that the characteristics of ICT create stress, which, in turn, has an effect on health costs and productivity. Emerging academic research is beginning to focus on several areas that characterize this negative aspect of ICT use. The elements that can be linked to techno-stress include the stress associated with the use of information technology, dependence, misuse, overwork, and interruption (Tarafdar et al., 2015). Techno-stress is linked to adverse effects such as decreased job satisfaction, engagement, and productivity as well as an increase in work overload and labor disputes (Tarafdar et al., 2007).

Thus, we pose the question: Are you unable to go on vacation without a computer? Do you check your messages on your mobile phone every five minutes? Are you typing on the table because your Internet is idle or not working anymore? If you answer in the affirmative to any of these questions, you may be suffering from techno-stress.

Techno-Stress

There exist recent high-quality studies on techno-stress in the literature. These studies provide valuable insights into techno-stress, such as the main factors that contribute to its development (Lei & Ngai, 2014). Scholars also emphasize the link between techno-stress and job satisfaction and performance, while others believe that techno-stress generates a job–family conflict. Although ICTs can improve flexibility and work–life balance, it can facilitate the reversal of work in the family domain (Weil & Rosen, 1997).

According to Tarafdar et al.(2011), the creators of techno-stress and the associated results are the main findings that define techno-stresses such as "[a] manifestation of an undesirable phenomenon generated by the use of IS (information system)in the place working" (Tarafdar et al., 2015). The authors note that three key aspects of techno-stress are:

- Creators of techno-stress (factors that create stress)
- Consequences of techno-stress (unfavorable conditions manifested by the individual in response to the stress process)
- Techno-stress inhibitors (factors that moderate stress)

We thus review the literature on the different concepts of techno-stress. This section will allow us to not only provide a theoretical foundation for the term, but also facilitate an understanding of the link between the mechanism (creator of techno-stress and mitigation) and consequences of techno-stress (satisfaction/performance role of stress and productivity/innovation).

Extant research examines the influence of the creators of techno-stress on work—that is, it studies the link between creators of techno-stress and job satisfaction or performance, such as by Tarafdar et al. (2010, 2011, 2015). Further, Rizzo et al. (1970) derive the elements of role stress from the constructs of role ambiguity, role overload, and role conflicts. Srivastava, Chandra, and Shirish (2015) claim that certain personality traits combined with the creators of techno-stress can lead to positive results in work. Alam (2016), on the other hand, links the creators of techno-stress and productivity to develop three factors of techno-stress: techno-complexity, techno-uncertainty, and techno-overload. The author also finds that their relationship is negative on the productivity of the crew.

According to the literature, there are different currents concerning techno-stress. This distinction is made mainly through the double-edged (Lei & Ngai, 2014) and neutral aspects of techno-stress from a global perspective. Selye (1979) suggests that stress creator distinctions should be based on the type of stress and not on the level of stress. Because it is not any techno-stress that yields a negative result, different types of techno-stress should be evaluated differently. For example, the stress factors related to the company policy—the role stress—is qualified as a type of negative stress because the managers consider these stresses constraining effects on employees' professional careers. Such stresses offer no room for the realization of quotas, and is, thus, a *bad stress*.

According to Lei and Ngai (2014), techno-stress is described as a working accelerator; it allows the employee to work faster and be more motivated while waiting for a reward or moral recognition from the manager. Lei and Ngai, thus, base their claim on the techno-stress factor of Ayyagari et al. (2011)—"work overload, work-family conflict, invasion of privacy, role ambiguity and job insecurity"—to explain that ICT users may offer different assessments of different techno-stresses. Thus, techno-stress factors are identified as a challenge that often includes "measures of work/role demands, pressure, urgency of time and workload" (LePine et al., 2005).

Thus, Lei and Ngai (2014) claim that work overload is a neutral creator of techno-stress (i.e., with positive and negative effects) because it can stimulate employees' work efficiency by allowing them to perform different tasks simultaneously and quickly. On the other hand, it is a vital link between performance and evaluation thereof by the manager. Hence, it does not contribute as a favorable techno-stress, since it is likely to be evaluated as a threat. One (or more) creator of techno-stress allows us to better understand the different factors of techno-stress; this way, ICT users can collectively determine their level of techno-stress (Tarafdar et al., 2007). Tarafdar et al. (2007) cite five creators of techno-stress: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. These are characteristic factors of technology that could generate stress for users.

Creator of Techno-Stress in Five Frames

The five factors associated with the creators of techno-stress (techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty) reduce the efficiency with which ICT users can improve their performance at work (Tarafdar et al., 2010). Thus, these effects are related to individual characteristics of personality and interpersonal relationships (Kahn et al., 1964). We identify the factors that produce techno-stress in the following five frameworks: PM tasks, role of PM, organization, professional career, and private life.

