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Impact of Technostress in Enhancing Human Productivity: *An Econometric Study*

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ABSTRACT

Information Technology in the corporate world, effects of the continuing developments in information technology (IT) on business activities. In the enterprise, information technology has made significant changes on production design, management control, decision-making and organizational design and is becoming increasingly indispensable part of many aspects of business and everyday life. Easy worldwide communication provides instant access to a vast array of data, challenging assimilation and assessment skills. At the same time, there is a need for specialized staff support, training for managers and employees, and a redefinition of jobs. It has also made employees work under greater mental pressure and sense of anxiety and pessimism as they have to keep up with the fast advancing pace of the new ICTs, employees have to constantly renew their technical skills as well as enduring pressure from a more complex system and higher expectations for productivity. Managers need to consider the effects of various new problems aroused by information technology, including overcoming resistance to the use of computers, mental pressure and security of information. Studies have found technostress to have significant negative impact on employee productivity. The paper concludes that results are evident which verified that there is a negatively influences of IT usability on the workforce which specifically has interacting with IT innovations regularly on productivity. This will provide a foundation for organizations to comprehend and alleviate technostress, thus improving employee performance and productivity.

KEYWORDS

MANOVA	Techno stress
Human	Information Technology (IT)

PREFACE

The technostress problem is more evident in information technology (IT) professionals, who simultaneously create new technology and are affected by it. Today, the IT industry is the fastest growing industry in each country and they are facing tremendous competitive pressure. IT professionals must continually learn and apply new technology into their projects as quickly as possible. Due to shortage of time, they are forced to update their knowledge and skills in their spare time including holidays. They are subjected to workload increases due to the complexity of new technology systems and the relatively short time frame to complete IT projects. According to a health survey (Anne, 2004 and Wang *et al.*, 2008), the main causes of job stress for white-collar workers in China are workload and occupational crises. To keep up with the fast advancing pace of the new ICTs, employees have to constantly renew their technical skills as well as enduring pressure from a more complex system and higher expectations for productivity. In the meantime, the introduction of new technologies is often accompanied by organizational downsizing, which means there are fewer people to do the same amount of work. At present, most of the organizations are carrying out IT reconstruction within the workforce. As more and more technologies are placed on employee desktops, the technostress level may also increase while the organizational productivity and work efficiency may suffer. Companies must take practical measures to cope with technostress (Tu, Wang, & Shu, 2005). Various types of stress have been defined by researchers in the past. Especially, work related stress is considered as the major reason for being stressful, i.e. 'technostress'. This is a stress caused by the inability to cope with the new computer technology in a healthy manner. Craig Brod (1984) was the first to define technostress in a more formal manner. This is expressed in many ways: irritability, headaches, resistance to learning about the computer or outright rejection of the technology, etc. Sometime, it turns into anxiety, technophobia or computer phobia by which employees started to hesitate or avoid the use of technology (Rosen *et al.*, 1987). Upgraded information technology has revolutionized the working pattern of the organizations. Technostress affects work related culture and has brought its own problems to many employees of the organization. Inspite of several training programs, employees in many organizations are not able to cope up with it and are unable to make themselves comfortable (Lalitha & Pangannaiah, 2006).

ICT innovations have changed the personal and professional life due to the ramifications of the rapid influx in the technology (Hoffman, Novak, & Venkatesh, 2004). The most conspicuous development in the globalization context has been the Information and Communication Technology (ICT) influx. It seems to have turned the world into a global village. Endless connectivity, interactive organizations, information sharing and infinite access have all become the new ICT buzz words. The new trends in the world market economy have brought to the fore the debate on the impact of the Liberalization, Privatization and Globalization wave. The impact is most visible in the context of developing economies, as it astutely plays down its drawbacks and accentuates its advantages. One of the highlighted positives being the influx of Information and Communication Technology (ICT). If, on the one hand, globalization has precipitated the onward march of ICT, the growing success in ICT initiatives has also brought the global community closer. ICT, in the globalization context, is all about global knowledge, access, participation and governance in the information age. It has radically changed our views about boundaries between organizations and the boundaries within the organizations. . On the one hand dependence on advanced ICTs brings noted convenience and productivity gains. On the other hand, however, people are suffering from being surrounded by overwhelming and rapidly changing technologies. This often leads to ICT related technostress experienced by employees in many organizations which affect employee productivity negatively (Ragu-Nathan *et al.*, 2002 and Tarafdar *et al.*, 2007 and Ragu-Nathan *et al.*, 2008). Nowadays, information and communication technology (ICT) is ubiquitous, and the quality of our home, work and social life is significantly dependent on the quality of ICT-based information systems. Since the majority of ICT and ICT-based information systems are developed and used in business organisations, ICT workers, including ICT professionals and ICT non-professionals or end-users, have both intentional and unintentional power over the general public. They have to recognise their responsibility to the general public and develop a professional outlook

and attitude in order to create and maintain a safe and reliable information society.

