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Exploring Technology Characteristics as Antecedents of Technostress with Hrmis in Government Agencies of Malaysia: A Mixed-Method Research

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Article Info
Volume 81
Page Number: 1053 - 1065
Publication Issue:
November-December 2019

Article History
Article Received: *3 January 2019*
Revised: *25 March 2019*
Accepted: *28 July 2019*
Publication: *25 November 2019*

Abstract

This study investigated technology characteristics as the antecedents of technostress with HRIMS in government agencies of the Malaysian peninsula. The study employed a mixed-method which was carried out in two phases. The first phase involved semi-structured interviews with HRMIS system experts to explore the experience of users of the HRMIS. In the second stage, a survey was carried out among public sector employees, who used the system to validate the influence of technology characteristics on technostress. The qualitative result revealed technological characteristics of accessibility, accuracy, complexity, reliability, and pace of change as problems experienced by end-users. However, the quantitative survey showed that only accessibility, reliability, and pace of change were significant antecedents of technostress. The findings have implications for system design and development. The result suggests that the upgrading of the HRMIS in the Malaysian public sector should consider the accessibility and reliability of the system. Changes to the system should also not to be too frequent without adequate training given to end-users.

Keywords: *Technostress, End-user satisfaction, HRMIS, Public sector employees, Mixed-method, Malaysia*

1. Introduction

The utilization of technology in human resource management functions, which is also known as electronic human resource management (e-HRM), has facilitated quick and seamless execution of human resource activities, practices, strategies and policies (Shilpa and Gopal, 2011), enhancing the HRM processes and subsequently organizational performance (Parry, 2011; Ruel *et al*., 2007; Sanayei and Mirzaei, 2012). While e-HRM gives significant operational and strategic benefits as well as improves efficiency in employee management, the unfavorable effects of the use of these applications are also on the rise, especially on the end-users who are expected to be able to use the technology well. However, as employees have to constantly learn and update their skills as the technology becomes more advanced, they are likely to experience frustration and anxiety (Tarafdar *et al*., 2011a, 2011b). When this happens, the employees are said to experience technostress. Derived from a combination of technology and stress, technostress is experienced when a person is unable to cope with the new computer technology in a healthy manner (Brod, 1984), making him or her discomposed, fearful, tense, and anxious that ultimately ends in psychological and emotional repulsion and prevents him or her from further learning or using the technology (Wang *et al*., 2008). According to the technology acceptance model (TAM) (Davis, 1989, 1993), users are likely to feel stressed when the system is not perceived to be user-friendly.

Past studies have demonstrated the negative influence of technostress on various work-related outcomes, such as job satisfaction, organizational commitment, innovation, productivity, and performance (Lee *et al*., 2014; Sami and Pangannaiah, 2006; Suh and Lee, 2017; Tu *et al*., 2005; Ungku Norulkamar *et al*., 2009; Wang et al., 2008). Research has also shown that technostress can negatively affect productivity, end-user satisfaction, as well as end-user performance (Tarafdar *et al*., 2007; Tarafdar *et al*., 2010). However, despite the empirical evidence of the negative influence of technostress, few studies have investigated its antecedents, particularly those related to the technology itself (Ayyagari, 2007; Ayyagari *et al*., 2011). Ayyagari *et al.* (2011) further pointed out that previous studies on the effect of information systems and stress did not consider technology characteristics in their framework as a potential stressor. This, despite much research carried out on their effect on individuals and organizations (Dastgir and Mortezaie, 2012; Mustafa *et al*., 2010; Rushdan, 2004).

Based on the existing gap in the literature, the purpose of the present study is to explore the antecedents of technostress in public sector organizations. By filling the gap, the study contributes to the existing literature in IS and HRMIS, especially in the context of technostress. The finding could also enhance the technology acceptance model (TAM) by considering the role of technostress in influencing the use of technology. Furthermore, investigating technology characteristics is crucial for the system developers to consider important features when designing a new system or upgrading an existing one.

The paper is organized as follows: The next section reviews the literature on E-HRM, HRMIS, as well as technostress and its antecedents. Subsequently, an overview of the research methodology and findings of the study are discussed. In the final section, the theoretical and managerial conclusions and recommendations for future research have been presented.

