The Impact of Job Characteristics and Motivators on Perceived Stress Among Information Technology (IT) Consultants

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Abstract: The aim of the study was to test the relationship between job characteristics (job demands, job control) and perceived stress (e.g., stressed, pressured, tense) with motivators (e.g., recognition, achievement, the work itself, the possibility for growth and work significance) as the mediating variable. In this cross-sectional study a web-based questionnaire survey was conducted among 380 information technology (IT) consultants at ten IT consultancy companies in Sweden. The results showed that job demand was positively related to perceived stress and that motivators mediate the relationship between job control and perceived stress. The results point to the importance of motivators among IT consultants in the framework of job stress and performance. The managers' impact on the work characteristics in the work environment is also discussed.

Keywords: IT consultants, motivation, job demand, job control, stress.

INTRODUCTION

The Information Technology (IT) consultants' work exhibits many characteristics of knowledge work. IT consultants have to deal with non-standard problems and this work is often performed in co-operation with the customers who make intense demands. The IT consultants' environment may therefore be stressful. However, despite the increasing interest in knowledge-intensive firms, there are relatively few studies that describe the working conditions of IT consultants in terms of their psychosocial work environment, such as job demands, job control and stress.

PSYCHOSOCIAL FACTORS, WORK MOTIVATION AND STRESS

Job stress has become a major issue among employees in advanced industrial societies. Such stress often results from high job demands in relationship to the workers' abilities, frustrated aspirations and dissatisfaction with valued goals. Stressors, such as quantitative overload, qualitative underload, low control and low social support may have harmful effects on an individual's health and well-being [1, 2].

De Jonge *et al.* [3] found that a work situation with both high job demands and job control was related to a high degree of work motivation. In general, motivation comes from workers' desire or need to perform to the best of their ability. Most motivation theories and definitions describe causal relationships as a process that starts with needs/goals and ends with satisfaction. According to Katzell and Thompson [4], work motivation is a broad construct pertaining to the conditions and processes that account for the arousal, direction, magnitude and maintenance of effort in an individual's job. One of the most well-known motivation theories on behaviour and job satisfaction is Herzberg's two-factor theory ("Motivation-Hygiene Theory") [5]. Herzberg *et al.* suggest that certain factors ("motivators", "satisfiers") motivate while others are preventive and remove the hindrances to forming positive job attitudes ("hygiene factors", "hygienes"). According to this theory, motivators come from achievement, recognition, the work itself, responsibility, advancement and the possibility for personal growth. The model in the current study is a mediational one where we propose that motivators act as a mediator: "A *mediator* variable is one that is responsible for the transmission of an effect, but does not alter the nature of that effect" [6].

IT Consultants Work Situation

The IT sector relies on the latest technology and technologically qualified workers. Much IT research assumes that IT professionals are a homogenous group, but there are at least two major sub-occupations in the profession – *IT professionals* who are employees of their organizations and *IT consultants* who are employed by consultancy firms and mainly work at other organizations. IT consultancy firms that act in an increasingly competitive global market require well-educated and motivated employees who continuously devote themselves to skills development.

For IT consultants, solving customer problem may produce feelings of competence, accomplishment and growth. But if customer expectations increase excessively the IT consultants' sense of self-efficacy may diminish and their optimism may decrease. To the best of our knowledge, very little research has been published pertaining to the work conditions, work motivation and health among IT consultants. Nevertheless, some studies are interesting in this context. For example, the results of a study among IT consultants (N=521) in Sweden imply that motivational orientation may play a differentiating role in the "burnout"

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process and furthermore indicate that motivational frameworks may add to the understanding of the associations between involvement in work and negative outcomes, such as burnout [7]. Previous research also indicates that there are some inappropriate psychosocial working conditions in the IT sector [8, 9]. In a study of a group of IT consultants in the USA, Brown [10] found that a job that provides autonomy, challenge, feedback and the ability to use skills was important in promoting job satisfaction and work motivation. However, this study had some limitations because of its small sample size (N=21) and a low response rate (49 per cent). In a cross-sectional study among Swedish IT consultants (N=167), Wallgren and Johansson Hanse [11] found that motivators might act as a partial mediator in the relationship between job control and perceived stress.

AIM

The aim was to apply a Structural Equation Modeling (SEM) procedure of the relationship between job control, job demands, motivators and perceived stress among IT consultants among different IT companies in Sweden.