Techno-overload and the manager's task frame: In this case, there is increased workload because of technology. According to Davis (2002), ease of access to information has led managers to communicate more information than necessary and receive more information than they can process and use.

Techno-complexity and the role of the manager: This describes situations wherein the complexity associated with ICT renders the skills of managers inadequate and forces them to devote time and effort to learning and understanding various aspects of ICT (Ragu-Nathan et al., 2008). An individual experiences a role conflict when exposed to conflicting or incompatible role demands (Tarafdar et al., 2007). Managers often play several roles within the organization. Apart from their daily tasks of managing, they must also oversee the tasks of their team. In this case, a managerial role conflict is inevitable.

Techno-uncertainty and the organizational framework: Techno-uncertainty refers to contexts wherein persistent changes and upgrades in an ICT are distracting users and creating uncertainty for them—they must constantly learn new ICTs (Ragu-Nathan et al.,2008). This phenomenon often has an organizational and interpersonal effect. Thus, this uncertainty is oriented not only toward employees, but also toward managers (team leader), which can create an interpersonal conflict.

Techno-insecurity in the professional carrier context: This concerns the threat of job loss associated with techno-insecurity (Fuglseth & Sørebø, 2014).

Techno-invasion in privacy: Techno-invasion describes the invasive effect of ICTs in creating situations wherein users are reachable at all times and places, as managers feel the need to be constantly connected (Gaudioso et al., 2017). Techno-invasion mainly refers to the overflow of professional life into the private sphere of the manager. The five creators of techno-stress classified into five different frameworks makes our understanding of the causes of techno-stress in the managerial context easier.

Role Stress for Proximity Managers

Roles are naturally linked to a set of expectations based on the prescriptions of others who interact with the organizational system in which they play a central role (Wincent & Örtqvist, 2009). Glazer and Beehr (2005) state that organizational stressors include role overload, role conflict, role ambiguity, and role proximity. A conceptual analysis of role stress can reveal it to be an important mediator and a key construct between techno-stress creators and individuals' performance. We first propose to distinguish between the two types of managers: intermediate managers (IMs) and PMs. They are then "designated rightly or wrongly as guarantors of social support in organizations" (Codo & Soparnot, 2013).

Role Overload

Role overload occurs when the perceived expectations of stakeholders are impossible to achieve within given limits (Wincent & Örtqvist, 2009). In other words, the extent to which the time and organizational resources available to the person are insufficient to meet the expectations of the defined role (Latack, 1981). On the other hand, there is role overload when managers have multiple roles (Tarafdar et al., 2007). According to Delaye and Boudrandi (2010), the MP is gradually becoming a facilitator who must listen to her or his colleagues and seek consensus and harmony in the team.

Role Conflict

Role conflicts occur when a lack of expectations is associated with a role. The latter often concerns a conflict between the individual's time, resources, or abilities (Rizzo, 1970). Moreover, several managers may have contradictory expectations (Veloutsou & Panigyrakis, 2004). In our preliminary case, some PMs in the telecommunications field suffered from discrepancies only because of different habits or modes of use of certain customer service software. Finally, there exists role conflict between requirements and role expectations (Souder, 1981).

Role Ambiguity

Role ambiguity is the degree of lack of clear information about the expectation associated with a role, method for fulfilling known role expectations, consequences of role performance (Kahn, 1964). Studies identify role conflicts and ambiguity as relevant predators, employee absenteeism, role demands (Schaufeli et al., 2009), and a history of burnout (Olivares-Faúndez et al., 2014). Thus, role conflicts and ambiguity appear to lead to a decline in productivity, tension, dissatisfaction, and psychological withdrawal from work (Van Sell et al., 1981).

Role Proximity

The PM organizes the collective of work and makes the decisions closer to the employees; this represents an essential relay with the hierarchy of the company (Scotto, 2014). According to Peretti (2006), any PM combines the rationality of the turnover and the corporate strategy, but also occupies the mission of human resource of her or his team. Thus, the manager should be the "transmission belt" between the strategy and the technical area (Mélèze, 1972). For this, she or he must demonstrate an ever-increasing ability to take responsibility (Delaye & Boudrandi, 2010). These role proximity characteristics allow managers to be the first (in the best case) to detect stress in the employment relationship (Mansour & Commeiras, 2015).

Finally, we consider that the PM obeys a double techno-stress, that is, she or he undergoes stressful situations like any other individual and suffers the indirect effect of the team's techno-stress (*see* Figure 1).

METHODOLOGY

Model Development

We describe the research design in Figure 2 below: The focus of technostress is on the technostress creator, role stress, and performance of the PM in the context of ICT use.

