Journal of International Technology and Information Management

Volume 24 | Issue 1 Article 5

2015

Validating the Technostress Instrument using a Sample of Chinese Knowledge Workers

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ABSTRACT

Today, the phenomenon of technostress is both pervasive and global. Nevertheless, research efforts, especially empirical and cross culture studies, in this domain have been very limited. In addition, lack of consistency in the technostress measure found in existing literature made it difficult to build a unified body of knowledge of technostress. Using a sample of 221 Chinese knowledge workers, this study cross-validated and refined the technostress measure developed by Tarafdar et al. (2007). It was found that the instrument offered high validity and reliability after some respecification in the Chinese context. Technostress experienced by Chinese knowledge workers was investigated and compared to that of US workers. The influence of individual and organizational characteristics on technostress was also examined.

INTRODUCTION

As an integral part of today's work environment, information technology has become an important contributor to work-related stress. The IS research community has long acknowledged the dual nature of ICTs (e.g. Thatcher & Perrewe, 2002; Brillhart, 2004; Ayyagari et al., 2011). While significant productivity gains, organizational effectiveness, and innovation have been achieved via the use of ICTs, their negative impacts on employees and organizations should not be overlooked. ICT-triggered disruptions in technologies, business processes, employee roles and responsibilities, and organizational culture can be significant sources of stress for today's workforce. Technostress is defined as any negative effect on human attitudes, thoughts, behavior, and psychology that was direct or indirect results from technology use (Weil & Rosen, 1990). Its adverse effects on employees range from behavioral outcomes such as decreased work participation, productivity and performance to cognitive and psychological symptoms such as perception of work overload, information fatigue, computer anxiety and dissatisfaction at work (Brod, 1984; Weil & Rosen, 1997; Suh & Han, 2003; Tu, et al., 2005). Studies have also found strong evidence to support that technostress led to decreased organizational and continuance commitment (Ragu-Nathan et al., 2008). Physical health dysfunctions such as sleep difficulties, headaches, irritability, stomach intestinal problems, and cardio vascular diseases have also been increasingly linked to technostress at work (Brillhart, 2004; Brod, 1984). Therefore, in today's technology-rich work environment, organizations can no longer afford to be oblivious about the pervasiveness of technostress and its toll on the workforce. Instead, organizations need to help employees reduce technostress in order to amplify their return on investments in technology and ensure organizational success.

Globally, technostress is also on the rise. Heightened levels of technostress have been reported among workers in some of the fastest-growing economies such as China (Tu et al., 2005; Qiang et

  ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

al., 2005), India (Sinkovics et al., 2002; Maudgalya, et al., 2004), Indonesia (Suharti and Susanto, 2014) and Malaysia (Ibrahim et al., 2014). The existence of heightened technostress in emerging economies is understandable as workers in these countries experienced dramatic changes in technological and business environments within a very short period of time. At the same time, this also reminds us that studying technostress requires a global perspective. While most of the existing studies on technostress are US-centric, it is necessary to expand technostress research to the global context. In addition, studying technostress in varied socio-economic and technological settings may yield interesting insights regarding the antecedents, consequences and remedies for technostress.

Prior studies have also found that technostress was experienced by both IT professionals and end-users. The stress for IT professionals stemmed from rapid obsoletion of technical skills and increasing end-user demands for technical support (Sethi et al., 2004; Thong & Yap, 2000; White & Lester, 2002). The stress has also been attributed to high absenteeism and turnover rate witnessed among IT professionals (Igbaria & Siegel, 1992). In addition to white collar workers, unskilled clerical workers whose jobs involved repetitive data entry reportedly experience a high level of technostress as well (Uhl, 1984). Technostress is therefore a universal and global phenomenon which has been witnessed among workers across business functions, organizational levels, and national and cultural boundaries.

