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Analysis and modelling of work stress in manufacturing industries in Kerala ,India

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Abstract

This study examines the influence of factors responsible for work stress among the employees in the public sector industries in Kerala, India. The sample size of the subjects selected for the study consists of 75 Engineers, 110 Supervisors and 675 Workers in the selected manufacturing industries in kerala, India. Seven factors were identified with the existing literatures, and in consultation with safety experts for the evaluation of work stress. The instrument developed by using these factors had validity, unidimensionality and reliability. The response rate was 81.3%. It is observed that existence the factors responsible for work stress among all the categories of employees in these industries. It is also noted that relatively low level of control among workers is the main cause of work stress. The factor model and structural equation model proposed are equally good in predicting the work stress in manufacturing industries.

Keywords: Work stress, structural equation model, manufacturing industries, factor model

1. Introduction

Occupational stress is becoming a major problem in both corporate and social sectors .In industrialized countries, there have been quite dramatic changes in the conditions of work, during the last decade due to the economic, social and technical development. As a consequence the people today at work are exposed to high quantitative and qualitative demands at the work place. In multinational companies, lean production, and down sizing has raised stress level of employees [1]. The national institute of occupational safety and health (NIOSH-USA) defines stress as "the harmful physical and emotional responses that occur when the requirements of the job does not match with the capabilities, resources of the workers."

The cost associated with work place stress indicate an international trend among industrialized countries. A recent report says that work related ailments due to work related stress is likely to cost India's exchequer around ₹72000 Crores between 2009-15 [2]. Though India is a fast developing country it is yet to create facilities to mitigate the adverse effects of work stress. The study of work stress in the member states of European Union (EU) points out that an average of 22% of the working Europeans experience work stress [3].

It is noted that work stress occurs among the employees at the context of work and at the content of work [4]. The potential stressors for these hazards in the context of work are organizational culture and function, role in the organization, career development, decision latitude and control, interpersonal relationship at work, work-home interface and change [4,5].

Studies on the employees perceptions and descriptions of their organizations, suggest three distinct aspects of organizational function and culture: organization as a task environment, as a problem solving environment and as a development environment [6,7]. The available evidence suggests that the organization is perceived to be poor in respect to these environments, will likely to be associated with higher stress. It is found that factors like poor communication, poor leadership, and lack of clarity about the organizational objectives and structure of the organization may lead to work stress [8].

Another major source of stress is associated with persons role at work.A great deal of research is done on role ambiguity and role conflict. Role ambiguity is the result of employees uncertainties, lack of information about the job role, expectation and responsibilities [4].It is found that role conflict and role ambiguity are instrumental in developing physiological disorders and says that the above factors can also lead to organizational dysfunction and decreased productivity [4].

Lack of expected career growth is one of main sources of work stress. The factors connected with this are poor promotion polices, job insecurity and poor pay in the organization [4].Earlier studies show that poor promotion prospects and blocked career may lead to work related stress hazard like coronary heart disease (CHD)[9].

Decision latitude and control are important aspects of work stress. These shows the extent which the employees are participating in the decision making process, and also shows the freedom given to the employees for choosing their work. The researchers indicate that individuals with highest income group was a most likely to have low strain due to greater job control [10].

The number of research works points out the need of good relationship with superiors ,support from the superiors and support from the colleagues at work for the elimination of work related stress hazards. It is found that the real source of problems connected with work stress are not located in the work environment, but is person-based, and the most effective way to reduce stress is to change the person based factors. Accordingly a questionnaire has been developed and circulated among the check out assistants in the age groups 18 to 56yrs, who belong to both sex. It is noted that higher level of job demands with lower level of support at work resulted in increased job stress [11].

Many literature points out the work related stress hazards due to work-family conflict .It is found that that work-family conflict is a form of inter role conflict ,in which the role pressures from the work family domains are mutually non compatible in same respect [12].

Change is one of the most commonly found stressor at the context of work[13]. It is observed that changes in the modern work environment as result of technological advances, organizational restructuring and various redesign options can elevate the work stress [4]. Researchers indicate that rapid changes along with poor relationship can lead to one set of work related stress hazards [14].

Like context of work, content of work are also leads to work stress. These factors arise due to improper design of the task ,work load and work pace,and work schedule [4,5].

There are several aspect of job content ,which are found hazardous and these include low value of work ,low use of skills ,repetitive work , uncertainty , lack of opportunity to learn, high attention demand , conflicting demand , insufficient resources [4].The research work shows that ,work related stress hazards arise due to meaning less task and lack of variety etc…It is also noted that most stressful type of work are those which have excessive demand and pressures that do not match with the workers knowledge and abilities [15].