Well-organised codes of conduct for guiding ICT workers in their professional behaviour have already been laid down; however, these codes may not function well on their own, unsupported by context. An ICT worker is not necessarily an independent and unchallenged entity; he/she works within a complex environment filled with various types of *stress and pressure.* This complex cultural situation—in which young people are struggling to find direction in their lives or simply to survive, to improve their living conditions, and to develop their identities—has been given various names. Some call it the information or informational age, while others prefer the term techno-culture (Robins & Webster, 1999) or techno capitalism, global media culture, or simply globalization, referring to the dialectic process in which the global and the local exist as "combined and mutually implicating principles". Labels such as post-industrial, virtual and cyber society are also in use (Beck, 2002). The idea behind all these terms is that across the globe, ICT are playing a central role in young people's lives and in society at large (Hand & Sandywell, 2002). This revolutionary change has also enhanced the expectation level of management as far as productivity and work culture is concerned. Employees are often expected to be reachable through email or cell phone while at home or even on vacation. It also influenced psychological health of workers as well as superiors or top management level by increasing their workloads (Duxbury & Higgins, 2001 and Thomee *et al.*, 2007). The objective of this paper is to explain the relationship in the present-day business organizations mainly between IT personals and increased usage of information technology (IT) and how these relationships affect the productivity and efficiency of the employees.

This research paper is divided into five sections. Section 1 i.e. the present section gives the conceptual framework of technostress affecting IT personnel in Indian context. Section 2 gives a comprehensive review of existing literature which is the prime tool in identifying the research gap. Section 3 identifies the research objectives, data and methodology used. Section 4 presents the analysis and interpretation of the results and Section 5 entails the summary and conclusions of the research study.

REVIEW OF LITERATURE

There are many studies conducted which are focused on the stress originating by the use of information technology directly or indirectly, like, Bloom, 1985; Doronina, 1995; Weil & Rosen, 1994 & 1997. It is evidently proved that the organizational environment plays an important role to enhance technostress for employees (Schein, 1971; Murphy, 1987; Farina *et al.,* 1991; Hendrix *et al.*, 1995; Sosik & Godshalk, 2000 and Raitoharju, 2005). Numerous studies identified that technostress integrated with the rapid use of IT/ICTs are as follows: Craig Brod, 1984; Compeau & Higgins, 1995; Clark & Kslin, 1996; Arnetz & Wiholm, 1997; Thong & Yap, 2000 and Sethi *et al.*, 2004). Some studies found that technostress is an important fallout of the inevitable use of ICTs in organization and illustrates the bivalent nature of their organizational influence (Lloyd & Gressard, 1984; Igbaria & Prasuraman, 1989; Brosnan, 1998; Desai & Richards, 1998; Bryan, Ajay & Simon, 2002; Ragu-Nathan *et al.,* 2002; Finn & Korukonda, 2003; Burton-Jones & Hubona, 2005.

Many researchers focused on gender issue and confirmed that female personnel showed more stress than men (Burke & Belcourt, 1974; Davidson & Cooper, 1983; Nelson *et al.,* 1990; Rosen & Maguire, 1990; Smits *et al.*, 1993; Shaw, 1994; Ranson & Reeves, 1996; Gefen & Straub, 1997; Whitley, 1997; Moore, 2000; Venkatesh & Morris, 2000; Ahuja, 2002; Perrons, D., 2002; Day & Livingstone, 2003; Harris & Wilkinson, 2004; Matud, M., 2004, and Cameron B. & Butcher-Powell L., 2006). While others insist that there are no differences between the sexes on the issue of technostress (Martocchio & O'Leary 1989, and Hamilton & Fagot, 1988). Whereas a single study showed that female IT professionals had less self perceived occupational stress than men i.e. Tung, 1980.