While the phenomenon of technostress is pervasive and global, research efforts, especially empirical studies, in this domain have been very limited. There is only a paucity of published studies in the recent years that has made significant contributions to the field's understanding of technostress. Among these studies, the work of Tarafdar et al. (2007) found that techostress was manifested behaviorally and psychologically in the following five dimensions: techno-overload, -invasion, -complexity, -insecurity, and -uncertainty. These dimensions were operationalized to develop an instrument for assessing the technostress level of individuals and adopted successfully by several studies (e.g. Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2010, 2011). To the best of the authors' knowledge, this instrument for measuring technostress has never been cross-validated in a national context other than the United States. Therefore, the primary objective of this study is to cross-validate the technostress measure using a sample of 221 Chinese knowledge workers. The validation of the instrument for the Chinese context arguably represents an important step in globalizing technostress research for the following two reasons. First, as the 2nd largest economy in the world, China is quickly becoming a technological powerhouse rivaling the US in widespread adoption of work technologies in both multinational and domestic corporations. As in the US, technostress has been recognized as an increasingly pressing issue for organizations in China (Tu et al., 2005). A validated measure would enable researchers that focus on IS issues in China to empirically study the technostress phenomenon with confidence. Second, Chinese organizations operate in an economic, political and cultural environment that is drastically different from that of the US. Validating the measure in this environment allows researchers to effectively evaluate the suitability of using the current technostress instrument in a global context. It also makes cross-culture comparison of technostress possible. The second objective of this study is to investigate the level of technostress experienced by Chinese knowledge workers using the validated instruments and compare the technostress level of Chinese knowledge workers to that of their US counterparts. The influence of the employee and organizational characteristics on the level of tecnostress he or she experiences is also examined and compared to the findings of

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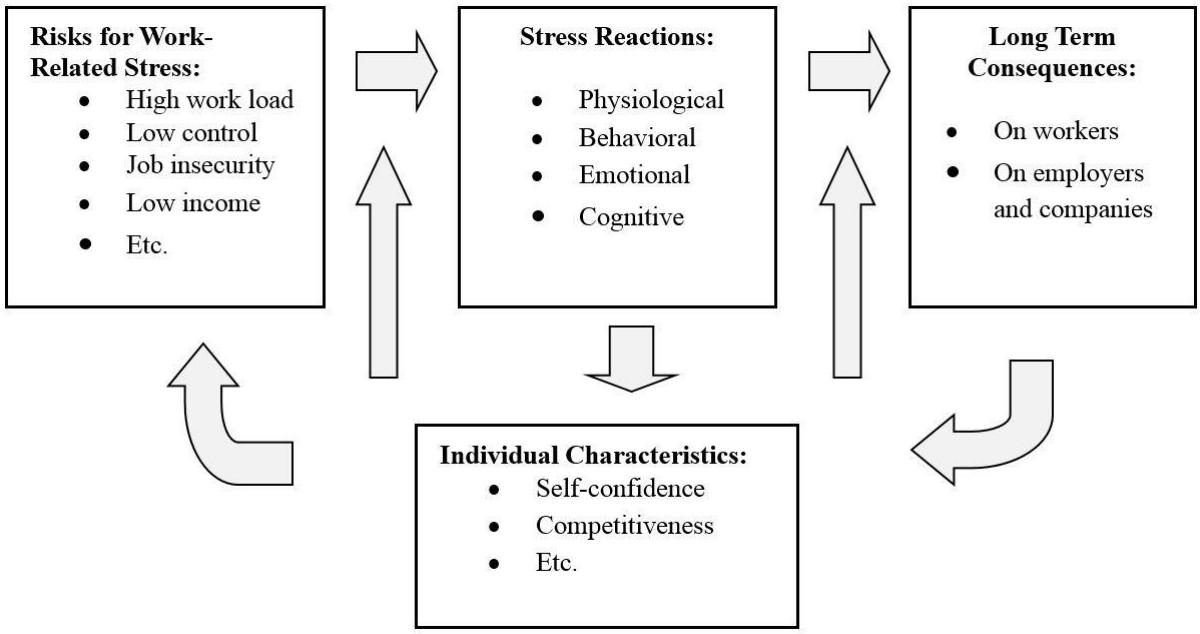
prior studies.

LITERATURE REVIEW

The general findings from research on work-related stress can be best summarized using the Model of Work-Related Stress (See Figure 1) adapted from Kompier & Marcelissen (1990) and Cooper et al. (2001), both of which have received overwhelming empirical support and provided foundation for subsequent studies on technostress (e.g. Ragu-Nathan et al., 2008). According to the model, when exposed to various risks for work-related stress, employees demonstrate stress reactions, which may be physiological, behavioral, emotional, and/or cognitive. Long term consequences, usually negative, on employees and employers will form if the stress reactions persist for a long period of time. The model also recognizes that individuals demonstrate different levels of ability to cope with stress; therefore, the strength of the stressor-reaction-long-term consequences chain is moderated by individual characteristics. On the other hand, individual characteristics are also influenced by stress experiences. Stress experiences in the past may make an employee more immune to future stress if personal development was achieved through the experiences or more vulnerable if long-term damages occurred.