First, we highlight the set of assumptions that give meaning to the five creators of techno-stress in the specific context of a managerial role in order to understand how managers feel the stress associated with the use of ICT (**H1**). Then, we consider the theme of the role of an individual as a PM in the organization combined with techno-stress in order to determine if the role overload (**H2a**), role conflict (**H2b**), ambiguity of role (**H2c**), and role proximity (**H2d**) are positively related to role stress. This way, we are able to understand how creators of techno-stress can increase role stress (**H3**). Job performance indicates that management is executed through the performance of work in the role prescribed by an organization as well as innovative and more spontaneous work behaviors (Katz, 1964). In our case, the work performance of the PMs is related to the activity and function of the PM and her or his team. This varies by department. We thus distinguish the performance of the PM by individual performance (*IP*) and group performance (*GP*) (**H4**). Finally, we consider role stress—that is, the hypothesis of role stress as a mediator between the creator of techno-stress and the PM's performance (**H5**).

Hypotheses

From the literature, we highlight the set of propositions that give meaning to the five creators of techno-stress in the specific context of a PM role in order to understand how PMs feel about the associated stress from ICT use. We propose the following hypotheses:

H1: The five frames of techno-stress creators positively generate techno-stress.

Figure 1. Double effects of techno-stress on the PM
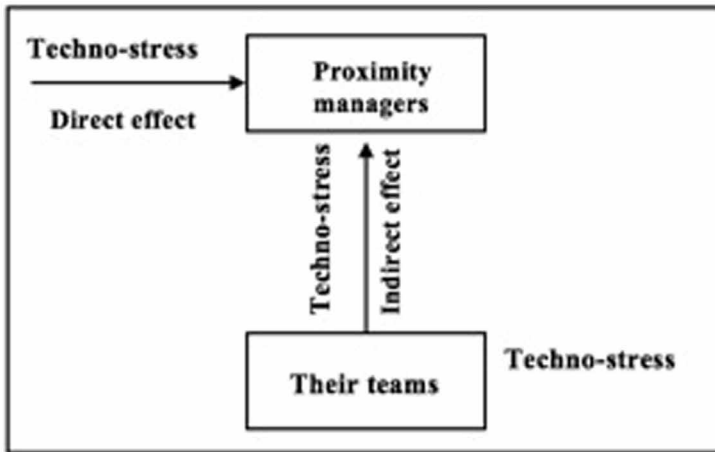
Figure 2. Research design: Technostress creator, role stress, and performance of proximity manager
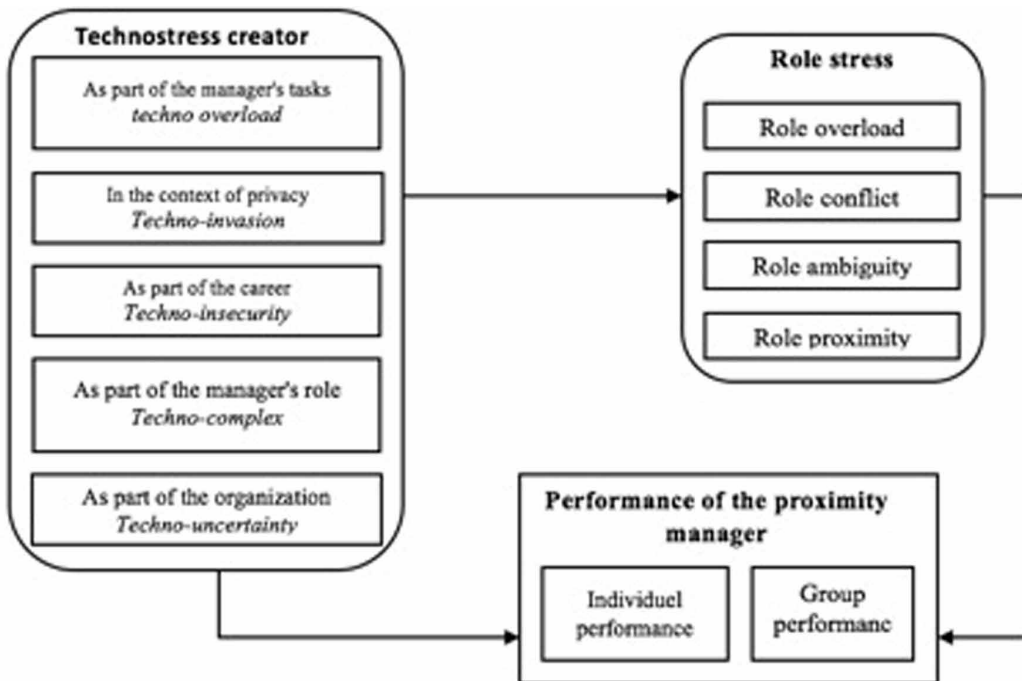
We consider the theme of the role of an individual as the PM in the organization, along with techno-stress, and, thus, seek to determine if role overload (RO), role conflict (RC), role ambiguity (RA), and proximity of role (RP) are positively related to role stress. Thus,

H2a: Role overload by the PM is positively related to role stress.
H2b: Role conflict by the PM is positively related to role stress.