2. Literature Review

Human Resource Management Information System (HRMIS)

Several definitions for HRMIS, or sometimes known as e-HRM, HRIS, HRMS, or virtual human resource. Voerman and van Veldhoven (2007) defined e-HRM as administrative support for HR functions in organizations by the application of Internet technology. Strohmeier (2007) pointed out that E-HRM is a technology platform that provides both network and support tools for two or more individuals or a group of collective actors, performing shared HRM activities. Bondarouk and Ruel (2009) described e-HRM as "an umbrella term covering all possible integration mechanisms and contents between HRM and technologies aiming at creating value within and across organizations for targeted employees and management" (p. 507).

The main reasons for implementing HRMIS are to transform the role of human resource (HR) functions into a more strategic one, indirectly improved the perceived status of HR professionals inside and outside the organizations (Hussain, Wallace, & Cornelius, 2007; Panayotopoulou, Vakola, & Galanaki, 2007). Other than that, HRMIS enables human resource management to be managed more systematically as the system encompasses both the operation and the management functions. Many studies have shown the positive impacts of HRMIS to HR functions, employees and organizations as a whole. For example, HRMIS allows organizations to enhance their HRM strategic paradigm, decrease costs and increase efficiency, and facilitate management and employees (Alwis, 2010, Ruel *et al*., 2007; Stone & Dulebohn, 2013).

However, as the benefits of EHRM have been empirically documented, organizations also should be aware of some negative impacts of HRMIS. For instance, HRMIS primarily focuses more on efficiency and cost reduction and may give adverse impact on protected groups and can potentially invade personal privacy (Stone & Dulebohn, 2013).

Besides, less attention is paid to understand the negative influence of EHRM, especially on the end-user, particularly technostress and its contributors.

Technostress and its Antecedents

As indicated earlier, technostress is the feeling of anxiety and frustration as a result of the use of information and computer technology (ICT) (Wang *et al*., 2008). Because of the negative impact on attitudes, thoughts, behaviour or psychology caused directly or indirectly by technology (Weil and Rosen, 1997). Brod (1984) referred to technostress as a modern disease of adaptation of the use of the technology.

Based on a comprehensive review of stress-related literature, very limited studies had explicitly highlight the antecedents of stressors. Several factors such as usability characteristics, intrusive characteristics, and dynamic characteristics of certain technologies (Ayyagari *et al*., 2011), occupational characteristics (Yan, Guo, Lee, & Vogel, 2013), computer self-efficacy and technology dependence (Shu, Tu & Wang, 2011) have been reported to be related to technostress. Tarafdar et al. (2007) proposed five dimensions of technostress linked with the use of technology. These dimensions are techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. They demonstrated that these dimensions were associated with end-user satisfaction, role conflict, job satisfaction, innovation, productivity, and commitment. This study is different from previous studies, which emphasized the impact of environmental factors, such as technological characteristics as antecedents of technostress.

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Research Context

In Malaysia, e-HRM is referred to as human resource management information system (HRMIS). Propelling the country into the era of the knowledge-based economy requires the Malaysian government to be more efficient and effective in the delivery of public services (Eia, 2004). In 1999, the Malaysian government decided to capitalize on ICT to automate the administrative and operational processes under the electronic government (EG) project (Eia, 2004). One of the target areas under the EG project was human resource management processes (Public Service Department of Malaysia [PSD], 2010). The HRMIS application aims to centralize and integrate human resource data capture, thereby enabling better access to strategic and consolidated HR information for government agencies (PSD, 2010). At the individual level, HRMIS provides a single interface for public sector employees to perform human resource function online which was otherwise done manually, thereby facilitating the accomplishment of the job processes (Zahari *et al.*, 2018).

In 2012, after HRMIS was implemented, the Malaysian government had instructed PSD and the Malaysian Administrative Modernization and Management Planning Unit (MAMPU), an agency under the Prime Minister Department responsible modernizing and reforming the administrative structure and systems of the public sector, to upgrade the system, following reports that many users (i.e., public sector employees) were not happy with the application of the technology (MAMPU, 2011). The upgrade version of the system is called HRMIS2, which was the focus of the study.

Method

This study was carried out in various government agencies in the northern states of the Malaysian peninsula. The government agencies involved in the study were state governments of Perlis, Kedah Penang, Perak, Pahang, Selangor, Melaka, Negeri Sembilan and Johor. Other ministries such as Ministry of Home Affairs, Ministry of Health, Ministry of Transportation, Ministry of Defense and Prime Minister's Department were also participated in the study.