Figure 1: Model of Work-Related Stress Adapted from Kompier & Marcelissen (1990) and Cooper et al. (2001).



Rosen et al.'s study (2010) developed a taxonomy of work stressors that included the following eight categories: work role, workload, situational constraints, job control, workplace interpersonal characteristics, career-related concerns, job conditions, and acute stressors. These stressors' impact on key strains including decreased task performance, organizational citizenship behavior (OCB) and increased counterproductive work behavior (CWB) has been extensively studied (e.g. Tubre & Collins, 2000; Gilboa et al., 2008; Penney & Spector, 2005; Stewart & Barrick, 2000;

Tepper et al., 2008)

As opposed to research in work stress, technostress research is still in its fetal stage. There is currently a lack of conceptual models and empirical studies on work-related stress caused by information technologies. In the practical domain, most organizations are oblivious, in denial, or naïve about the existence of technostress and its negative impact on employees and organizations (Weil & Rosen, 1999). The lack of understanding of technostress is likely to limit employees' potentials at work and prevent organizations from amplifying their return on investments in ICTs.

At this early stage of technostress research, developing a reliable scale to measure technostress levels of individuals is deemed critical to laying the foundation for further empirical work. The quest for a measure for technostress began with identifying the stressors and manifestation of technostress. A number of studies have made notable contributions in this regard (e.g. Brillhart, 2004; Ennis, 2005; Tarafdar et al., 2007). Brillhart (2004) identified four forms of technostress: data smog, multitasking madness, computer hassles, and burnout. Data smog referred to the information overload experienced by users that could lead to Information Fatigue Syndrome. Multitasking madness referred to the conflict between the multitasking nature of computer systems and the limitation of the human mind. Computer hassles referred to the technical problems and annoyances (e.g. system crash, sub-standard performance, virus, spam, pop-up ads, etc.) caused by ICT use. Finally, burnout referred to the feeling of exhaustion resulted from the conflict between experiencing too much pressure and lack of satisfaction from ICT use. Ennis (2005) examined technostress experienced by librarian and found six causes of technostress, including pace of change, lack of training, increased workload, lack of standardization, reliability of technology (or the lack thereof), and changing roles at work. In addition, peer pressure was also found to contribute to technostress. One study found that when companies reward employees for increasing their computer literacy, it caused increased levels of technostress among employees (Si et al., 2007). Therefore, excessive pressure on learning new technologies exerted by organizations can prove to be counterproductive.

The work of Tarafdar et al. (2007) is arguably the most notable in this area due to its strong theoretical and empirical support. Tarafdar et al. (2007) suggested that technostress was manifested behaviorally and psychologically in a number of ways including techno-overload, -invasion, -complexity, -insecurity, and -uncertainty. These dimensions were referred to as technostress creators (Ragu-Nathan et al., 2008) or stressors (Ibrahim et al., 2014) in subsequent studies that adopted this conceptualization. One can easily see the parallelism between the technostress creators and work stressor taxonomy developed by Rosen et al. (2010). In Tarafdar et al.'s (2007) conceptualization of technostress, techno-overload refers to the feeling of increased workload due to ICTs. It is similar to the workload stressor, which is the result of increased amount or difficulty of work. Techno-invasion refers to the feeling of work entering into other areas of life due to ICTs leading to higher levels of family-to-work conflict. This can be partially explained by job control stressor caused by the employee's lack of autonomy to decide how and when to perform tasks. Techno-complexity refers to the user's lack of confidence in using new technologies. This dimension is closely related to the concepts of task difficulty (McGrath, 1976) as well as computer anxiety and computer self-efficacy, both of which have been found to influence technology use (Compeau & Higgins, 1995; Weil & Rosen, 1999). Technology-insecurity, which is a career-related concern stressor, refers to the user's fear of being replaced by others with better

  ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

technology skills. Finally, techno-uncertainty refers to the user's unease about constant changes in technology. This dimension can be viewed as both a job condition and role ambiguity stressor as rapid technology changes and ever expanding roles are a fact of life in organizations today.