Model Specification

A full SEM was used in the study (see Fig. **1**). This process model consists of the independent latent variables of 'job demands' and 'job control', the mediating latent variable 'motivators', and the dependent (endogenous) latent variable 'perceived stress'. Job demand was hypothesized to be positively associated with perceived stress (p1) and job control negatively associated with perceived stress (p2). Moreover, job demand was hypothesized to be negatively related to motivators (p3), job control positively related to motivators (p4), and finally, motivators negatively related to perceived stress (p5) [12, 13].

METHOD

Participants

In this cross-sectional study a questionnaire was distributed to IT consultants in Sweden. The questionnaire was addressed to 422 respondents who were employed at 10 IT consultancy companies. The overall response rate was approximately 90 per cent (N=380).

The IT consultants worked full time, mainly with assignments for external customers in the industrial and the public sectors. The IT consultants were hired by customers for specific tasks with deadlines and often worked in a project-oriented work organization. Approximately one per cent of the respondents were below the age of 26, approximately 90 per cent were between ages 26 and 50 and approximately nine per cent were older than 50 years. About 55 per cent of the respondents had more than 10 years of IT work experience, 33 per cent between six and ten years and 12 per cent fewer than six years. 80 per cent of the respondents were males.

Procedure

This study was web-based and accessible *via* Internet. Each potential subject in the study was sent an e-mail with information about the study and an Internet link to the web page where the questionnaire was available. The e-mail explained the purpose of the survey and guaranteed confidentiality. When subjects logged in on the web page, an authorization check was made and data was stored about which subjects had answered the questionnaire. These responding subjects were not sent reminders. The questionnaire was constructed so that each question had to be answered in order for the questionnaire to be considered complete, ensuring there were no missing data. The questionnaire was accessible for a period of four weeks, and three reminder emails were sent out.

Questionnaire

All participants responded to a questionnaire concerning background variables, job characteristics (job demands, job control), motivators and perceived stress.

Background variables. This section of the questionnaire asked questions about age (a nine-point response scale) and years of employment in the IT sector (a five-point response scale).

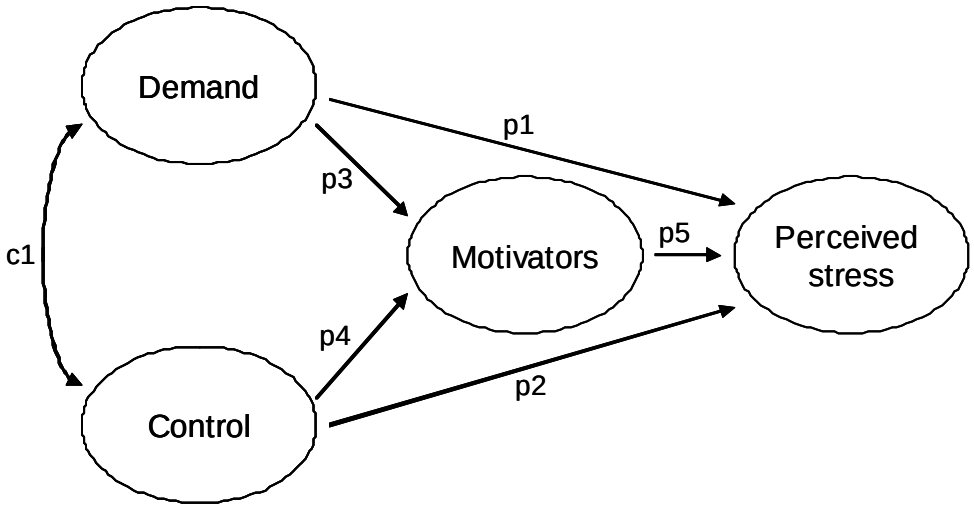

Fig. (1). Specification of the full structural equation model tested in this study, with the mediating effect of motivators. Only latent variables and their relations have been depicted, where p = paths (regression weights).

Job demands. Workers' attitudes toward their job demands were assessed using a Swedish version [14, 15] of a questionnaire developed by Karasek [16]. This job characteristic includes four manifest variables: whether it was necessary to work fast, hard and with high effort, and whether the participant has enough time to do the job (reversed score). The questionnaire uses a four-point response scale for each question and frequency-based grading (never, seldom, sometimes and often). High values (scores) for job demands indicate high demands.