The studies on the effect of work stress among men and women working groups in USA and found that due to high psychological work demands like excessive work load and time pressures leads to work stress and cause depression and anxiety in young working adults[16]. It is noticed that work related stress hazards like depressive disorders and abdominal fat among workers due high work demands [17]. A higher correlation between work stress and Coronary Heart Disease (CHD) was noted by many researchers in their study among male and female employees of different age groups [18].

Two major factors responsible for work stress due to the improper work schedule are shift work and long working hours .The studies conducted in Italy among the shift workers observed that shift work leads to poor sleep and health related problems [19].

Studies conducted among white collar workers in Sweden, points out that work stress is associated with men subjected to long working hours (75 hours/week) and it is shown that this leads to wide range of ill health in men and women[20].

Several models have been proposed to explain the causes of work related stress. Frankenhaeuser have described a model where stress is defined in terms of imbalance between the perceived demands from the environment and individuals perceived resources to meet those demands[21].This imbalance can be caused by quantitative overload (A very high work pace, too much work to do etc…) or qualitative overload (too much responsibility, problems too complex to solve, conflicts etc…)

A well known model describing work stress or strain is the demand control model proposed by karesek and Theorell and developed and expanded by others. According to this model, the combination of high demands and lack of control and influence (low job discretion) over the work situation causes high work strain[22].

Johannas Siergrist proposed a new model for stress at the work called the effort-reward imbalance model. According to this model, lack of adequate reward in response to the individual's achievement efforts is considered to contribute to high stress levels and elevated health risks .Reward could be obtained in terms of economic benefits, such as higher income [23, 24].

Factor analysis is the basic model and has received a lot of attention in the field for many years [25] and is used for the develop the relationship of a set of variables [26, 27].

Structural equation modelling of work stress was done by many researchers earlier [28].In this association between the different variables namely stress, health, work, family and finance are analyzed. The structural equation modelling was done by means of confirmatory factor analysis.

2. Subjects

Total number of subjects selected for this study is 830 and the resulted sample consists of Engineers (75 Nos.),

Supervisors (110 Nos.) and workers (675 Nos.). Participants selected for this study consists of both male and female employees of age between 25 to 55 and had sufficient educational back ground for their job. All employees are permanent and working in shifts in rotation and each shift consists of 8 hour duration per day. However the majority of the employees, in these industries were males and number of woman participants is about 10% of the male participants. All the industries are large scale and profit making for the last five years and located at different districts of Kerala, India. .

3. Methods

From the literature review and with the consultation of safety experts seven factors were identified for the evaluation of work stress in the absence of well defined factors for the evaluation of work stress in Kerala ,INDIA. They are demand, control, manger support, peer support relationship, role and change. The final draft of the questionnaire had 35 items with seven subscales .All the questions were likert type with five fixed alternatives(always, often, sometimes ,rarely, never). In addition to this 10 demographic questions are also included in the questionnaire. This questionnaire was refined and validated further by means of confirmatory factor analysis (CFA)[29,30].This resulted in removal of five items from the questionnaire. The number of retained items in the questionnaire were demand (7 items), control (4 items),manager support (4 items),peer support (4 items),relationship (4 items), role (5 items) and change (2 items). The values of Comparative Fit Index (CFI), Tucker Lewis Index (TLI),and Cronbach alpha shows that the refined scale has good validity and unidimensionality in addition to reliability [31-33]. The analysis was performed by using the software AMOS-7 [34].The filled up schedules are then carefully edited for completeness, consistency and accuracy . The overall response rate was 81.3%.

On the basis of data so collected, the influence of factors on works stress analysis is performed using one-way ANOVA . A Factor modelling of work stress was done by means of Alpha factor analysis and Structural equation modelling of work stress was done further to find the association of factors responsible for work stress in manufacturing industries.

4. Results

4.1. Correlation Matrix

A correlation analysis between the variables /factors so identified was performed and the result of the analysis is given in the Table-1.It is noted that all the correlations were positive, but no significant correlation was found between the variable/factors(<0.5). Therefore the variable selected for the study can be treated as indep endent variables for the purpose of research. The correlation analysis were carried out by means of SPSS-15.

Table – 1 Correlation between the factors

Variables/ Factors	Demand	Control	Manager support	Peer support	Relationship	Role	Change
Demand	1	0.354	0.249	0.240	0.310	0.214	0.196
Control	0.354	1	0.279	0.227	0.310	0.168	0.251
Manager support	0.249	0.279	1	0.426	0.319	0.313	0.357
Peer support	0.240	0.227	0.426	1	0.498	0.313	0.461
Relationship	0.310	0.310	0.319	0.498	1	0.440	0.474
Role	0.214	0.168	0.313	0.313	0.440	1	0.353
Change	0.196	0.251	0.357	0.461	0.474	0.353	1

4.2 .Influence of factors on different categories of employees

The influence of these factors are analyzed among different categories of employees by means of one-way ANOVA .The result of the test is given in the Table -2 .The test is conducted for 0.5 level significance.