This study employed a mixed-method to meet the objective of the study. Specifically, an exploratory sequential design strategy (Creswell and Clark, 2010) was used. The strategy involved two design phases. First, the study qualitatively explored the phenomenon before proceeding with the quantitative phase. According to Bryman (2006), this two-phase design is referred to as the quantitative follow-up design whereby the qualitative exploratory results are used to generate the hypotheses and quantitatively examine whether they can be generalized.

The Qualitative Phase

In the first phase, the study explored the stressors of end-users from the perspective of seven HRMIS system experts. Of these seven experts, two were from Kedah, three from Perlis, and two from Penang. These HRMIS experts were identified and selected with the assistance of the human resource managers of the government agency. The experts were the key people in charge of HRMIS in their organization. The system experts were deemed to be able to provide the expert judgment of the topic under study because they handled and addressed the problems faced by the HRMIS end-users and also because they had attended a series of intensive training in HRMIS provided by the PSD to enhanced their HRMIS domain knowledge. This study recruited seven system experts in keeping with the recommendations by Romney *et al.* (1986) that a small sample (as small as four individuals) is adequate to provide the necessary information as long as the participants are knowledgeable about the phenomenon under study.

Qualitative data were collected using semi-structured interviews. Five HRMIS experts in Kedah and Perlis were separately interviewed while the experts in Penang requested that they were interviewed together. All the interviews were conducted as a single session and were held in the meeting room provided by the organization. All participants were given the interview questions a few days before the interview. The interview guide was specifically designed to gather data of the background of the participants, the current stage of HRMIS2 implementation in the organization, and their views about the end-user experience in using the HRMIS2.

The interview data were transcribed immediately (within a day of the interview) to ensure that no memories of the interviews were lost and the details of the body language and other cues of the participants were effectively captured. Once transcribed, the data were hand analyzed. According to Creswell (2012), hand-analyzed data involves the researcher reading the data, marking them by hand, and then dividing them into parts. First, the researcher explored the data to gain a general sense of understanding of the data. Next, the coding process was done to segment and label the texts to form descriptions and broad themes in the data. This process also involved examining any overlaps and redundancies before collapsing the codes into broad themes. Then, these themes were layered into several main themes to portray the complexity of the phenomenon. This procedure was then repeated for all participants.

The Quantitative Phase

This phase was implemented after the completion of the first phase, which includes the generation of the qualitative result. The qualitative result indicated five key stressors related to technology. They were accessibility, accuracy, reliability, complexity, and pace of change (refer to the qualitative results for more detail). In this

phase, the key aim was to validate the qualitative result and examine the influence of such characteristics on technostress by surveying the end-users of HRMIS.

To achieve this aim, survey data were collected from 490 public sector employees in various government agencies across the country. To be eligible to participate in the survey, the following criteria were used. The participant should (1) be an HRMIS2 end-user, (2) not be a staff employee with PSD Malaysia or the HR department of government agencies because some of them were the developers or technical staff of the HRMIS, and (3) have used HRMIS at least once since the time of inception of the system. For the last criterion, two screening questions were asked: (1) "From January 2013 till date, have you used HRMIS software at least once?" and (2) "What is the frequency of your HRMIS usage?"

However, before the survey was carried out, written approval was sought from the HR manager of the government agencies. A brief description of the research study, the instruction on how to distribute and collect the completed questionnaire, and the tentative timeframe of the survey were shared with the managers. The survey was pilot tested among 60 participants in selected government agencies, randomly chosen, to identify any errors or weaknesses found in the questionnaire. The participants were excluded from the actual survey. Based on their feedback, the questionnaire survey was revised and improved.

The final questionnaire consisted of items that measured the five technology characteristics and technostress. It also asked demographic questions. Except for the demographic questions, all items were taken from established measures as follows: (1) technostress was measured using 23 items from Tarafdar *et al.* (2007); (2) accessibility and accuracy were used using the items from Nelson *et al.* (2005); and (3) complexity, reliability, and pace of change were measured using ten items taken from Moore and Benbasat (1991), DeLone and McLean (1992, 2003), and Heide and Weiss (1995). A five-point Likert scale, ranging from '1' "strongly disagree" to '5' "strongly agree" were used to measure all items. Appendix 1 shows the items.

The sample had the following profile: The gender split was 36.7% males and 62.4% females, and participants below 33 years old formed 31.6%. Almost half of them had a high-school certificate as their highest level of education (45.1%). As for the current position held, more than half of the participants were clerical staff (59.6%), followed by mid-level management (20.8%) and non-management (13.1%). The average age, working experience, and years of working with the current organization were 37, 12.88, and 6.38, respectively. The result also indicated that the average computer usage in terms of years was 13.4, and the average computer confidence was 5.75.