Job control. Workers' attitudes toward their jobs were assessed using the PAK questionnaire [17]. PAK is a Swedish acronym for: 'Psychosocial work questionnaire'. Job control was measured using a short version of PAK, consisting of three manifest variables. Each manifest variable has five fixed response alternatives that were assigned points from 1 (very unsatisfactory) to 5 (very satisfactory). The manifest variables are: influence on the rate of work, influence on working methods and influence on the allocation of tasks.

Motivators were operationalized by five job variables. Four designated by Hertzberg *et al.* as "motivators" [5]: recognition, achievement, the work itself (variety) and the possibility for growth and one of Hackman and Oldham´s [18] dimension of "The work itself": task significance. The first three variables were assessed using items (facets) from the Minnesota Satisfaction Questionnaire (MSQ) [19], and the fourth job variable was developed by the authors. The fifth job variable was adopted from the Job Diagnostic Survey (JDS) scale developed by Hackman and Oldham [20].

Participants used a five-point scale to rate the importance of these job variables. The questionnaire began with a general question about the rate of satisfaction regarding these job variables: "How satisfied am I with this aspect of my job?" In this study, measures spanned the four job variables as described above, with one question on each dimension: work itself/variety ("The possibility to do different things from time to time"); recognition ("The praise I get for doing a good job"); achievement ("The feeling of accomplishment I get from the job"); "possibility for growth" ("The possibility of learning new skills so I develop and grow as a person"); "task significance" ("My job has great influence on others"). The questionnaire used the following five response alternatives for the first four variables: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied and for the fifth variable: totally agree, somewhat agree, somewhat disagree, totally disagree.

Perceived stress. Perceived stress was operationalized using a mood adjective checklist [11, 21]. This checklist, constructed to measure mood at work. The stress dimension was considered in this study and was measured using the variables "rested" (reversed score), "relaxed" (reversed score), "calm" (reversed score), "tense", "stressed" and "pressured". The respondents were instructed to think about how they usually feel at the end of a normal workday. There were six fixed response alternatives ranging from "not at all" to "high degree/great extent". The six variables were aggregated in pairs into three parcels. The technique used to build the parcels was a combination of an item-to-construct balance [22] and a priori questionnaire construction [23]. The three positively worded variables were coupled with the three negatively worded variables that were reversely coded. The variable with the highest factor loading from the negatively worded variables was matched with the variable with the lowest factor loading from the positively worded variables. The procedure continued until no variables remained.

Statistical Analysis

Input data to SEM consisted of the raw data stored in SPSS. The correlation matrix with means and standard deviations is presented in Table **1**. This study had no internal missing values. SEM, in which the measurement (Confirmatory Factor Analysis, CFA) and the structural aspects of the model are tested simultaneously, was carried out using the maximum likelihood methods of the AMOS program [24]. AMOS is an acronym for Analysis of MOment Structures (i.e. analysis of mean and covariance structures).

The focal point in SEM is the extent to which the hypothesized model adequately describes or fits the sample data. In accordance with the classification of recommended fit indices, a number of fit indices were considered. The Chi-square value statistic is a goodness-of-fit measure that assesses the magnitude of the discrepancy between the sample (the observed) covariance matrix and the estimated (fitted) covariance matrix. Jöreskog and Sörbom [25] propose that the Chi-square value statistic should be regarded as a measure of fit rather than as a test statistic, i.e., a measure of overall fit of the model to the data. A large, statistically significant value relative to the degrees of freedom indicates a poor model fit. The Chi-square value statistic is sensitive to sample size, and with a large sample size even trivial differences may result in the rejection of the specified model. The normed Chi-square measure is the ratio of the Chi-square value to its degrees of freedom, where ratios in the range of 2 to 1 are indicative of an acceptable fit between the hypothetical model and the sample data. Values below 1.0 indicate an "overfitted" model, and values larger than 2.0, or the more liberal limit of 5.0, indicate that the model does not fit the observed data and needs improvement. However, there is no consensus on what precisely represents a good fit. The Root Mean Square Error of Approximation (RMSEA) is a measure of the discrepancy per degree of freedom for the model. Values of about 0.05 or less indicate a close fit of the model to the data, and values of about 0.08 or less indicate a reasonable error of approximation [24, 26].