Some past literature define the concept of stress as a continuous and dynamic process which affects employees psychologically, (Shirom, 1988; Newton, 1989; Dewe, 1991; Hart, Wearing & Headey, 1993; Hart and Wearing, 1995) which are mostly focused on individual intensity in place of organizational aspects, while, several other are considered organizational phase (Wilkins & Ouchi, 1983; Denison & Mishra, 1995; Ma & Bao, 1999;

Hannakaisa *et al.*, 2000; and Wang *et al.*, 2008). In this paper, Questionnaire technique is used to get an apparent picture about the usual proceedings of the personnel which is also an approved and much used technique for the analytical surveys (Robertson *et al.*, 1990; Cooper & Williams, 1991; Rees & Cooper, 1992; Bogg & Cooper, 1995; Lim & Teo, 1996; Cameron & Butcher-Powell, 2006 and Rajput & Gupta, 2011).

After reviewing the literature, we can define technostress as a reflection of one's discomposure, fear, tenseness and anxiety when one is learning and using computer technology directly or indirectly, that ultimately ends in psychological and emotional repulsion and prevents one from further learning or using computer technology and hence, this leads to major fallouts because of technology, which affects the productivity adversely and to study this is the main focus of this paper. To address these issues, in the form of strategy is vital for the organization and for human resource managers (HR managers) on the ignorance of which there can be major downbeats.

RESEARCH OBJECTIVES

The main objective of this paper is to examine the occupational stress on IT employees and its impact on their productivity and efficiency.

Hypotheses can be formulated are as follows:

***Ho*: There is negative relationship between level of centralization and level of innovation on techno-stress among employees.**
***H1*: High level of centralization and innovation are directly related to level of Technostress.**
***Ho*: There is no impact of innovation and automation in organization on employee Technostress and no effect on employees' productivity.**
***H2*: The organizational environment of innovation increases the level of employee Technostress and affects employee productivity negatively.**

DATA

This paper is focused on analysing the impact of increased techno-stress among the personnel of IT organizations and its impact on productivity and efficiency. To understand this relationship a structured questionnaire was formulate. The interview sessions were also organized to supplement the information which is not elicited by the questionnaire with a further exercise of probing the respondents about their responses on the survey. The data was collected through a combination of mail surveys and semi-structured interviews. Total 580 correct responded questionnaires were used for the analysis. Among 580 participants, 60 per cent are male respondents (N = 348) and 40 per cent are female respondents (N = 232) which is coded by 2 and 1 respectively. Out of total 18.1% respondents are from supervisor or top management level, and the rest 81.9% are other qualified staff. Age is corresponding in three groups, 174 are below 25 years of age, 341 are from 25 to 45, and the rest 65 are older than 45. The staff which is selected from educational background, categorized in four categories, such as, 1: 5% (29) have done high school, 2: 45% (261) have completed 4 years college, 3: 20% (116) cleared graduation and 4: rest 30% (174) have done other courses. The adequacy test of the sample size is done by Kaiser-Meyer-Olkin (KMO) and Bartlett's Test. Reliability test is done by Cronbach Alpha. Validity test was done by factor analysis.

METHODOLOGY

Sources of stress were assessed with 61 items adopted from Cooper et al.'s (1988) occupational stress indicator (OSI). The psychometric properties of the OSI have been established in previous studies. Items were scored from 1 (strongly agree) to 5 (strongly disagree) on a five-point Likert Scale response. Williams (1996) analyzed the data from over 20,000 participants working in over 100 different organizations to evaluate the scale structure and reliability to test the psychometric properties of the OSI on a huge diverse sample and see if the instrument could be improved. The OSI consists of five subscales which tap five dimensions of stress: (1) Techno-overload, (2) Techno-invasion, (3) Techno-complexity, (4) Techno-insecurity and (5) Techno-uncertainty. Tarafdar et al. (2007) further developed and validated a technostress measurement scale based on US data. The scale defined five components of technostress that describe typical situations where the use of computer technology can potentially create technostress. The five components are: (1) Techno-overload: the ICTs pushes employees to work faster; (2) Techno-invasion: the pervasive ICTs invades

personal life; (3) Techno-complexity: the complexity of new ICTs makes employees feel incompetent; (4) Techno-insecurity: the job security of employees threatened by fast changing ICTs; and (5) Techno-uncertainty: the constant changes, upgrades and bug fixes in ICT hardware and software impose stress on the end-users.