Before the data were analysed, this study tested for common method bias by performing Harman's single-factor test (Podsakoff *et al*., 2003). The result indicated that such bias was not a threat in this study. Non-response bias was also checked by comparing the data from early responders and late responders (Armstrong and Overton, 1977). No significant differences between the two groups were found, indicating that non-response bias was not a problem.

3. Results

The Qualitative Result

When asked to identify the causes or stressors of technostress, the participants' responses primarily revolved around five major themes of technological characteristics, namely, accessibility, accuracy, reliability, complexity, and pace of change. Table 1 summarises the result. The following shows samples of the extracts. From the result of each antecedent, a hypothesis was developed to examine the influence of the antecedent on technostress.

Table 1: Antecedent factors by keywords

Keywords	HRMIS experts' results (n = 7)	Total results
Technology Characteristics		
Accessibility	• Four HRMIS experts stated the limitations of HRMIS from the aspects of accessibility that could cause a delay in performing daily tasks. • Two HRMIS experts agreed with the view put forward by the researcher without elaborated further the point.	Six HRMIS experts voiced that the HRMIS accessibility problems have caused their tasks to be disturbed and without realizing, they experience technostress.
Complexity	• Three HRMIS experts highlighted that some HRMIS users felt that the system is too complex and difficult to use. This causes them refuse to use the system or learn how to use the HRMIS.	Four HRMIS experts cited the problems of accessibility when using the HRMIS.

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	• One HRMIS expert agreed that the complexity of HRMIS can cause technostress without elaborating further.	
Accuracy of data	• Five HRMIS experts revealed that HRMIS has a problem related to data quality. Data in the HRMIS is not necessarily trustworthy. This gives problems to data processing and retrieval.	Five HRMIS experts viewed that accuracy of data in HRMIS is a source of technostress.
Reliability	• Three HRMIS experts stated that HRMIS has problems of information processing speed. This delays the accomplishment of daily tasks. • Two HRMIS experts agreed with the opinion highlighted by the researcher without further discussion.	Five HRMIS experts noted that the HRMIS has reliability problems of data speed and quality. These problems add pressure to users.
Pace of change	• Three HRMIS experts mentioned that frequent changes that occur in HRMIS make them to constantly feel unsure about the HRMIS. They are also forced to learn in advance about these changes. • Two HRMIS experts agreed with the researcher's view without elaborating further the point.	Five HRMIS experts revealed that the changes made to the HRMIS have caused users to always feel unsure and they need to learn about the changes in advance before being able to use the HRMIS.

Accessibility

During the interviews, the experts informed that HRMIS could only be accessed on a computer or notebook through a single browser (i.e. Internet Explorer). That is, the system could be not accessed through smartphones and other devices. Because of this constraint, HRMIS users were forced to stay at their workplace, after office hours, to complete their work. Sometimes, they had to come to work during weekends or even when they were on leave. Four HRMIS experts related the experience of the HRMIS users who went to them for help or their own experience in such a situation.

> *I feel that the information should be able to be accessed by them from anywhere, but it cannot be accessed through smartphones, tablets, and others. For those without Internet Explorer, this is also a problem. This situation has caused some tasks to be delayed or abandoned. Sometimes the user is forced to complete the work outside of office hours because of this problem (HRMIS expert 1).*

> *This system can be opened in other browsers; however, it cannot be clicked. Many users had made a complaint that the HRMIS cannot be accessed because this system only utilizes Internet Explorer (HRMIS expert 2).*

Previous studies have pointed out that easy access to the information system or technology is considered to be an important condition or property of a system that could increase its usage or adoption. Access is an important factor that drives the system quality of information system (Nelson *et al.*, 2005). Thus, various measures that address system quality, including accessibility, need to be undertaken with IS to promote continual usage that leads to satisfaction (DeLone and McLean, 1992, 2003). The HRMIS experts in this study also described accessibility as one key factor that could lead to technostress. Therefore, it was hypothesised that:

H1. Accessibility is negatively related to technostress.