The hypothesis of mediation was tested using SEM as proposed by Brown [27], estimating direct, indirect and total effects. According to Brown, the direct effect is the influence a variable has on another variable in a direct relation, and an indirect effect is the sum of all paths from one variable to another that are mediated by one or more additional variables. Furthermore, the total effect is the sum of the direct and indirect effects. In this study, direct, indirect and total effects were estimated using AMOS, and their standard errors were estimated using the bootstrap function of AMOS.

RESULTS

The Model of Job Characteristics and Perceived Stress

Structures for relationships between the latent variables were specified and analyzed. Direct effects for the model are reported in Fig. (**2**).

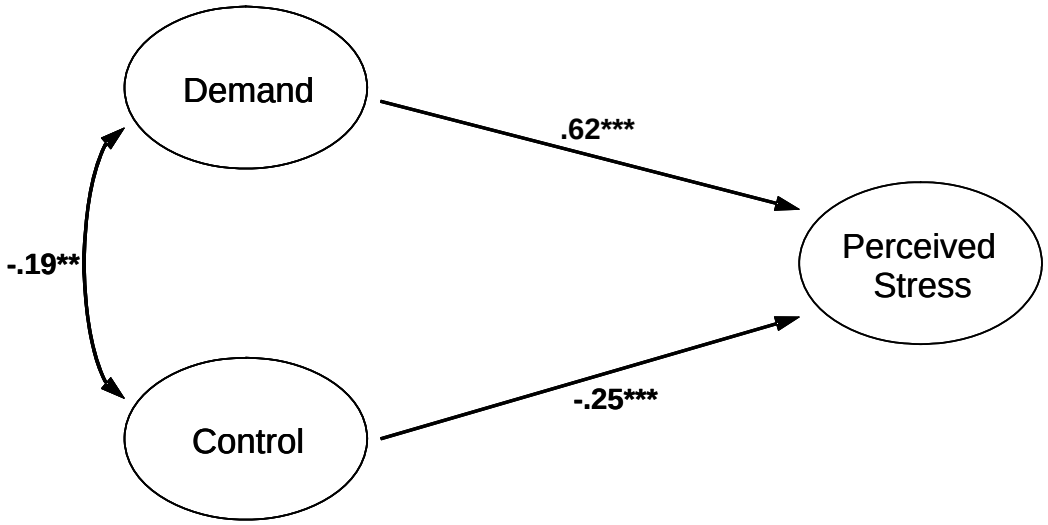

Fig. (2). Structural equation model with no mediator among IT consultants (N=380). Measurement and structural components with standardized estimates. Significance levels: ** $p < .01$, *** $p < .001$.

The model of three latent variables (job demands, control and perceived stress) showed acceptable overall fit indices. The modification indices in AMOS, however, indicated that a significant improvement in model fit would occur with two correlated errors (the respective correlated error was found in the same latent variable). After the modification the model indicated good overall fit indices (Chi-square=81.76; Normed Chi-square=2.72; RMSEA=.067). All paths (factor loadings) in the measurement models were significant. In the structural part, the path between job demands and perceived stress and the path between job control and perceived stress were both significant and in the expected direction. High job demands (statistically) predicted high perceived stress and high job control predicted low perceived stress among the IT consultants.

The Model of Job Characteristics, Motivators and Perceived Stress

The second proposed model, that is, the full structural model with motivators as a mediator showed acceptable overall fit indices. The modification indices in AMOS, however, indicated that a significant improvement in model fit would occur with two correlated errors (the respective correlated error was found in the same latent variable). After the modification the model indicated good overall fit indices (Chi-square=164.64; Normed Chi-square=2.03; RMSEA= .052). Intercorrelations, means and standard deviations are presented in Table **1**, and direct effects is presented in Fig. (**3**).

In the model, five of six paths were significant and were also in the expected direction (when controlling for other latent variables). In accordance with the first model of job characteristics and perceived stress, the paths between job demands and perceived stress and between job control and perceived stress were significant. The job control latent variable was significantly related to motivators, which means that high job control (statistically) predicted high scores in the latent variable ("motivators"). Moreover, the job demands latent variable was significantly related to motivators, signifying that high job demands (statistically) predicted high scores in the latent variable ("motivators"). Furthermore, motivators were significantly, although negatively (i.e., expected direction), related to perceived stress. Thus, job control and job demands were found to be significantly related to changes in motivators, which in turn affected perceived stress.