H2c: Role ambiguity by the PM is positively related to role stress.
H2d: Role proximity by the PM is positively related to role stress.

To understand how creators of techno-stress can increase role stress, we formulate the following hypothesis:

H3: The creator of techno-stress is positively related to role stress.

Finally, as stated earlier in this section regarding job performance, we distinguish the performance of PMs by *IP* and *GP*. We thus hypothesize:

H4: The creator of techno-stress is negatively related to the PM's performance.

Finally, regarding role stress, we hypothesize that

H5: Role stress is negatively related to the PM's performance.

Our research model, described in figure 3, proposes that consistent with the relations between *technostress creator, role stress, and performance of proximity manager* described in figure 2

Method and Data Collection

We used the questionnaire methodology to collect data and test our research model. The data were collected through questionnaires distributed to the PMs (managers or team managers) of organizations that extensively use ICT to perform their professional tasks. In our questionnaire, we asked all respondents what types of ICT they use. To maintain anonymity of respondents' information, we

Figure 3. Research model. Note: Techno-overload (*CTS_OV*); Techno-invasion (*CTS_INV*); Techno-complex (*CTS_COM*); Techno-insecurity (*CTS_INS*); Techno-uncertainty (*CTS_UNC*); Role overload (*RO*); Role conflict (*RC*); Role ambiguity (*RA*); Role proximity (*RP*); Individual performance (*IP*); and Group performance (*GP*).
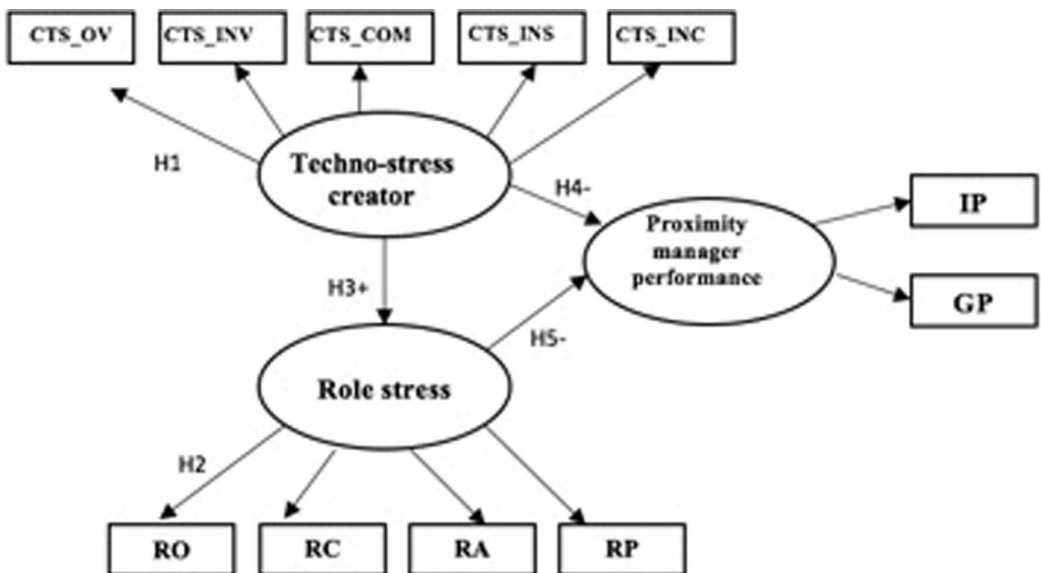
asked respondents questions on company size and type of business sector but avoided asking questions on their name and the name of the company (we make exceptions wherein people have accepted that we quote their company and the position occupied).

Incomplete responses were removed from the sample—for example, we reject questionnaires with missing important information (e.g., type of business sector, gender, or seniority). We asked respondents that "In general, do you feel a form of burnout at work? If so, is this exhaustion related to ICT?" Responses from individuals who did not fit the criteria in the sample were excluded, that is, responses that do not include the reference to the link between work exhaustion and ICT use, since we are working on the harmful side of techno-stress associated with the use of ICT. All items were measured on a five-point Likert scale, where "1" means "I totally disagree" and 5 means "I totally agree."

Based on the reviewed literature and hypotheses, we established the elements for the construction of items. Following Tarafdar (2008), we develop the techno-stress creator items based on 27 items. Role stress items were derived from Tarafdar's (2011) concepts of role ambiguity, role overload, and role conflict. PM performance items were based on the amount of work (Gilboa et al., 2008), quality of work (Ones et al., 1996), presence, interpersonal relationship (Lu et al., 2010), and knowledge sharing (Tarafdar, 2007).

An online link to the questionnaire was attached to the e-mail invitation, reminding participants of anonymity and voluntary participation. A reminder email was sent a few days after the initial invitation in order to increase the response rate.