Accuracy

The HRMIS experts also related that data accuracy, or lack of it, in HRMIS could contribute to technostress. Some users entered the data incorrectly into the system, which in turn created problems when the data were processed and used in reporting or when the task was implemented. Several HRMIS experts described this type of situations as follows:

> *We need to declare any form of wealth that is owned. If it is done manually, then it is all right, but it needs to be done using the system. In one case, the user forgot which year the motorcycle was purchased and*

how much it costs. However, he needs to enter the correct value. Since he forgets, he simply enters any value he wishes. However, an actual real value is required. This means that the information in this HRMIS contains data that cannot be trusted (HRMIS expert 5).

We cannot put too much trust in the system. We need to check the data (HRMIS expert 6).

Accuracy is an important factor relating to the data quality of an information system (Nelson *et al*., 2005). Information accuracy is a fundamental factor in decision-making and has a significant impact on satisfaction (Gudigantala *et al*., 2011). Not only does information have to be accurate, but it must also be perceived to be accurate by the users. The correctness of information extracted from the system over a period of time and the trustworthiness of the information may shape the overall perception of accuracy toward IS. If users have the notion that the information provided by certain technologies or IS is usually inaccurate, any work related to the use of the technology will be perceived as conflicting. This conflict increases the demands on users, suggesting work overload and an invasion of privacy due to technology. Therefore, it was hypothesized that:

H2. Accuracy is negatively related to technostress.

Complexity

The HRMIS experts cited that some users felt that the HRMIS system was too complex and complicated their work. This fear was compounded by their limited knowledge of information technology.

The user needs to click various icons, so it becomes complicated. If given a choice, they would say that it is all right if HRMIS was not implemented. At SUK, for the younger staff and lower grades, it is fine, but for the senior staff, it is a difficult task (HRMIS expert 1).

It is very complex and to a point where the user cannot understand how to use the HRMIS. The user needs to obtain assistance from the system administrator, and this makes it difficult for them. Hence they rarely use the HRMIS since it is too complex. This condition can cause technostress, as you mentioned earlier (HRMIS expert 5).

Scholars found that ease of use of a system could facilitate the voluntary adoption of the information system (Davis, 1989; Moore and Benbasat, 1991). A high perception of complexity enhances the gap between person-environment by changing the perceptions of workload (Ayyagari *et al*., 2011). Complexity could lead to excessive multitasking and stress, thereby contributing to the rejection of technology or IS (Ayyagari *et al*., 2011; Ragu-Nathan *et al*., 2008). A technology or IS that is too complex requires a steeper learning curve, i.e. users may take a longer time to learn particular aspects of the system. This will have a cascading effect, thus delaying the completion of other tasks, especially within a limited time frame. Consequently, their time and personal space will be invaded. Users will also feel threatened and insecure about their jobs. They will feel that they are likely to lose their jobs to other more technology savvy people (Tarafdar *et al*., 2011a, 2011b). Complexity will also increase uncertainty. Hence, it was hypothesized that:

H3. Complexity is positively related to technostress.

Reliability

A reliable system is expected to give a quick response consistently and does not suffer from any sudden breakdowns. A slow system can delay and disturb the routine tasks of the users and thus force them to spend more time to complete their work. Work delays put added pressure on users.

For instance, it takes quite a while to open a menu option, approximately five minutes, and sometimes the user needs to re-enter because the time limit has lapsed due to system slowness. So this task will take very long to complete. That is the main problem and causes their work to be delayed (HRMIS expert 2).

Some of the staff would come to work during weekends to have time to complete the work. If in Kedah, the HRMIS problem from the aspect of processing speed can occur from Monday to Thursday (HRMIS expert 5).

Reliability has frequently been used to measure system quality (DeLone and McLean, 1992, 2003; Nelson *et al*., 2005). Recently, reliability has also been linked to strain (Ayyagari *et al*., 2011). The HRMIS experts in this study stressed that HRMIS should be consistent in supporting users in performing their daily tasks. Frustration and stress would set in if the technology of an information system demonstrates unreliable performance such as disruptions, breakdowns, or unexpected long response times (Ayyagari *et al*., 2011). Furthermore, these conditions also cause extended work time for users, causing them to spend excessive hours to handle the unfinished tasks. Therefore, it was hypothesized that:

H4. Reliability is negatively related to technostress.

Pace of Change

The implementation of HRMIS in government agencies began in 1999. Since then, the system was enhanced

periodically, affecting the users because they had to update themselves continuously. Several HRMIS experts described how frequent changes affected users.