In addition to its solid theoretical foundation, the aforementioned stressors were operationalized to create a measure of technostress and empirically validated by the same authors (e.g. Ragu-Nathan et al., 2008; Tarafdar et al., 2007; 2010; 2011). The availability of a technostress instrument facilitated the subsequent empirical studies on the impact of technostress. Adopting the concepts from the sociotechnical theory and role theory, Tarafdar et al. (2007; 2011) found that ICT induced stress was inversely related to individual productivity and increased role stress by increasing role conflict and role overload among workers. The findings suggested that increasing mandatory work technologies at work caused employees to be confused by inconsistent job requirements and expectation and overburdened by expanded responsibilities and workload. The role stress ultimately impaired the employee's ability to perform his or her work efficiently and effectively. Adopting a transaction-based model of stress, Ragu-Nathan et al. (2008) found that technostress negatively impacted job satisfaction, organizational commitment and continuance commitment while technostress inhibitors (i.e. literacy facilitation, technical support and involvement facilitation) positively impacted these personal and organizational outcome constructs.). It was also found that individuals who experienced low computer anxiety and had high confidence in their ability to use ICTs would experience lower levels of technostress. Finally, Tarafdar et al. (2010) found that technostress decreased user satisfaction with the ICT they used and the extent to which ICT could be utilized for productivity and innovation in the end-user computing context.

Personal characteristics such as age, gender and personality were found to influence the level of technostress experienced (Korukonda, 2005; Moreland, 1993; Tu et al., 2005; Tarafdar et al., 2011). Conflicting findings were discovered regarding the effect of age on technostress. For example, one study found elder workers demonstrated lower levels of technostress than younger workers whereas another study found otherwise and suggested that it could be explained by the fact that older workers in general bore heavier family and work responsibilities and experienced decreased learning capacity for new technologies. Men were found to experience higher levels of technostress than women. Neuroticism was found to correlate strongly with technophobia while openness and extraversion correlated negatively with technophobia. Furthermore, computer self-efficacy, technology competence, technology dependence, formal education and one's workload tend to moderate the level of technostress experienced by the employee (Tarafdar et al., 2011; Suharti & Susanto, 2014). Technostress has also been attributed to technology characteristics. Ayyagari et al. (2011) found that technology's usability, dynamic and intrusive features could be related to work stress. Therefore, the convergence of work and personal technologies, the blurring of the work and life boundary, and constant connectivity created by recent adoption of mobile and wireless technologies and mobile work practices will likely exacerbate technostress experienced by employees (Chen & Nath, 2008).

In summary, the literature review discussed above indicated that prior studies on technostress predominantly focused on the areas including technostress stressors, impacts of technostress, and individual and technology characteristics that influenced technostress. However, lack of consistency in technostress measure is evident among prior empirical studies making it difficult to build a unified body of knowledge on technostress; key studies in this area (e.g. Tarafdar, 2007;

Ayyagari et al., 2011; Suharti & Susanto, 2014) employed various measures for technostress. Furthermore, empirical studies on technostress are primarily US-centric creating a void in cross-cultural understanding of technostress, which is a global phenomenon. Therefore; cross-validating the measure for technostress in a cultural context other than the US is important and has the potential to lead to more empirical exploration of technostress globally.

RESEARCH METHODOLOGY

A questionnaire that included 23 items of the technostress instrument developed by Tarafdar et al. (2007) and items designed to assess the characteristics of the respondents and their organizations was developed and used in this study. The items were written in the form of statements with which the respondent was to agree or disagree on a 5-point Likert scale. The questionnaire was professionally translated into Chinese and reviewed by three domain experts with bilingual background for translation accuracy. The questionnaire was then distributed to 1,500 Chinese business employees who worked with ICTs on a regular basis in 64 companies located in a major metropolitan area in China. The completed survey was mailed back directly to the researchers in a prepaid envelop. The respondents were assured of their confidentiality and that no individually identifiable data would be collected or released. A total of 221 responses were returned and considered complete and usable for the purpose of this study, rendering a response rate of 14.7%. The sample covers a diverse group of businesses, both from Chinese domestic and multinational companies, across different industries. The respondents work in a wide range of functional areas and range from relatively new entrants into the workforce to experienced employees. Their ages are however concentrated in the range of 30 to 39 years old. The respondents are distributed relatively evenly between the genders (57% of males and 43% of female). Table 1 summarizes demographic information of our respondents. Table 2 summarizes the industries of the participating organizations.