FACTOR ANALYSIS

Factor analysis is a statistical method to depict variability among observed variables in terms of a potentially lower number of unobserved variables called factors. In other words, it is possible, for example, that variations in three or four observed variables mainly reflect the variations in fewer such unobserved variables. Factor analysis searches for such joint variations in response to unobserved latent variables. The observed variables are modeled as linear combinations of the potential factors, plus "error" terms. The information gained about the interdependencies between observed variables can be used later to reduce the set of variables in a dataset. Factor analysis originated in psychometrics, and is used in behavioral sciences, social sciences, marketing, product management, operations research, and other applied sciences that deal with large quantities of data. In this paper, Gender, age and Educational level are few factors which are categorized in the basis of Centralization and Innovation forms the basis of factor analysis. They are found to be satisfactory reliability scores.

Analysis: The analysis will isolate the underlying factors that explain the data. Factor analysis is an interdependence technique. The complete set of interdependent relationships is examined. There is no specification of dependent variables, independent variables, or causality. Factor analysis assumes that all the rating data on different attributes can be reduced down to a few important dimensions. This reduction is possible because the attributes are related. The rating given to any one attribute is partially the result of the influence of other attributes. The statistical algorithm deconstructs the rating (called a raw score) into its various components, and reconstructs the partial scores into underlying factor scores. The degree of correlation between the initial raw score and the final factor score is called a factor loading. There are two approaches to factor analysis: "principal component analysis" (the total variance in the data is considered); and "common factor analysis" (the common variance is considered). In this paper "principal component analysis" is used.

ANALYSIS AND INTERPRITATION

***Ho*: There is negative relationship between level of centralization and level of innovation on techno-stress among employees.**

***H_1*: High level of centralization and innovation are directly related to level of Technostress.**

Level of innovation and centralization has a positive impact on level of technostress as is evident from table 1 which gives details of descriptive of variables under study i.e. means, standard deviation and correlation. Results reveal an overall significance positive correlation between technostress and the extant of centralization ($r = 0.288$, $p < 0.01$) and innovation environment ($r = 0.156$, $p < 0.01$) and is in congruence to the review of literature deliberated above like (Zhou, 1996). To find out the impact of centralization and level of innovation in the organization after taking into account the possible effects of control variables, ***stepwise multiple regressions*** are used to test the hypotheses, the results of which are reported in table 2. It was revealed that the t-value of both the extent of centralization ($t = 6.029$, $p < 0.01$) and innovation environment ($t = 2.439$, $p < 0.05$) are found to be significant with no collinearity in the regression model which leads us to the rejection of null hypothesis (*Ho*) and acceptance of alternative hypothesis (H_1) i.e. high relationship of centralization and technostress. Hence, we can say that if employees are forced to learn the new technology over long period of time, there is likelihood for them to suffer from technostress which is evident from there level of dissatisfaction and fatigue. On the other hand, in a more decentralized set-up, employees will be more willing to accept new technology which reduces the level of technostress. This is an important implication for the management to balance centralized organizational structures with participation mechanism to avoid high levels of employee technostress and should be incorporated in the strategies.

Table 1: Means, Standard Deviations and Correlation of Measures

Measures	Mean	S.D.	1	2	3	4	5
Gender	0.65	0.019	.	.	.	.	.
Age	1.79	0.027	0.105(**)	.	.	.	.
Educational Level	2.85	0.029	0.121(**)	0.018	.	.	.
Centralization	7.24	0.078	0.007	0.036	-0.117	.	.
Innovations	8.99	0.076	-0.039	-0.034	-0.054	0.242(**)	.
Technostress Level	**71.42**	**0.445**	**0.038**	**0.112(**)**	**-0.003**	**0.288(**)**	**0.156(**)**

*** p<0.05, and ** p<0.01; N=580**

Table 2: Regression Results: Technostress an Organizational Environment

	Unstandardized Co-efficients		Standardized Co-efficients		Sig. Value	Collinearity Statistics	
Independents	***B***	***S.E.***	***Beta***	***t-value***		***Tolerance***	***VIF***
Gender	0.661	0.949	0.031	0.698	0.492	0.963	**1.048**
Age	1.438	0.628	0.094	2.33	0.027	0.981	**1.029**
Educational Level	0.285	0.599	0.023	0.52	0.641	0.974	**1.035**
Centralization	1.246	0.208	0.246	6.029*	0	0.952	**1.059**
Innovations	0.517	0.24	0.102	2.439*	0.018	0.956	**1.056**
Adjusted R^2	0.091						
F-value	**11.472**						