> *Sometimes the information about the changes is not delivered or is delivered late to the user, which disrupts their work. In this situation, the user needs to obtain information early on and learn about the changes; only then can they use the system normally. There is also the probability that they will feel worried if they do not speedily learn about the changes in the HRMIS (HRMIS expert 5).*

> *Recently, PSD Malaysia is upgrading the HRMIS, and it is certain that there will be changes. Because of these changes, the user will become increasingly unsure and will constantly need to learn new things about the HRMIS (HRMIS expert 7).*

The frequency of changes to existing technologies can be referred to as pace of change (Ayyagari, 2007). Ayyagari *et al.* (2011) argued that a change in existing technologies or the introduction of new technologies requires that users learn new skills. The increased demands for new skills add to the workloads, making them stressed (Ayyagari et al., 2011; Suharti and Susanto, 2014; Wang *et al*., 2008). Constant changes in the technology can also cause the user to perceive that the technology is difficult to use, especially if the users are not active adopters. Very often, changes made on the software and hardware applications also trigger feelings of frustration and anxiety because of the uncertainty associated with it (Ayyagari *et al.*, 2011). Therefore, it was hypothesised that:

H5. Pace of change is positively related to technostress.

The Quantitative Result

The five hypotheses formulated were later tested using the partial least square (PLS) (Ringle *et al.*, 2005) structural equation modelling. The PLS is a prediction-oriented variance-based approach that focuses on the endogenous target constructs in a model and aims at maximizing their explained variance (Hair *et al*., 2012). When evaluating a PLS path model, two separate assessments of the model are involved: measurement model and structural model.

Measurement Model

The measurement model involved analysing the reliability and validity of the instrument. Specifically, the convergent validity and discriminant validity were checked to ascertain the goodness of measure of the current model. The assessment of the measurement model was performed by examining the individual loadings, internal composite reliability, and discriminant validity. Convergent validity is confirmed when the indicator items of a specific variable converge or share a high proportion of variance in common (Hair et al., 2010). In examining convergent validity, Hair *et al.* (2010) recommended considering the factor loadings, average variance extracted (AVE), and .7 or higher for CR.

Based on previous studies, this study conceptualized technostress as a second-order construct (Ragu-Nathan *et al*., 2008; Tarafdar *et al*., 2007). Thus, the study followed the method suggested by Hair *et al*. (2014) by using the repeated indicator approach to model the second order factor.

To obtain a good measurement model, the study deleted three items (one each from accuracy, reliability, and complexity) because they did not meet the cut-off loading, AVE, and CR. The analysis was re-run, and the new loadings were obtained, as presented in Table 2. The result showed that the measurement model exceeded the recommended values, indicating sufficient convergence validity.

Discriminant validity was performed to show the dissimilarity between measurement tools of different constructs by checking that the AVE should be larger than the square root of AVE of a latent variable with the other variables in the model (Fornell and Lacker, 1981). Table 3 shows that the calculated values of AVE of all the constructs presented in the diagonal values were higher than the correlation values presented in off-diagonal ones, indicating that the measurement model of this study had adequate discriminant validity.

Table 2: Result of the measurement model

First order constructs	Second order constructs	Items	Loadings	AVE	CR
Accessibility		acce1	0.866	0.685	0.865
		acce2	0.923		
		acce3	0.673		
Accuracy		accu4	0.938	0.748	0.855
		accu6	0.784		
Complexity		comp8	0.885	0.561	0.710
		comp9	0.582		
Pace of change		poc13	0.835	0.630	0.871
		poc14	0.685		

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		poc15	0.761		
		poc16	0.879		
Reliability		relia11	0.583	0.600	0.741
		relia12	0.928		
	Technostress	Techno-complexity	0.647	0.618	0.889
		Techno-invasion	0.811		
		Techno-insecurity	0.810		
		Techno-overload	0.759		
		Techno-uncertainty	0.883		

Note:
AVE = Average Variance Extracted, **CR** = Composite Reliability
accu5, relia10, comp7, were deleted due to low loading
Table 3: Discriminant validity

	ACCESS	ACCU	COMP	POC	RELIA	TSTRESS
ACCESS	**0.828**					
ACCU	0.347	**0.865**				
COMP	0.222	0.603	**0.749**			
POC	-0.231	-0.142	-0.110	**0.794**		
RELIA	0.355	0.441	0.269	-0.102	**0.775**	
TSTRESS	-0.246	-0.141	-0.094	0.286	-0.157	**0.786**