Table 1: Respondent Profiles.

Gender	Frequency	Percent (%)
Male	126	57.0
Female	95	43.0
Age		
25-29	33	14.9
30-39	178	80.5
40-49	10	4.5
Years with the Current Company		
0 – 5	31	14.0
5 – 10	69	31.2
10 – 15	82	37.1
Over 15	39	17.7
Company Profile		
Chinese	51	23.1
Multinational	170	76.9
Total	221	100.0

ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

Table 2: Industries of participating companies.

Industry	Multinational	Chinese	Total
Advertising/Marketing	3	0	3
Construction	0	1	1
Education	2	2	4
Healthcare	3	2	5
Hospitality	5	1	6
Manufacturing	5	3	8
Non-Profit	1	2	3
Financial/insurance	8	1	9
Professional Services	6	1	7
Retail	3	1	4
Technology	9	2	11
Transportation	2	1	3
Total	47	17	64

DATA ANALYSIS

To assess whether the study suffered from nonresponse bias, early respondents and late respondents were compared. Early respondents were those whose surveys were received among the first 25% of responses, and late respondents were those whose surveys were received among the last 25% of respondents. The characteristics of the respondents and their organizations for the two groups were compared. The variables used in the analysis included gender, age, years with current company and type of company the respondent worked for. All the comparisons between the early respondent and late respondent groups rendered insignificant results and indicated that the study did not suffer from nonresponse bias.

In order to validate the measure of technostress in the Chinese context, Confirmatory Factor Analysis (CFA) was performed on the technostress instruments developed by Tarafdar et al. (2007). The initial measurement model was found to have relatively good fit with the data. Nevertheless, a review of the modification indices suggested that the model could be improved from respecification; therefore, the model was respecified by dropping Item 6 which shared a high degree of residual variance with other items. In order to ensure the theoretical integrity of the model, Item 6 was also evaluated from a substantive point of view before deletion. Item 6 asked respondents to rate their agreement or disagreement with the statement, "I spend less time with my family due to this technology." The authors suspected that the respondents might find it difficult to see the direct relationship between the use of work technologies and the amount of time spent with family. Furthermore, an examination of Tarafdar et al.'s (2007) original validation of the instrument indicated that this item had one of the lowest factor loadings on the construct it was designed to measure. Therefore, the item was concluded to be poorly worded and subsequently removed from the measurement model.

The resulting measurement model for technostress consisted of 22 items and showed significant improvements in model fit over the original model. All goodness-of-fit indices were found well

within the range of acceptance (χ^2 = 330.94; χ^2/df=1.71; GFI=0.91; CFI=0.94; RMSEA=0.06; RMR=0.05). Overall, the revised model demonstrated very good fit to the data collected from Chinese knowledge workers. The overall fit of the models was assessed using six fit indices: Chi-square, Chi-square/df, Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI), Root Mean Square Residual (RMR), and Root Mean Square Error of Approximation (RMSEA). Chi-square/df ratios of up to 3 with insignificant p values are indicative of acceptable fit models. While the Chi-square statistic is a global test of a model's ability to reproduce the sample variance/covariance matrix, it is highly sensitive to sample size and model complexity. Therefore, other model-fit indices such as CFI that are independent of sample size were evaluated along with the Chi-square statistics. A CFI above 0.90 is indicative of a well-fitting model. A RMSEA that is less than 0.08 indicates good fit and reasonable errors of approximation in the population, and a standardized RMR value of 0.05 or less indicates a well-fitting model. The factor loadings of the items are shown in Table 3. All items have reasonably high factor loadings on the constructs they measure. All model parameters are significant at the 0.001 level. According to these threshold values, the respecified measure of technostress demonstrated very good fit with the data.

Table 3: Factor loadings of technostress items.

Item	Overload	Invasion	Complexity	Insecurity	Uncertainty
TS1	0.73				
TS2	0.80				
TS3	0.85				
TS4	0.54				
TS5	0.55				
TS7		0.61			
TS8		0.86			
TS9		0.86			
TS10			0.73		
TS11			0.83		
TS12			0.73		
TS13			0.60		
TS14			0.71		
TS15				0.81	
TS16				0.53	
TS17				0.74	
TS18				0.70	
TS19				0.56	
TS20					0.63
TS21					0.83
TS22					0.75
TS23					0.59

ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

The internal consistency of the measurement model was assessed by computing the composite reliability. These reliability coefficients are displayed for all the latent factors in Table 4. All items have higher composite reliability coefficients than the benchmark value of 0.60 recommended by Bogozzi & Yi (1988). This suggests a high internal reliability of the data. The Average Variance Extracted (AVE) values for all factors are higher than the threshold of 0.5, indicating that adequate discriminant validity exists. In summary, with some modification to the technostress instrument developed by Tarafdar et al. (2007), the instrument was found both valid and reliable in the context of technostress of Chinese employees.