The test of the indirect effect (i.e. mediation) showed that the effect of control on perceived stress through motivators was statistically significant. The indirect effect of job demands on perceived stress through motivators was not significant. Indirect and total estimates are presented in Tables **2** and **3**.

DISCUSSION

Job Demands, Job Control and Stress

The results from the current study show that job demands have a significant impact on perceived stress among IT consultants, confirming earlier research results among IT consultants [11] and other occupations [2, 28]. The daily work of IT consultants is often characterized by projects with strict deadlines where there is often no time for important recovery between overlapping projects. It is not unusual that a new IT task starts before the last one is completed. In general, high job demands affect perceived stress which in turn might affect the quality of one's decision-making [29]. In a work situation characterised by prolonged exposure to high job demands and low job control may lead to high stress and resulting in tension [2], difficulties in decision making (cognitive), headaches and musculoskeletal symptoms [1]. Previous research has reported health consequences (e.g. musculoskeletal pain) among Visual Display Unit (VDU) workers [30]. A Swedish study among white-collar workers showed that a combination of high VDU use and high mental stress significantly increased the prevalence odds ratios for shoulder symptoms [31]. Moreover, in a study among several occupational groups in Norway the association between burnout dimensions (exhaustion, disengagement, professional efficacy) and musculoskeletal pain were analysed. The Norwegian study included 601 information

Table 1. Mean, Standard Deviation, and Pearson Correlation of the Study Variables (N =380)

Variable	*M*	*SD*	D1	D2	D3	D4	C1	C2	C3	M1	M2	M3	M4	M5	PS1	PS2	PS3
D1	3.09	0.56	-														
D2	2.97	0.55	0.55**	-													
D3	2.59	0.70	0.43**	0.48**	-												
D4	1.71	0.74	0.38**	0.32**	0.45**	-											
C1	3.34	0.79	-0.25**	-0.17**	-0.24**	-0.31**	-										
C2	3.84	0.77	-0.04	0.04	-0.06	-0.11*	0.45**	-									
C3	3.36	0.94	-0.07	0.01	-0.05	-0.04	0.41**	0.57**	-								
M1	3.45	0.94	0.03	0.10	0.06	-0.06	0.31**	0.37**	0.36**	-							
M2	3.42	1.00	-0.07	-0.03	-0.09	-0.16**	0.22**	0.18**	0.22**	0.28**	-						
M3	3.63	0.84	0.05	0.09	-0.03	-0.05	0.21**	0.26**	0.25**	0.43**	0.39**	-					
M4	3.08	1.07	-0.01	0.01	-0.03	-0.06	0.23**	0.26**	0.29**	0.54**	0.32**	0.41**	-				
M5	1.75	0.69	-0.19**	-0.24**	-0.19**	-0.07	-0.14**	-0.26**	-0.22**	-0.30**	-0.17**	-0.31**	-0.20**	-			
PS1	2.82	0.79	0.36**	0.32**	0.44**	0.49**	-0.34**	-0.21**	-0.13*	-0.13*	-0.15**	-0.12*	-0.14**	-0.04	-		
PS2	2.91	0.77	0.33**	0.32**	0.40**	0.46**	-0.33**	-0.21**	-0.19**	-0.16**	-0.14**	-0.16**	-0.16**	-0.03	0.82**	-	
PS3	2.78	0.78	0.32**	0.31**	0.41**	0.43**	-0.35**	-0.26**	-0.21**	-0.17**	-0.16**	-0.21**	-0.14**	-0.02	0.79**	0.81**	-

Demand: In your job is it necessary: D1= to work very fast; D2= to work very hard; D3= to work with a very high effort, and D4= do you have enough time to do the job?
Control: What´s your influence on: C1= the rate of work; C2= the working methods; C3= the allocation of tasks?
Motivation: How satisfied with this aspect of job: M1= the chance to do different things from time to time; M2= the praise I get for doing a good job.
M3= the feeling of accomplishment I get from the job; M4= the possibility of learning new skills so I develop and grow as a person; M5= my job has great influence on others.
Perceived stress: The six variables were aggregated in pairs aggregated to three parcels: PS1= rested+pressured; PS2= stressed+relaxed; PS3= tense+calm.
* p < .05. ** p < .01.

technology workers and the results showed a significant relationship between the burnout dimensions and musculoskeletal pain [32].