Note: Diagonals (in bold) represent the square root of average variance extracted (AVE) while the other entries represent the correlations.
ACCESS = Accessibility, ACCU = Accuracy, COMP = Complexity, POC = Pace of change, RELIA = Reliability, TSTRESS = Technostress

Structural Model

The structural model describes the interrelationships of variables between the constructs. Initially, the path estimates were obtained that represented the hypothesized relationships among the constructs (Hair *et al.*, 2011). Then, a bootstrap analysis was employed to examine the statistical significance of the path coefficient. The path coefficient is significant when the t-value is larger than the critical value. Critical values for the one-tailed test are 1.23 (significance level = 10%), 1.645 (significance level = 5%), and 2.33 (significance level = 1%).

The main evaluation criterion for the structural model in PLS is the R^2 measure. The R^2 value of technostress was .355, suggesting that 35.5 percent of the variance in technostress could be explained by the five factors derived from the interviews with the HRMIS experts. Table 4 shows that H1, H4, and H5 were supported but H2 and H3 were not. Specifically, the bootstrap analysis showed that three antecedent variables, i.e. accessibility (β=.159, p<.01), reliability (β=-.065, p<.10), and pace of change (β=.239, p<.01) were found to be significantly related to technostress.

Table 4: Hypotheses testing

Hypothesis	Relationship	Beta	Std. error	t-value	Decision
H1	Accessibility → Technostress	-0.159	0.059	-2.795***	Supported
H2	Accuracy → Technostress	-0.002	0.061	0.357	Not Supported
H3	Complexity → Technostress	0.001	0.066	0.021	Not Supported
H4	Reliability → Technostress	-0.065	0.056	-1.310*	Supported
H5	Pace of change → Technostress	0.239	0.042	6.019***	Supported

***p< 0.01, **p< 0.05, *p<0.1 (based on one-tailed test with 1000 bootstrapping)

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4. Discussion and Conclusion

The present study provides empirical evidence of the role of technology characteristics in contributing to technostress. Accessibility, reliability, and pace of change were found to be significant technological stressors. Such finding resonates with past research that technology or usability characteristics were significant in influencing user satisfaction and system usage (Anggelidis and Chatzoglou, 2012; DeLone and McLean, 2003; Hou, 2012; Gudigantala *et al*., 2011; Tarafdar *et al*., 2011a, 2011b). The finding also confirms the validity of the technology acceptance model (TAM) that stress the importance of technology characteristics in influencing the use of technology (Davis 1989, 1993). As indicated by the qualitative result, problems with technological characteristics negatively affected the end-user perception of the system. The quantitative result indicated that accessibility, reliability, and pace of change were significant stressors.

Limited accessibility reported by the end-users in this study was found to contribute significantly to technostress. When the HRMIS2 could not be accessed from other devices, the end-users reported that they were forced to work longer hours to complete their job or had to come to work during weekends or even when they were on leave. In this situation, work-life balance is likely to be affected (Day *et al*., 2010; Nam, 2014; Nixon and Spector, 2014). Furthermore, difficult-to-access information may lead to increased workload because the end-users had to spend more time in getting the desired information. Past research found that increased workload could lead to increased strain or stress (Day *et al*., 2010). In this regard, the workload could be decreased by providing easier access to information, thus reducing the end-users' time at work spent on information-gathering tasks and enhancing their ability to work more efficiently. According to Day *et al*. (2010), accessibility or availability of information could be a resource for increasing control and flexibility at work and improving communication and collaboration among employees.

System reliability was another stressor significantly found to lead to technostress as indicated by the quantitative result. Past research also found the criticality of reliability in influencing user satisfaction (Gudigantala *et al*., 2011) or the supporting factors in technology usage (Nelson *et al*., 2005). Frustration, anxiety, and stress are likely to set in when the technology suddenly breaks down or slows to respond, causing delays in job performance (Ayyagari *et al*., 2011). In this situation, the end-users are likely to feel stressed because they are forced to spend more time to complete their tasks at hand.

Frequent changes to the system were also found to be a significant stressor for public sector employees when using HRMIS2. While continual improvements to the existing system are necessary for better system delivery and subsequent organizational performance (Bayo-Moriones *et al*., 2013), they are a source of technostress to the end-users. Frequent changes made to the HRMIS2 disrupted work because they were not certain how to use the new system, especially when they were not properly trained to cope with the changes in advance. As the majority of the participants had only a high school certificate, the constant cycle of learning new skills and knowledge might be perceived as being burdensome. The frequent changes to HRMIS2 were likely to make them think the system was difficult to understand. Since they were not using the system actively, they might not explore the system completely, affecting their adaption to changes.

