

ANALYSIS AND MODELLING OF WORK STRESS BASED ON EXPERIENCE IN CHEMICAL INDUSTRIES IN KERALA, INDIA

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ABSTRACT

This study examines the influence of factors responsible for work stress among the employees having different experience. The total number of participants for the study is 554 and the subjects were selected from profit making chemical industrial units in Kerala.. 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 employees irrespective of their experience .It is also observed that relatively higher amount of demand, low control and low support for the employees having 15-20yrs of experience. The factor model proposed is found good in predicting the work stress in chemical industries.

KEYWORDS: Work stress, Chemical industries, Validity, Unidimensionality, Reliability, 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 downsizing has raised stress level of employees (ILO, 2005). 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 costs associated with work place stress indicate an international trend among industrialized countries. A recent report says that work related an ailment due to work related stress is likely to cost India's exchequer around 72000 Crores between 2009-15 (The Economic Times, 2009) 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 (EASHAW, 2005).

It is noted that work stress occurs among the employees at the context of work and at the content of work (Cox *et.al.* 2006). 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 (Mackay *et.al.* 2004; 4 Cox *et.al.*,2006).

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 (Cox *et.al.* 2006. 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.

Another major source of stress is associated with person's role at work. A great deal of research is done on role ambiguity and role conflict .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 (Cox *et.al.*, 2006) Lack of expected career growth is one of main sources of work stress. The factors connected with this are poor promotion policies, job insecurity and poor pay in the organization (Cox *et.al.* 2006).

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 (Park, 2007; Cox *et.al.*,2006) 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(Ben ,2007; Mackay *et.al.*, 2004).

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 (Yang *et.al.*,2006).Change is one of the most commonly found stressor at the context of work(Launis and Pihlaja, 2007)]. 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 (Cox *et.al.* 2006)

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 workplace, and work schedule (Mackay *et.al.*,2004; Cox *et.al.* ,2000)].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 (Cox *et.al.*,2006).The research work shows that ,work related stress hazards arise due to meaningless 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 (WHO,2007).

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(Melchior *et.al.*,2007).

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 (Conway *et.al.*,2008) 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 (Krantz *et.al.*,2008).

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 (Frankenhaesuer, 1996).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 (Karasek and Theorell, 1990).

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 (Siegrist *et.al.*, 2004; Segrist, 1996).

Factor analysis is the basic model and has received a lot of attention in the field for many years and is used for the develop the relationship of a set of variables (Lee, 2007). Structural equation modelling of work stress was done by many researchers earlier (Chan, 2005).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 554. For the purpose of study participants were divided in to seven groups based on their experience namely, up to 5yrs ,5-10yrs,10-15yrs,15-20yrs,20-25yrs,25-30yrs, and 30yrs and above .All the participants were permanent and working in shifts in rotation and each shift consist 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 chemical type, large scale and profit making public sector units 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, manager 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) (Natemeyer *et.al.* 2003). This resulted in removal of five items from the questionnaire. The numbers 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 (Natemeyer *et.al.* 2003; Ahire, 1996; Cronbach, 1955) The analysis was performed by using the software's AMOS-7 and SPSS-15 (Arbuckle, 2006). The filled up schedules are then carefully edited for completeness, consistency and accuracy and results are given in the Table-4. The overall response rate was 81.3%.

On the basis of data so collected, the influence of factors responsible works stress for different experience groups is performed using one-way ANOVA. Factor modeling of work stress was done by means of Alpha factor analysis

4. RESULTS

4.1 CORRELATION BETWEEN THE FACTORS

The correlation analysis between the factors so identified showed that no significant correlation exists between them (<0.5), therefore these factors are considered as independent variables for this study. This analysis was done by means of SPSS-15 and the result is given in Table-1

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 EXPERIENCE GROUPS

The influences of these factors are analyzed among the employees belonging to different experience groups by means of one-way ANOVA. The result of the test is given in the Table -2 .The tests are conducted for 0.5 level significance.