Our database included French, Canadian, Moroccan, and Chinese respondents. The questionnaire in French was submitted to different managers in France, Canada, and Morocco. Among the respondents, we included audit managers from the People's Bank in Morocco, insurance managers at the MMA in France, and a manager at the Atomic Energy Commission in Canada. We received answers from managers in the legal field as well (senior partner in law firms.) and telecommunications. The form in English was submitted to various Chinese managers in the fields of trade, banking, and tourism. Table 1 shows the respondents' data.

ANALYSIS AND RESULTS

First, we consider the identification of the reliability and the validity of the variables (items) by the factor analysis method. "Factor analysis is appropriate from an exploratory point of view (exploratory factor analysis or AFE)" (Carricano et al., 2010). This method is used to describe the data in an aggregate number of factors; it also provides discriminant validity for the factors (Tarafdar et al., 2007). We estimate the reliability with Cronbach's alpha coefficient, where the objective is to check if "the statements share common notions, and if they are coherent between them" (Carricano et al., 2010). Table 2 presents the results of the factor analysis and Table 3 shows the item outcomes as well as the reliability of each variable, which is at an acceptable threshold between 0.7 and 0.9. Finally, to keep a correlated and reliable set of items, Table 4 shows the correlation matrix among different components.

We used the partial least squares regression approach on AMOS to test our hypothetical relationships. The T-tests for the "path" coefficients were obtained by bootstrapping, generated by 343 samples of which 318 are valid. This re-sampling, by default, allows us to provide reasonable standard estimates (Chin, 1998).

Figure 4 shows the partial least squares model and the coefficients with significance levels. To respond to the relationships between technostress creator, role stress, and PM's performance described in Figure 2, we consider that the technostress creator, role stress, and PM's performance are significantly linked. Then, role stress emphasizes that techno-stress creators influence the performance of PMs negatively when the level of role stress increases.

Table 1. Demographic samples

Panel A: Genre		
	Workforce	Pourcentage Valide
Man	171	55,7
woman	141	44,3
Total	318	100,0
Panel B: Age of respondent		
	Workforce	Pourcentage Valide
- 25 years	41	12,9
Between 25 years and 35 Between 35 years and 50	70	22,0
	144	45,3
+ 50 years	63	19,8
Total	318	100,0
Panel C: Respondent's level of education		
	Workforce	Pourcentage Valide
No diploma	44	13,8
Bachelor's / College	106	33,3
BTS/IUT /Certificat/Licence	121	38,1
Master and more	47	14,8
Total	318	100,0
Panel D: Seniority of the respondent		
	Workforce	Pourcentage Valide
-1 year	73	23,0
Between 1 year and 2 years	129	40,5
Between 2 years and 5 years	73	23,0
+ 5 years	43	13,5
Total	318	100,0
Panel E: Respondent's activity area		
	Workforce	Pourcentage Valide
Industry	114	35,8
Trade	15	4,7
Telecommunication	68	21,4
Bank / Insurance / Financial Services	20	6,3
data processing	15	4,7
Hospitality and Tourism	35	11,0
Transport and logistics	24	7,5
Juridic	20	6,4
Other sectors	7	2,2
Total	318	100,0
Panel F: Respondent's country		
	Workforce	Pourcentage Valide
France	91	28,6
Canada	70	22,0
Morocco	84	26,4
China	73	23,0
Total	318	100,0

Table 2. Component matrix

		CTS-OV	CTS-INV	CTS-COM	CTS-INS	CTS-INC	RO	RC	RA	RC	IP	TP
CTS-OV	1	0.653										
	2	0.621										
	3	0.699										
	4	0.746										
	5	0.768										
	6	0.616										
CTS-INV	7		0.608									
	8		0.774									
	9		0.759									
	10		0.733									
	11		0.622									
CTS-COM	12			0.773								
	13			0.569								
	14			0.704								
	15			0.742								
	16			0.597								
	17			0.607								
CTS-INS	18				0.441							
	19				0.587							
	20				0.581							
	21				0.503							
	22				0.642							
CTS-UNC	23					0.6						
	24					0.410.						
	25					0.764						
	26					0.807						
	27					0.751						
RO	28						0.865					
	29						0.847					
	30						0.918					
	31						0.843					
	32						0.865					
	33						0.841					

Table 2. Continued

		CTS-OV	CTS-INV	CTS-COM	CTS-INS	CTS-INC	RO	RC	RA	RC	IP	TP
RC	33							0.815				
	34							0.858				
	35							0.817				
	36							0.891				
	37							0.891				
RA	38								0.6			
	39								0.833			
	40								0.829			
	41								0.86			
	42								0.838			
	43								0.752			
	44								0.759			
	45								0.749			
	46								0.805			
RP	47									0.835		
	48									0.879.		
	49									0.838		
	50									0.826		
	51									0.836		
IP	52										0.839	
	53										0.846	
	54										0.851	
	55										0.83	
GP	56											0.839
	57											0.839
	58											0.765
	59											0.913
	60											0.926
	61											0.756

We performed a partial least squares regression model on H1, H2, H3, H4, and H5. We find that the variables techno-invasion (*CTS_INV*), techno-complexity (*CTS_COM*), techno-insecurity (*CTS_INS*), and technology uncertainty (*CTS_UNC*) have direct effects on the creator of techno-stress. On the other hand, techno-overload (*CTS_OV*) does not directly generate techno-stress on PMs.