Table 4: Composite factor reliability, average variance extracted, mean, and standard deviation.

Factor	Composite Factor Reliability	Average Variance Extracted	Mean	Std. Deviation
Techno-Overload	0.83	0.50	3.24	.80
Techno-Invasion	0.83	0.62	3.17	1.03
Techno-Complexity	0.84	0.52	2.68	.85
Techno-Insecurity	0.83	0.51	2.36	.80
Techno-Uncertainty	0.80	0.50	3.29	.82
Overall Technostress			2.95	.57

As the second objective of this study, technostress levels of Chinese employees were examined and compared to those of US workers. Table 4 also displays the descriptive statistics for the technostress factor scores and overall technostress score. On average, moderate technostress was demonstrated among the respondents. Relatively higher level of stress was found in techno-uncertainty (3.29), techno-overload (3.24) and techno-invasion (3.17). Nevertheless, techno-invasion produced a larger variability as indicated by its relatively high standard deviation, suggesting that the degree of techno-invasion may vary by the nature of the individual's job. When compared to the findings of Ragu-Nathan et al (2008), both Chinese and US employees displayed relatively high techno-overload and -uncertainty and relatively low techno-complexity and –insecurity. Nevertheless, Chinese employees displayed considerably higher techno-invasion than US employees did (3.17 vs. 2.21).

Finally, the effects of gender, age, years with the current company and company type (Chinese domestic or multinational) on technostress were examined. Tables 5 and 6 display the ANOVA and correlation results, respectively. The results showed that technostress level varied across gender, age, and years with the company. Male respondents demonstrated a significantly higher level of technostress than female employees did. This finding was consistent with the finding of Ragu-Nathan et al. (2008) among US managers. Gender was also found to have significant impact on techno-invasion and techno-insecurity. Besides overall technostress, there appeared to be a significant difference of techno –overload and techno-uncertainty levels across age groups. Contrary to Ragu-Nathan et al.'s (2008) finding that technostress decreased as age increased, this study found that respondents between the age of 30 and 39 demonstrated the highest levels of techno-overload, techno-uncertainty and overall technostress. However, this finding might be

sample specific as the great majority of the samples fell into the 30 to 39 age category. Number of years with the current company was found to impact techno-uncertainty and overall technostress significantly. No significant difference was found in technostress and its components across respondents working for Chinese domestic companies and multinational companies, which were often perceived to have a higher degree of IT sophistication and adoption (Chen, 2010).

Table 5: ANOVA results on the effect of gender, age and company type on technostress.

	N	Mean	Std. Deviation	F	Sig.
Techno-Overload					
Gender				.734	.392
Male	126	3.28	.70		
Female	95	3.18	.91		
Age				3.949	.021**
25-29	33	2.99	.64		
30-39	178	3.31	.82		
40-49	10	2.78	.70		
Company Type				0.002	0.961
Chinese Domestic	51	3.23	.82		
Multinational	170	3.24	.79		
Techno-Invasion					
Gender				8.71	.004*
Male	126	3.24	.93		
Female	95	2.87	.94		
Age				.327	.721
25-29	33	2.90	.81		
30-39	178	3.11	.98		
40-49	10	3.05	.84		
Company Type				1.209	.273
Chinese Domestic	51	3.05	1.00		
Multinational	170	3.21	1.04		
Techno-Complexity					
Gender				2.51	.114
Male	126	2.76	.84		
Female	95	2.58	.85		
Age				1.099	.335
25-29	33	2.55	.81		
30-39	178	2.69	.84		
40-49	10	3.00	.99		
Company Type				1.152	.284
Chinese Domestic	51	2.79	.82		
Multinational	170	2.65	.85		
Techno-Insecurity					
Gender				4.45	.036**

ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

Male	126	2.46	.76		
Female	95	2.23	.83		
Age				.056	.946
25-29	33	2.33	.94		
30-39	178	2.36	.78		
40-49	10	2.42	.55		
Company Type				.009	.924
Chinese Domestic	51	2.35	.89		
Multinational	170	2.36	.77		
Techno-Uncertainty					
Gender				.423	.516
Male	126	3.32	.84		
Female	95	3.25	.80		
Age				5.192	.006*
25-29	33	2.87	.60		
30-39	178	3.36	.82		
40-49	10	3.28	1.06		
Company Type				3.153	.077
Chinese Domestic	51	3.11	.88		
Multinational	170	3.34	.80		
Technostress (Overall)					
Gender				6.253	.013**
Male	126	3.01	.54		
Female	95	2.82	.58		
Age				2.499	.085***
25-29	33	2.73	.52		
30-39	178	2.97	.57		
40-49	10	2.91	.49		
Company Type				.363	.548
Chinese Domestic	51	2.89	.63		
Multinational	170	2.94	.55		

* significant at the 0.01 level, ** significant at the 0.05 level, *** significant at the 0.10 level

Table 6: Correlation results on the effect of years with the company on technostress.

		Techno-Overload	Techno-Invasion	Techno-Complexity	Techno-Insecurity	Techno-Uncertainty	Technostress (Overall)
Yrs with the company	N	221	221	221	221	221	221
	Pearson Correlation	.036	.060	.10	.033	.17	.12
	Sig. (2-tailed)	.589	.374	.140	.630	.014**	.068***

* significant at the 0.01 level, ** significant at the 0.05 level, *** significant at the 0.10 level

DISCUSSION

The prime objective of this study is to cross-validate the technostress measure using Chinese knowledge workers. The measure was found to be valid and reliable in the Chinese context with some respectification, deletion of item 6. Therefore, it is recommended that the respecified measure be used to evaluate technostress among Chinese employees. The findings from this study also allowed us to establish a new benchmark for technostress among knowledge workers in China. Overall, moderate technostress was found among the respondents. When compared to US employees studied in Ragu-Nathan et al. (2008), both samples displayed similar pattern and degree of technostress with the exception of techno-invasion. Chinese employees demonstrated considerably higher techno-invasion than US employees did. Therefore, we recommend Chinese companies to pay closer attention to the invasive aspects of a new information technology before adopting it in the workplace.

This study also investigated the role of individual and organizational characteristics in technostress. In terms of gender, male and female employees differed significantly in their technostress levels rendering an agreement to findings by Ragu-Nathan et al (2008). Chinese female employees exhibited significantly lower stress level from techo-invasion, techno-insecurity, and overall technostress. A plausible explanation to this may be that women have generally been considered secondary providers in their families in the Chinese culture. Therefore, it is reasonable for female Chinese employees to feel less compelled to allow work technologies to spill over to their family lives and less threatened by the risk of being replaced by others with superior technical skills. This finding may also be partially explained by women's ability to multitask more successfully than men, which has been suggested by some prior research (e.g. Moore et al., 2008).

Our data produced some evidences that contradicted prior findings. Ragu-Nathan et al. (2008) found that technostress decreased as respondents' age increased. Interestingly, the post-hoc analysis unveiled that Chinese employees in the age group of 30-39 experienced significantly higher level of techno-overload and –uncertainty than their younger (25 -29 years of age) and older (40 – 49 years of age) counterparts did. This suggests that the effect of age on employees' technostress may not always be linear as Ragu-Nathan et al. (2008) found among US employees. A possible explanation for this result may be that employees between 30 and 40 are the group that experience the most drastic increase in their family and career responsibilities, thus higher role ambiguity and conflict. Therefore, the effect of age on technostress warrants further investigation, especially in the global context. In addition, this study found that technostress increased as respondents' years with the current company increased suggesting that tenured employees tended to become complacent and disengaged with learning new technologies.

This study has a number of implications to research and practice. For researchers, this study validated and refined the measure of technostress using a sample of Chinese knowledge workers. It confirmed the general validity of the technostress measure developed by (Tarafdar et al., 2007) and recommended a respecified technostress measure that can be used in future empirical and/or

  ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

cross culture studies. The differences in techostress level and impact of individual and organizational characteristics on technostress between Chinese and US employees suggested that national culture, economy or technological environment might have played a role and warranted further empirical investigation. From the practical perspective, this study offered organizations a valid measure to evaluate technostress levels among their employees globally. It helped raise organizations' awareness of technostress and motivated them to invest resources in technostress prevention and reduction. For Chinese organizations that want to gauge their effectiveness in dealing with technostress, they can compare the technostress level of their employees to the technostress benchmark of a basket of diverse companies included in this study and identify areas to focus on in their future efforts to combat technostress.