Despite being demonstrated to affect end-users' negative experience with the technology as indicated by the qualitative result, accuracy and complexity were found to be insignificant stressors in the quantitative survey. Since the survey involved those who used the system to support their daily work and were not involved in decision-making, system accuracy may not be perceived as being crucial for their work. Accuracy in HRMIS2 could be a critical requirement for an HRMIS2 expert, but not for general HRMIS2 end-users. The same explanation could be offered for the insignificant role of complexity in influencing technostress. Also, perhaps the end-users of HRMIS2 perceived the system to be generic and not work-specific.

Implications

The present study investigated the role of technology characteristics as the antecedents of technostress. The result suggests that researchers should pay particular attention to these factors as they are most likely to cause end-users to feel stressed when using the technology, affecting their job performance (Ayyagari *et al*., 2011; Brooks *et al*., 2017; Tarafdar *et al*., 2010; Tarafdar *et al*., 2015). Considering technology characteristics in the design and development of a system for effective job performance is crucial in addition to the consideration of user characteristics, as indicated in past research (Isaac, Abdullah, Ramayah, Mutahar, & Alrajawy, 2018; Norzaidi, Chong, Murali, & Intan Salwani, 2007). When the technology is perceived as user-friendly in that it is easy to use and useful (Davis, 1993; Hung et al., 2007), end-users are likely to feel happy and satisfied with the system because it facilitates toward the accomplishment of the job.

One key theme in both the qualitative and quantitative findings is that when the technology is perceived to have problems in accessibility, reliability, and frequent changes, the job performance of the end-users is likely to be negatively affected. As indicated from the qualitative result, when this happens, end-users are likely to feel stressed with the technology they are using. Even though the quantitative survey indicated a direct effect of technology characteristics on technostress, it is possible that such effect occurred because job performance of the end-users was adversely affected by

limited accessibility, poor reliability, and the frequent changes made to the system or technology. While this explanation is probable, more research is needed to validate the speculation. Interestingly, such result may provide an alternative theoretical proposition that stress is likely to be the result *of* job performance as opposed to the existing proposition that commonly suggests that stress is likely to result *in* job performance (Ayyagari *et al*., 2011; Brooks *et al*., 2017; Tarafdar *et al*., 2010; Tarafdar *et al*., 2015).

Practically speaking, the finding provides practical insight, especially to system developers and designers about they need to consider when upgrading the HRMIS2 in the future so that the end-users will not experience stress while using it. In addition to making the system user-friendly, the result suggests that managers develop relevant and necessary technostress management programs to help those affected negatively by the system. This recommendation is relevant because the findings indicated that interruptions created by the inaccessibility of certain information led to technostress. Inaccessibility would also result in extra workload due to unfinished work. Therefore, managers are recommended to train end-users on how to manage their time as a strategy to deal with technostress conditions. Because of frequent changes to HRMIS2, managers could overcome technostress by continually educate the end-users about the changes, involve them in the development of the system, and provide necessary technical assistance and support.

Limitations and Directions for Future Research

The result of this study should be interpreted by considering the following limitations. Potential bias might exist with regard to the sample selection. Even though this study could not control the end-users to be selected, the screening questions were used to target the intended HRMIS end-users and hence minimize the sample bias. Even though the quantitative study found a significant influence of technology characteristics on technostress, a causal link could not be established since the study was correlational. It could be that people who experienced technostress perceived the technology as being problematic. Hence, future studies may wish to conduct a field experiment to establish causation. The finding may not also be generalizable to private sector employees who are likely to use a system tailor-made to the organizational needs. Nonetheless, it could be argued that end-user satisfaction is still an issue in such organizations if the system is not developed and designed to be user-friendly (Bartlett et al., 2012; Hung et al., 2007; Wang and Wang, 2010). Hence, future studies may wish to confirm the technology characteristics identified in this study and their influence on technostress and work-related outcomes.

Another avenue for future research is to examine other antecedent factors of technostress, such as the job context. In addition to technology characteristics, it is possible that the job or task characteristics could influence technostress as some tasks are easily automated while other tasks are not (Goodhue and Thompson, 1995). Hence, technostress is more likely to be experienced when complicated tasks are automated than when simple tasks are automated.

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