Table-2. Mean score of factors

Variables/Factors		Designation			F-value	P-value
		Engineer	Supervisor	Worker		
Demand	Mean	25.72	26.08	25.61	0.603	0.548
	S.D	3.78	4.36	4.11		
Control	Mean	15.09	13.70	12.32	16.644	< 0.001
	S.D	2.96	3.85	4.35		
Manager support	Mean	14.64	15.19	13.94	5.953	0.003
	S.D	2.96	3.85	4.35		
Peer support	Mean	15.94	16.10	15.34	3.748	0.024
	S.D	1.87	2.98	3.12		
Relation-ship	Mean	16.28	17.01	16.41	2.035	0.131
	S.D	1.98	2.82	3.04		
Role	Mean	22.79	22.93	22.56	1.187	0.306
	S.D	2.03	2.14	2.56		
Change	Mean	6.69	6.77	7.02	1.313	0.270
	S.D	1.73	2.34	2.04		

The mean score of the factors /variables points out that existence of factors responsible for work stress among all the categories of the employees in these industries.

It is noted that , significant difference in the factors, control, manager support, and peer support ($p<0.05$) among different categories of employees To identify which among the categories has significant difference , Tukey's multiple comparison test for each of the factors and the results are given in the Table -3

Table -3. Significant difference between different categories of employees

Factors/Variables	Difference between different designation levels
Control	Engineer and worker Supervisor and worker
Manager support	Supervisor and worker
Peer support	Supervisor and worker

The post- hoc analysis, reveals that considerable difference in the mean score of the factor "control" exists between engineers and worker.. Further a noted difference is observed for this factor between supervisor and worker .While analyzing the variables manger support and peer support considerable difference is observed only between supervisors and workers

4.3. Modelling of work stress

Modelling of work stress was done by earlier by several researchers [35,36], and this will help to analyze the work stress under the influence of different factors. Accordingly two different type of modelling for work stress carried out for this study are by means of Factor modelling and Structural equation modelling .

4.3.1 Factor modelling of work stress

Factor modelling of work stress was carried out by means of seven factors by Alpha method of factor analysis [37-39]. This yielded two factor structure for work stress as shown below (Table-4).It is noted that for each of the factors some variables had a higher factor loading ($\geq$0.4).For Factor -1,the variables manger support, peer support, relationship, role ,change had a high loading . The variables demand and control had a high loading on Factor -2. It is noted that factors /predictor variables namely demand and control are person based and mean while the other factors are team based and this made us to name the two factors as stress-personnel (Stress-P) and stress-team (Stress-T).

Table -4. Factor Matrix

Variables	Factor	
	1	2
Demand	0.167	0.968
Control	0.328	0.501
Manager support	0.748	0.178
Peer support	0.473	0.089
Relationship	0.689	0.304
Role	0.435	0.217
Change	0.654	0.238

Hence the above factors can be modeled as

Stress-P = 0.968 De +0.501 Cl and

Stress-T = 0.748 Ms + 0.473 Ps + 0.689 Re + 0.435Rl + 0.654 Ch

Where De, Cl, Ms, Ps, Re, Rl, Ch represents the variable demand, control , manager support, peer support, relationship, role and change and the above two models can be effectively used for the evaluation of work stress

4.3.2 Structural equation modelling of work stress.

Structural equation modelling of work stress was done by using the seven factors .This yielded two components for the work stress namely stress-personnel (stress-P),and stress-team (stress-T). The structural equation model was developed by using confirmatory factor analysis [40].This is shown in the Fig- 1. The rectangle represents observed factor /variables ,which are demand ,control, manager support ,peer support ,relationship ,role and change .Ovals are drawn on the diagram to represent work stress, which has been shown as two types stress-personnel (Stress-P) and stress-team (Stress-T).

The variable error is enclosed in a circle. the double headed arrows in the path diagram connect the variables ,which are correlated to each other[34]. The standardized regression weights are shown over the arrows. The squared multiple correlation of each observed variables /factors are represented over each of the respective rectangles.

5. Discussion

The main aim of the study is to develop and analyze the factors responsible for work stress among the employees in the public sector manufacturing industries in Kerala ,India. Accordingly seven factors were developed and the validity,and unidimensionality of the questionnaire was analyzed by means of CFA and the overall reliability of the questionnaire was found satisfactory (>0.70). . Interestingly it is found that the factors responsible for work stress is prominent in different categories of employees namely engineers, supervisors and workers these industries. It is also noted that lack of control among lower categories of employees particularly among workers compared to other categories of employees. The results of many earlier research supports the finding[9,41].