*** p<0.05, and ** p<0.01; N=580**

***Ho*: There is no impact of innovation and automation in organization on employee Technostress and no effect on employees' productivity.**

***H_2*: The organizational environment of innovation increases the level of employee Technostress and affects employee productivity negatively.**

MANOVA followed by a Scheffe's test (for pair-wise comparisons) is conducted to understand the varying level of technostress across various organizational internal environments. The result of MANOVA indicates that the difference of technostress is statistically significant under different organizational internal environments taking computer related technostress as dependent variable and centralization vs. innovation as organizational environment (see table 3). In the contemporary world, to introduce innovations and embedding that in organization culture is inevitable. To have a competitive edge, innovation has become the main strategy of many firms. The analytical results indicate an elevating level of technostress with high levels of innovations, especially when organization rewards an employee with higher level of computer literacy and vice-a-versa, thus, disrupting individual goals, similarly as the study done by Schwartz & Davis, (1981) and Sheridan (1992). Hence, a rational strategy is required on the part of the management to strike a balance between organizational and individual goals with right amount of assistance imparted time and again to all employees which will help in alleviating level of technostress.

Table 3: MANOVA Results: Technostress and Organizational Environment

Organizational Environment→ Technostress↓	Low Centralization & Low Innovation	Low Centralization & High Innovation	High Centralization & Low Innovation	High Centralization & High Innovation	*F*-Value
Techno-overload	9.69	9.91	10.65	10.58	**8.929*****
Techno-invasion	24.08	23.98	25.26	25.05	**2.454**
Techno-complexity	19.38	19.99	21.43	21.62	**12.583*****
Techno-insecurity	4.26	4.27	4.68	4.89	**10.059*****
Techno-uncertainty	11.014	12.25	11.24	12.63	**12.891*****
Technostress Level	**67.73**	**70.16**	**72.67**	**74.57**	**12.815*****

* p<0.05, ** p<0.01 and *** p<0.001; N=580

Table 4: Scheffe's Method

Quadrant I:	**Quadrant II:**
Low Centralization/Low Innovation	**Low Centralization/High Innovation**
Quadrant III:	**Quadrant IV:**
High Centralization/Low Innovation	**High Centralization/High Innovation**

The above analysis reveals that there are varying perceptions of employees under different organizational internal environments in relation to technostress. Direct relationship is revealed between level of technostress and centralization/innovation of organization. Out of five components, i.e. *Techno-overload, Techno-invasion, Techno-complexity, Techno-insecurity and Techno-uncertainty*, there is no significant difference of "techno-invasion" and the rest are found to be significant. Finally, the analytical results authenticate that the levels of employee technostress are significantly diverse in organizations that belong to the four different configurations of organizational environment shown above (see fig. 1). Organizations in Quadrant I (low centralization/low innovation) generate the lowest level of employee technostress as minimal technology is used in daily operations. Whereas, organizations in Quadrant IV (high centralization/high innovation) create the highest level of employee technostress as there is heavy dependence and usage of technology innovations to achieve the competitive edge. This framework of analysis will help the managerial personnel to develop and counter the negative impacts of technostress.

SUMMARY AND CONCLUSIONS

Technostress is becoming a new nightmare caused by our advancements in this technological age. This is a type of anxiety which is experienced when interacting with onslaught of newly improved and technological gazettes and computer upgrades invading our work, home and leisure time activity. It is on the rise and can appear as irritability, headaches, mental fatigue, panic, anger and feeling of helplessness. On the other side of the coin, these great inventions can save time, money and help us giving the timely information. This paper investigates the impact of different organizational environment, variables on the level of employee technostress. Research about technostress in Indian companies is relatively a new concept and can be extended to other culture setting also. Different marketing strategies, under different ownership types, can be explored on the bases of how employee perceive and respond to technostress. As it is now becoming a high up in work culture for both the system users and IT professionals. Since, it has both positives and negatives, one area of research can be as to how to make new ICTs more lucrative and productive in Indian firms. The results of this study should be useful for IT companies operating in India addressing the issues of technostress from the perspective of organizational behavior. Not only this, it will help the managers to formulate the best strategy striking a balance between innovations/centralization and level of technostress, so that as to alleviate its level.

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