Table 2. Indirect Effects for the Relationships Between Job Demands, Control and Perceived Stress with Motivators as a Proposed Mediating Variable

	Demand on Perceived Stress Through Motivators	Control on Perceived Stress Through Motivators
Estimate[a]	-.054	-.150
C.R.[b]	-1.32	-1.97*

[a]Standardized parameter.
[b]The ratio of the unstandardized parameter to its standard error.
* $p < .05$.

Table 3. Total Effects for the Relationships Between Job Demands, Control and Perceived Stress with Motivators as a Proposed Mediating Variable

	Demand on Perceived Stress Through Motivators	Control on Perceived Stress Through Motivators
Estimate[a]	1.356	-.206
C.R.[b]	7.62***	-1.44

[a]Standardized parameter.
[b]The ratio of the unstandardized parameter to its standard error.
*** $p < .001$.

In sum, on the organizational level, a work situation characterised by prolonged exposure to high job demands and low job control may lead to poor work performance and declined productivity. Good working conditions for IT consultants will result in optimum organizational outputs (e.g. quality, innovation) [33-35].

Motivators as Mediator

Motivation is, according to Jewell [36] a hypothetical construct and it is something that cannot be seen. Instead of trying to define motivation itself, Herzberg *et al.* [5] try to define antecedent conditions that presumably lead to motivation; they call these factors "motivators" (e.g., recognition, achievement). The job demands-resources model (JD-R model) consists also of antecedent conditions such as job resources (e.g., autonomy) which may play a motivational role [37]. In line with this, in the current study "motivation" is used to describe and explain an organizational behavior in general, whereas the research model contains the latent variable "motivators" which were operationalized by five antecedent conditions (e.g., recognition, achievement, the work itself, the possibility for growth and work significance) that according to prior research results lead to motivation.

Generally speaking, the result from the current study is in accordance with previous studies that argue that motivation is a consequence of the level of job demands and job control [1, 37]. In a study of job satisfaction and work motivation among IT consultants, Brown [10] found the strongest correlation between "autonomy" and motivation. Brown measured motivation with Hackman and Oldham's [18]

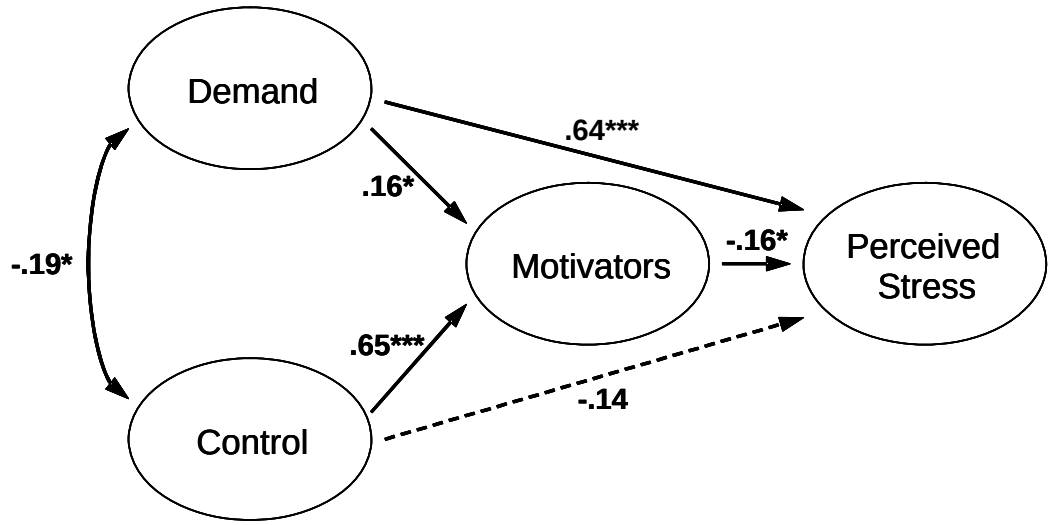

Fig. (3). Full structural equation model with motivators as mediator among IT consultants (N=380). Measurement and structural components with standardized estimates. The non-significant paths are marked as dotted lines. * $p < .05$. *** $p < .001$.

Motivating Potential Score (MPS). According to Hackman and Oldham, autonomy is the degree to which the job provides substantial freedom and independence and can be compared with job control in this study. However, Brown's results should be interpreted with some caution because autonomy was a part of the calculation of MPS that gives a high inter-correlation and also due to a low response rate.