There exists a significant relationship between role ambiguity (*RA*) and role proximity (*RP*) on role stress; by contrast, role overload (*RO*) and role conflict (*RC*) do not directly influence role stress. Thus, when the creator of techno-stress increases, the role stress increases. Further, relationship between the creator of techno-stress and PM's performance is not significant.

Finally, role stress is negatively related to the performance of the PM. That is, when role stress increases, the PM's performance decreases. We summarize the results in Table 5.

Table 3. Item development and evaluation of the reliability of the variables

Item		Item description	Average	Standard deviation
Creator of techno-stress (Item 1)	Techno-overload (CTS-OV) (Tarafdar, 2008) Reliability:0.907	1) I am forced by this technology to work much faster. 2) I am forced by this technology to do more work than I can handle. 3) I am forced by this technology to work with very tight schedules. 4) I am forced to change my work habits to adapt to new technologies. 5) I have a higher workload because of the increased technological complexity. 6) I am obliged because of this (these) TIC (s) to manage more unforeseen, conflicts, and problems of people of my team. *	25.242	2.860
	Techno-Invasion (CTS-INV) (Tarafdar, 2008) Reliability:0.746	7) I spend less time with my family because of this technology. 8) I have to be in touch with my work even during my holidays because of this technology. 9) I think that my personal life is invaded by this technology. 10) I feel overwhelmed by the decisions to be made about new technologies. * 11) I must be in contact all the time to research and disseminate information to my teams, my network or my business relationships depending on the circumstances. *	21.396	1.907
	Techno-Complex (CTS-COM) (Tarafdar, 2008) Reliability:0.899	12) I do not know enough about this technology to handle my work satisfactorily. 13) I need time to understand and use new technologies. 14) I find new recruits to this organization to know more about computer technology than me. 15) I often find it too complex for me to understand and use new technologies. 16) I play multiple roles within business because of this ICT. * 17) I find that the complexity of the newly introduced ICT increases the risk of conflict between the person's time, resources or abilities. *	25.492	2.644
	Techno-Insecurity (CTS-INS) (Tarafdar, 2008) Reliability:0.790	18) I feel a constant threat to my job security because of new technologies. 19) I need to constantly update my skills to avoid being replaced. 20) I am threatened by colleagues with new technological skills. 21) I do not share my knowledge with my colleagues for fear of being replaced. 22) I think there is less sharing of knowledge between colleagues, for fear of being replaced.	21.037	2.704
	Techno-Uncertainty (CTS-UNC) (Tarafdar, 2008) Reliability:0.872	23) There are always new developments in the technologies we use in our organization. 24) There are constant changes in the software of our organization. 25) There are constant changes in the computer hardware of our organization. 26) There are frequent upgrades in the computer networks of our organization. 27) There is always a TIC malfunction constraint (the software or program does not work. *	20.653	3.298
Role stress (Item 2)	Role overload (RO) (Rizzo, 1970) Reliability:0.931	28) I have to take work at home at night or on weekends. 29) The requests for quality work done on me are unreasonable. 30) I spend too much time at unimportant meetings that keep me away from my job. 31) I am responsible for an almost unmanageable number of projects or missions at the same time. 32) I just have more work to do than can be done in an ordinary day. 33) I feel that I just do not have the time to take an occasional break.	25.926	3.297
	Role conflict (RC) (Rizzo, 1970) Reliability: 0.898	34) I am working on unnecessary tasks or projects. 35) I find myself in the middle of conflicts between my supervisors and my subordinates. 36) The formal chain of command is not respected. 37) I do things at work that are accepted by one person and not by others. 38) I receive conflicting requests from two or more people.	22.266	3.055
	Role ambiguity (RA) (Tarafdar, 2011) Reliability: 0.920	39) My tasks and work goals are not clear to me. 40) My assigned tasks are sometimes too difficult and / or complex. 41) I do not have the authority to exercise my professional responsibilities. 42) The tasks seem to become increasingly complex. 43) I do not completely understand what is expected of me. 44) The organization expects more from me than what my abilities can provide. 45) I do not understand the role of my work in achieving overall organizational goals. 46) I do not have enough training and/or experience to properly perform my duties.	37.585	4.113
	Role proximity (RP) (Delaye, 2010) Reliability: 0.896	47) I need to be in touch all the time. * 48) I have permanent decision making. * 49) I play the role of transmission channel between the strategy and the technical area. * 50) I must be listening to people on my team and looking for the consensus and harmony of my team. * 51) I must always have a growing attitude to taking responsibility. *	19.873	3.497