LIMITATIONS, DIRECTIONS FOR FUTURE RESEARCH AND CONCLUSION

The current study has a number of limitations. First, over and/or under-estimated results may have occurred due to the self-reporting practice employed in the survey methodology. Second, the sample of this study included two types of Chinese employees, technical and non-technical knowledge workers, and no distinctions were made between these two types of employees in this study. Technical employees may experience different forms of technostress than non-technical employees; therefore, it is recommended that these two types of employees be separated in future technostress studies. Finally, the sample contains a disproportionately large number of respondents between the age of 30 and 39. Future studies should employ a sample with greater variability in age. Due to these limitations, the findings of this study should be interpreted with caution.

The empirically validated measure for technostress offers a solid theoretical foundation from the global perspective on which future technostress studies can build. Along with other studies, this research demonstrated the global prevalence of technostress among employees in today's business and technological environments. Prior studies have found that individual technology adoption and use behaviors do not universally hold across cultures. For example, it has been found that individuals whose national cultures that are high in uncertainty avoidance and risk-averse are less willing to adopt new information technologies and that social norms are strong determinants of individuals' technology acceptance behaviors in cultures that exhibit high feminine and uncertainty avoidance values (Jarvenpaa & Leidner, 1998; Thatcher et al., 2003; Srite & Karahanna, 2006). In addition to cultural differences, differences in economic development and technology infrastructure have also been found to influence technology use behaviors (e.g. Watson et al., 1997; Yan et al., 2006; Nath et al., 2014) Therefore, it is reasonable to expect individual differences driven by national culture, economy and technology infrastructure to be extended to the context of technostress. Future research projects are recommended to focus on empirical studies of technostress in the global context. For example, cross-culture comparison of the antecedents and consequences of technostress will help uncover the impact of cultural and national differences on technostress.

Organizations all over the world are increasing their investments in ICTs in the hope to become more competitive in the global economy. As a byproduct of growing dependence on technologies, technostress is prevalent among employees and preventing organizations from amplifying the returns on their ICT investments. Empirical validation and refinement of the technostress measure using a sample of Chinese knowledge workers represents an important step towards globalizing

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technostress research. We believe that this study makes significant contributions to the field's understanding of technostress that will eventually lead to effective strategies for preventing and reducing technostress among workers globally.

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  ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

APPENDIX A

TECHNOSTRESS MEASURE

In the following statements, the term "this technology" refers to the day-to-day computer applications you use in your job, such as e-mails, office automation systems, database systems, and any other job-related information technologies.

Techno-Overload

TS1 I am forced by this technology to work much faster
TS2 I am forced by this technology to do more work than I can handle
TS3 I am forced by this technology to work with very tight time schedules.
TS4 I am forced to change my work habits to adapt to new technologies.
TS5 I have a higher workload because of increased technology complexity.
TS6 I spend less time with my family due to this technology.

Techno-Invasion

TS7 I have to be in touch with my work even during my vacation due to this technology.
TS8 I have to sacrifice my vacation and weekend time to keep current on new technologies.
TS9 I feel my personal life is being invaded by this technology.

Techno-Complexity

TS10 I do not know enough about this technology to handle my job satisfactorily.
TS11 I need a long time to understand and use new technologies.
TS12 I do not have enough time to study and upgrade my technology skills.
TS13 I find new employees to this organization know more about computer technology than I do.
TS14 I often find it too complex for me to understand and use new technologies.

Techno-Insecurity

TS15 I feel constant threat to my job security due to new technologies.
TS16 I have to constantly update my technology skills to avoid being replaced.
TS17 I am threatened by co-workers with newer technology skills.
TS18 I do not share my knowledge with my coworkers for fear of being replaced.
TS19 I feel there is less sharing of knowledge among co-workers for fear of being replaced.

Techno-Uncertainty

TS20 There are always new developments in the technologies we use in our organization.
TS21 There are constant changes in computer software in our organization.
TS22 There are constant changes in computer hardware in our organization.
TS23 There are frequent upgrades in computer networks in our organization.

ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

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