The results from the full SEM with motivators as the mediator (see Fig. **3**) show that the relationship between job control and perceived stress is mediated by motivators. Hence, the study shows the importance of motivators in the job stress framework. We suggest interventions that would address both motivation and stress/strain experienced by IT consultants, and the organizational origins of both motivation and stress/strain in the workplace. Since managers influence job characteristics, it is important to involve them in this matter. The practical implication of the study is that managers must find inventive ways to explore what motivates each employee and must create sustainable development and a healthy work organization.

In addition, general recommendations for improving the working conditions for the IT consultants include factors such as increased skills, career growth, job control (e.g. decision making) and to protect the IT consultant from too much work pressure. These job factors should be considered simultaneously [30].

Methodological Considerations

The model is theoretically based on earlier research and, as such, is considered plausible. However, the proposed model is an "as if" model of causality [38]. The data are cross-sectional, which implies that the relationships observed cannot be interpreted causally and will need to be replicated longitudinally within the IT sector.

The measures in this study were based on self-reports. The IT consultants own perception of the working conditions must be considered if a good picture of how work influences his or her perceived stress is to be achieved. Theorell and Hasselborn [39] argue that cross sectional self-report assessments of psychosocial conditions and health have an important role in stress research.

The use of multiple measures (questions) of each construct (latent variables) tends to reduce the effect of measurement error [38]. The constructs used in this study are based on earlier theoretical and empirical research [1, 5, 11, 18, 19, 21]. This study shows good construct validity, thus confirming previous research.

CONCLUSIONS

It is reasonable to conclude that the characteristics of job demands and job control constitute important factors for illuminating the genesis of perceived stress among IT consultants. The results also point to the importance of motivators (e.g., responsibility, recognition, achievement and the possibility for growth) among IT consultants in the job stress and performance framework. The results show that motivators mediate the relationship between job control and perceived stress. Comprehensive stress interventions are suggested, which address both the stress experienced by IT consultants as well as the organisational origins of stress at work. Since managers have a substantial influence on the work organisation, it is important to involve and educate managers on the subject. To strengthen the results in this study, it is important to replicate the model with a longitudinal design in order to substantiate causality.

REFERENCES

[1] Karasek R, Theorell T. Healthy work. Stress, productivity, and the reconstruction of working life. New York: Basic Books Inc. 1990.

[2] Melin B, Lundberg U. A biopsychosocial approach to work-stress and musculoskeletal disorders. J Psychophysiol 1997; 11: 238-47.

[3] De Jonge J, van Breukelen JP, Landeweerd JA, Nijhuis FJN. Comparing group and individual level assessments of job characteristics in testing the job demand- control model: a multilevel approach. Hum Relat 1999; 52: 95-122.

[4] Katzell RA, Thompson DE. Work motivation: theory and practice. Am Psychol 1990; 45: 144-53.

[5] Herzberg F, Mausner B, Snyderman BB. The motivation to work. New York: Wiley 1959.

[6] Cox T, Ferguson E. Measurement of subjective work environment. Work Stress 1994; 8: 98-109.