Table 3. Continued

Item		Item description	Average	Standard deviation
Performance du manager (Item 3)	IP (*Gilboa et al., 2008*) (*Viswesvaran et al., 1996*) (*Lu et al., 2010*) Reliability:0.860	52) These new ICTs help improve my work productivity. 53) These new technologies give me the motivation to go to work every day. 54) This technology serves and maintains the technical core of my team's function. 55) These new ICTs help my team make fewer mistakes.	16.526	2.704
	GP Reliability:0.915 (*Gilboa et al., 2008*) (*Viswesvaran et al., 1996*) (*Lu et al., 2010*) (*Tarafdar, 2007*)	56) These new ICTs help improve the productivity of my team. 57) This technology helps my team identify innovative ways to do my job. 58) This technology serves and maintains the technical core of my team's function. 59) These new ICTs help my team make fewer mistakes. 60) These new technologies give my team members more motivation to go to work every day. 61) These new technologies allow us more sharing of knowledge between colleagues.	25.136	3.685

Note: * indicates that the factors adjust to the context of the PM.

Table 4. Correlation matrix between different components

	CTS_OV	CTS_INV	CTS_COM	CTS_INS	CTS_INC	RP	RA	RO	RC	PDG	PI
CTS_OV	1				.						
CTS_INV	.159**	1			.						
CTS_COM	.058	.032	1								
CTS_INS	.102	.177**	.150**	1	.						
CTS_UNC	.165**	.178**	-.004	.072	1						
RP	.904**	.173**	.148**	.187**	.211**	1					
RA	.785**	.194**	.118*	.203**	.176**	.802**	1				
RO	.084	.046	.180**	.132*	.193**	.222**	.159**	1			
RC	.060	.051	.039	.130*	.139**	.130*	.121*	.210**	1		
GP	-.011	.014	.012	.063	.040	-.045	-.056	-.015	.064	1	
IP	.008	-.002	-.075	.045	.021	-.013	-.050	-.041	.032	.136*	1

Note: ** $p < 0.05$; * $p < 0.10$; based on one-tailed t-test.

This study contributes to the theoretical and empirical development of techno-stress in the literature on information systems and in the business world. Theoretically, it enriches the literature on information overload while focusing on the role of PMs. We conclude that techno-stress can aggravate role stress and, thus, negatively affect PMs' performance. Empirically, an online survey was employed to test the proposed model. The validated scales in extant literature were adapted herein to formulate the questionnaire. The questionnaire comprised three main concepts: creator of techno-stress, role stress, and performance of the PM. Each of these aspects reflects a) the relationship between techno-stress factors and PM role stress and 2) the mediating effect of role stress between techno-stress and PM performance. More specifically, a thorough understanding of these two notions allows us to recognize how the factors of techno-stress manifest into negative effects on PMs. Our work is important given the lack of study on challenges faced by lower-level managers. We discuss the notion of role stress on PMs under role ambiguity and proximity. Thus, we develop the concept of role stress to highlight that creators of techno-stress negatively influence PMs' performance when the level of role stress increases. This clarification gives rise to the choice of *coping strategy*, an adaptive managerial behavior.

Figure 4. Result of the partial least squares regression analysis: Coefficients with levels of significance
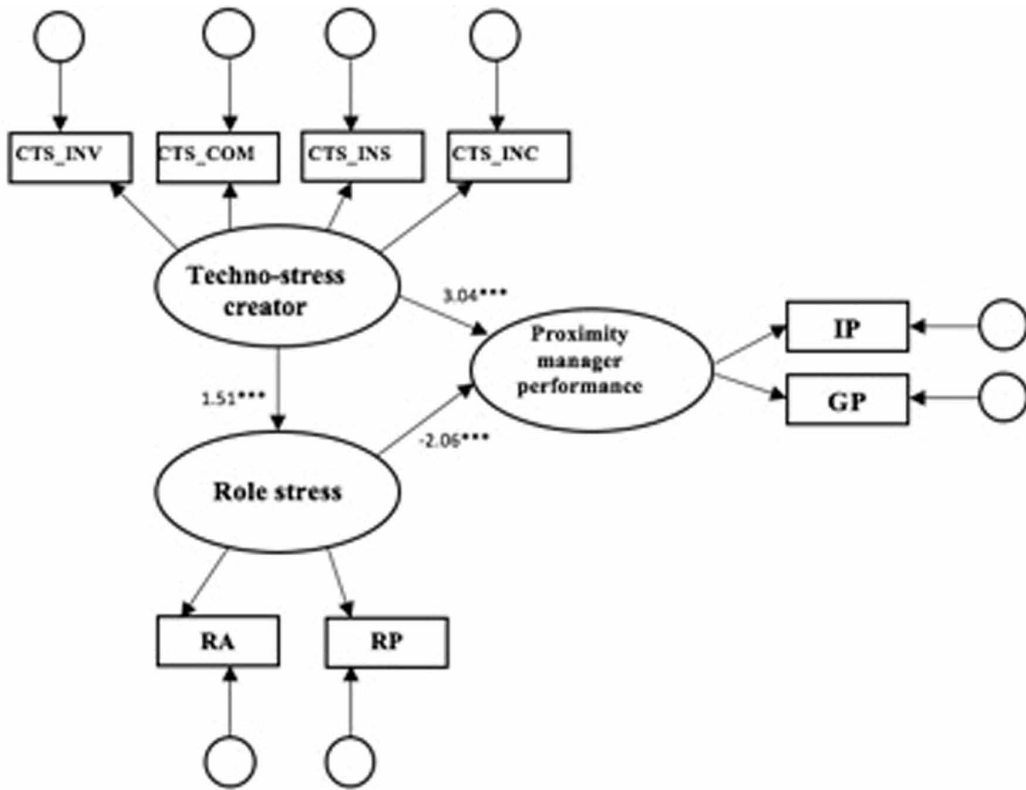