In factor modelling , alpha method of factor analysis was used to develop the model .This yielded two factor structure of work stress namely stress-personnel(Stress-P) and stress-team(Stress-T). This model can be effectively used for predicting the work stress in manufacturing industries .

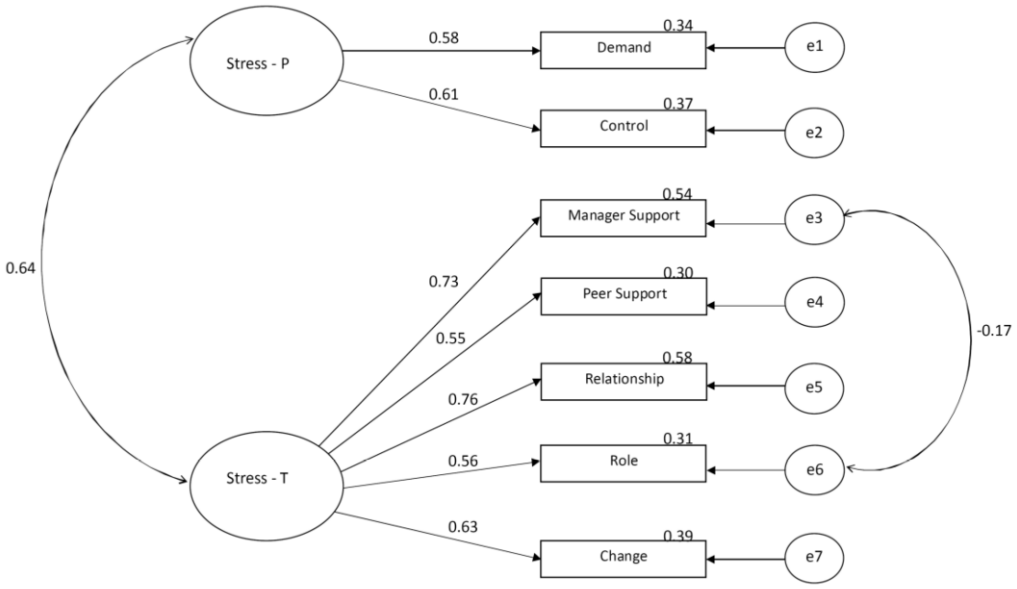

Figure -1 Structural Equation Modelling of Work Stress

Table-5. Model Fit Indices

$\chi 2$	Normed $\chi 2$	df	P-Value	GFI	AGFI	NFI	TLI	CFI	RMR	RMSEA	SRMR
18.336	1.528	12	0.106	0.994	0.986	0.986	0.991	0.995	0.202	0.025	0.0012

Structural equation modelling of work stress by using the seven variables was developed .The following goodness of fit indices are used to access the degree of fit, between the model and sample. Normed χ^2 (acceptable between 1 and 3) [42]. Normed fit index (NFI >0.90 excellent) [42,43].Tucker Lewis Index (TLI >0.90 acceptable, > 0.95 excellent) [44]. Comparative Fit Index(CFI >0.90 acceptable,>0.95excellent)[45,46].Root mean square error of approximation (RMSEA<0.08 acceptable,<0.05 excellent) [47]. Standard root mean square residual (SRMR <0.05 excellent) [48]. The values obtained for NFI,CFI, and TLI , Normed χ^2 ,RMSEA, SRMR values are well with in the acceptable limit ,hence structural equations model is found good in representing the work stress. The modelling was done by using AMOS-7 [34]

Initially an input structural equation model was developed by using the seven variables and it is noted that goodness of fit indices were not with in the acceptable limit for this model .Hence this model was modified further and the modified version is given in the Fig 1. It is noted that the goodness of fit indices for this modified model is well with in the acceptable limit (See Table- 5) and this model can be used to predict work stress among the employees in manufacturing industries.

Like any other research, the study also not free from limitations. The present study is limited only to public sector industries in Kerala, India, where majority of employees are males. Therefore it would be inappropriate to draw conclusions about male and female workers based on this result. The conclusion is drawn based on the data obtained by means of self reported measures. A comparative study was not carried out because of lack of literature or study of work stress in the context of Indian public sector industries.

6. Conclusion

Consistent with the literature, the results indicate that existence of factors responsible for work stress among all the categories of the employees working in public sector industries in Kerala, India and the instrument developed for the evaluation of work stress by using the variables / factors ,namely demand ,control, manager support, peer support, relationship, role and change had validity, unidimensionality and reliability and the instrument can be effectively used for the evaluation of work stress in different type of industries in addition to manufacturing industries . Low level of job control was noticed among lower designation level particularly among workers than engineers and supervisors. The factor model and structural equation model proposed are equally good in representing work stress in the manufacturing industries.

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