[7] Eriksson HU. A thesis on fire: studies of work engagement, type of behavior and burnout. Unpublished doctoral dissertation. Department of Psychology, Stockholm University 2005.
[8] Aziz M. Role stress among women in the Indian information technology sector. Women Manage Rev 2004; 19: 356-63.
[9] Lim VKG, Teo TSH. Occupational stress among information technology personnel in Singapore. Int J Inf Manage 1999; 19: 277-91.
[10] Brown MM. An exploratory study of job satisfaction and work motivation of a selected group of information technology consultants in the Delaware Valley. Doctoral Dissertation. Wilmington College: United States 2002.
[11] Wallgren LG, Johansson Hanse J. Job characteristics, motivators and stress among information technology consultants: a structural equation modeling approach. Int J Ind Ergon 2007; 37: 51-9.
[12] Levy PE. Industrial/organizational psychology. Understanding the workplace. New York: Houghton Mifflin 2003.
[13] Moorhead G, Griffin RW. Organizational behavior. Managing people and organizations. 7th ed. New York: Houghton Mifflin 2004.
[14] Theorell T, Perski A, Åkerstedt T, *et al*. Changes in job strain in relation to changes in physiological state. A longitudinal study. Scan J Work Environ Health 1988; 14(3): 189-96.
[15] Åkerstedt T, Knutsson A, Westerholm P, Theorell T, Alfredsson L, Kecklund G. Sleep disturbances, work stress and work hours. A cross-sectional study. J Psychosom Res 2002; 53(3): 741-8.
[16] Karasek R. Job demands, job decision latitude, and mental strain: implications for job redesign. Adm Sci Q 1979; 24 (2): 285-308.
[17] Rubenowitz S. Survey and intervention of ergonomic problems at the workplace. Int J Ind Ergon 1997; 19(4): 271-5.
[18] Hackman JR, Oldham GR. Work redesign. Cambridge, MA: Addison-Wesley Publishing Company 1980.
[19] Weiss DJ, Dawis RV, England GW, Lofquist LH. Manual for the Minnesota satisfaction questionnaire. Industrial Relations Center, University of Minnesota: Minneapolis 1967.
[20] Hackman JR, Oldham GR. Development of the job diagnostic survey. J App Psychol 1975; 60(2): 159-70.
[21] Kjellberg A, Wadman C. The role of the affective stress response as a mediator of the effect of psychosocial risk factors on musculoskeletal complaints—Part 1: Assembly workers. Int J Ind Ergon 2007; 37(4): 367-74.
[22] Little TD, Cunningham WA, Shahar G. To parcel or not to parcel: exploring the questions, weighing the merits. Struct Equ Modeling 2002; 9(2): 151-73.
[23] Little TD, Oettingen G, Baltes PB. The revised control, agency, and means-ends interview (CAMI): A multi-cultural validity assessment using mean and covariance (MACS) analyses. (Materialen aus der Bildungsforschung, no. 49) Berlin: Max Planck Institute 1995.
[24] Byrne B. Structural equation modeling with AMOS. Basic concepts, applications, and programming. 2nd ed. New York: Routledge 2010.
[25] Jöreskog K, Sörbom D. LISREL 8: Structural equation modeling with the SIMPLIS command language. Scientific Software International, Inc.: Chicago 1993.
[26] Kline RB. Principle and practice of structural equation modelling. 2nd ed. New York: The Guildford Press 2005.
[27] Brown R. Assessing specific mediational effects in complex theoretical models. Struct Equ Modeling 1997; 4(2): 142-56.
[28] MacDonald W. The impact of job demands and workload on stress and fatigue. Aust Psychol 2003; 38(2): 102-17.
[29] Ganster DC. Executive job demands: Suggestions from a stress and decision- making perspective. Acad Manage Rev 2005; 30(2): 492-502.
[30] Aarås A, Horgen G, Ro O. Work with the visual display unit: Health consequences. Int J Hum-Comp Interact 2000; 12(1): 107-34.
[31] Johansson Hanse JJ. The impact of VDU use and psychosocial factors at work on musculoskeletal shoulder symptoms among white-collar workers. Work Stress 2002; 16(2): 121-6.
[32] Langballe EM, Innstrand ST, Hagtvet KA, Falkum E, Aasland OG. The relationship between burnout and musculoskeletal pain in seven Norwegian occupational groups. Work 2009; 32(2): 179-88.
[33] Le Blanc P, De Jonge J, Schaufeli W. Job stress and health. In: Chmiel N, Ed. Introduction to work and organizational psychology: A European perspective. Oxford, UK: Blackwell 2000; pp. 148-77.
[34] Boles M, Pelletier B, Lynch W. The relationship between health risks and work productivity. J Occup Environ Med 2004; 46(7): 737-45.
[35] Pelletier B, Boles M, Lynch W. Change in health risks and work productivity over time. J Occup Environ Med 2004; 46(7): 746-54.
[36] Jewell LN. Contemporary Industrial/Organizational Psychology. 3rd ed. Pacific Grove: Brooks/Cole 1998.
[37] Bakker AB, Demerouti E. The job demands-resources model: state of the art. J Manage Psychol 2007; 22(3): 309-28.
[38] Kline RB. Principles and practice of structural equation modeling. New York: The Guilford Press 1998.
[39] Theorell T, Hasselhorn HM. On cross-sectional questionnaire studies of relationships between psychosocial conditions at work and health-are they reliable? Int Arch Occup Environ Health 2005; 78(7): 517-22.

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