Table 5. Hypotheses results

			Coefficient	Hypothesis	Result
Role stress	<---	Techno-stress creator	1.510***	H3	Valid
PM performance	<---	Techno-stress creator	3.035***	H4	Invalid
PM performance	<---	Role stress	-2.056***	H5	Valid
CTS_OV	<---	Techno-stress creator			Invalid
CTS_INV	<---	Techno-stress creator	.893***		Valid
CTS_COM	<---	Techno-stress creator	.844***	H1	Valid
CTS_INS	<---	Techno-stress creator	.901***		Valid
CTS_UNC	<---	Techno-stress creator	.891***		Valid
GP	<---	PM performance			
IP	<---	PM performance			
RA	<---	Role stress	.872***	H2c	Valid
RP	<---	Role stress	.944***	H2d	Valid
RO	<---	Role stress		H2a	Invalid
RC	<---	Role stress		Hb2	Invalid

Note: Standardized path coefficients, factor loadings, and significance values are shown. *** $p < 0.01$; ** $p < 0.05$. DISCUSSION & CONCLUSION

Discussion

First, the results show us that our variables and items are useful, and the quantitative analysis allows us to test the essential assumptions.

Second, the role overload and role conflict variables have no direct link to the role stress of the PMs, perhaps because managers are individuals with responsibilities; their moderate autonomy (Kitayama & Markus, 1994) allows them more room for maneuver and fewer conflicts between time, resources, or abilities.

Finally, to answer our question "How does the creator of techno-stress influence the performance of the PM?", we seek a causal link between the creator of techno-stress and PMs' performance. The result shows that this relationship is not significant contrary to our predictions. When the creator of techno-stress increases, performance, in fact, does not necessarily decline. This result seems to confirm the double-edged feature expounded by Lei and Ngai (2014), who states that techno-stress is a work accelerator. It allows the individual to work faster and be more motivated while waiting for a reward or moral recognition. That is, not all techno-stresses are negative. Hence, each techno-stress should be evaluated differently. In our case, the creator of techno-stress did not directly influence PMs' performance, but role stress did mediate the influence of the creator of techno-stress on the PM.

CONCLUSION

ICTs trigger unexpected organizational and individual lifestyle changes. Our survey shows that techno-stress is a manifestation of an undesirable phenomenon caused by the excessive use of ICT in the workplace. Identifying the five creators of techno-stress associated with PMs shows that the management of the ICT portfolio is increasingly temporal, urgent, and stressful. We examined this phenomenon to understand the harmful side of ICT. Such analyses allow us to propose solutions as well to counter these negative effects. Our quantitative study, therefore, has both theoretical and empirical contributions that expand the scope for more qualitative studies.

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ENDNOTES

[1]   The report titled "Measuring the Information Society" was published at the World Telecommunication/ICT Indicators Symposium 2016.

[2]   PM are conventionally the first level of management to whom non-managerial employees report. Within this broad definition, there is controversy on whether first-line managers and supervisors are co-extensive or distinct (Hales, 2005).

[3]   We conducted a survey within Bell, Nordia Inc. (Bell subcontractor), Sherbrooke, and Rogers Montreal. The survey participants included managers and managers of the service. The survey was done by email and telephone exchange on the subject of information overload in general. In a specific case concerning specific offers that have been communicated to PMs of the remote and face-to-face sales services, we find that the sales department's PMs were overwhelmed by notifications and emails on promotional offers. They were unable to communicate to their subordinates the main promotional offer that was to generate the bulk of the figures two weeks ahead.

[4]   Brand is an American writer who has founded a number of organizations including The WELL, Global Business Network, and Long Now Foundation.