TABLE: 2 MEAN SCORE OF FACTORS

Variables/Factors		Experience in Yrs							F-value	p-value
		Up to 5 yrs	5-10 yrs	10-15 yrs	15-20 yrs	20-25 yrs	25-30 yrs	30 yrs and Above		
Demand	Mean	25.84	25	25.37	28.92	25.99	25.88	26.63	1.602	0.144
	S.D	3.14	4.14	4.20	4.78	3.93	4.05	4.28		
Control	Mean	12.19	11.75	12.45	11.40	13.20	12.73	13.34	1.274	0.267
	S.D	4.23	4.72	4.51	4.54	3.76	4.23	4.27		
Manager support	Mean	16.02	14.97	13.80	13.14	14.60	14.39	13.25	1.210	<0.001
	S.D	2.78	3.25	4.27	4.13	3.42	4.77	3.96		
Peer support	Mean	15.87	15.46	15.38	15.16	15.79	15.78	16.21	1.020	0.481
	S.D	3.24	2.74	3.29	2.87	2.81	3.26	2.91		
Relationship	Mean	16.64	16.81	15.95	15.68	15.69	17.00	15.92	2.128	0.049
	S.D	2.79	2.70	3.20	3.48	2.98	2.69	3.46		
Role	Mean	23.17	22.58	22.83	22.16	22.52	22.99	22.73	1.423	0.204
	S.D	1.51	2.49	2.22	2.82	2.62	2.23	1.94		
Change	Mean	6.94	6.90	6.77	6.76	6.99	7.42	6.63	0.978	0.439
	S.D	2.14	2.09	2.00	2.10	2.09	2.13	2.21		

The mean score of the factors /variables points out that existence of factors responsible for work stress among all the employees irrespective of their experience .It is also noted that , significant difference in mean score of factors, manager support and relationship exists among different experience groups.($p < 0.05$) .

4.3 MODELLING OF WORK STRESS

Modelling of work stress was done by earlier by several researchers (Hsieh et.al.,2004; Palmer et.al.,2004) and this will help to analyze the work stress under the influence of different factors. Accordingly modelling for work stress carried out for this study are by means of Factor modelling and the analysis was done by means of software SPSS-15

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 (Costello and Osborne,2005; McDermeit,2000; Kaiser and Coffery,1965). This yielded two factor structure for work stress as shown below (Table-3).It

is noted that for each of the factors some variables had a higher factor loading (>0.4). For Factor -1, The variables manger support, peer support, relationship, role and 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-3 FACTOR MATRIX

VARIABLES	FACTOR	
	1	2
Demand(De)	0.203	0.646
Control (Cl)	0.204	0.552
Manager support(Ms)	0.681	0.260
Peer support(Ps)	0.452	0.235
Relationship(Re)	0.720	0.307
Role(Rl)	0.499	0.115
Change(Ch)	0.633	0.198

Hence the above factors can be modeled as

$$\text{Stress-P} = 0.646 \text{ De} + 0.552 \text{ Cl} \quad \text{and}$$

$$\text{Stress-T} = 0.681 \text{ Ms} + 0.452 \text{ Ps} + 0.720 \text{ Re} + 0.499 \text{ Rl} + 0.633 \text{ Ch}$$

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

5. DISCUSSION

The main aim of the study is to develop and analyze and model the factors responsible for work stress among the employees in the public sector chemical industries in Kerala, India. Accordingly seven factors were developed and the validity and unidimensionality of the questionnaire was analyzed by means of CFA. The following Indies were used for analyzing the validity and unidimensionality of the instrument/questionnaire- Tucker Lewis Index (TLI >0.90 acceptable, > 0.95 excellent) (Hair et.al. 1988; Ahire *et.al.*, 1996; Hu and Bentler, 1995). Comparative Fit Index (CFI >0.90 acceptable, >0.95 excellent) (Hair *et.al.* 1988; Ahire *et.al.*, 1996; Hu and Bentler, 1995). It is noted that the instrument / questionnaire so developed has sufficient validity and unidimensionality (Table-4) .The reliability of the questionnaire was evaluating Cronbach's Alpha. It is noted that the overall relaiilty instrument / questionnaire is at the satisfactory level (Cronbach's Alpha >0.70)(Table-4). The above analysis was performed by using AMOS-7 and SPSS-15

TABLE: 4 VALIDITY AND RELIABILITY OF THE INSTRUMENT/QUESTIONNAIRE

SI No	Variables	No. of items	CFI	TLI	Cronbach alpha
1	Demand	7	0.901	0.900	0.713
2	Control	4	0.980	0.976	0.797
3	Manager support	4	0.942	0.930	0.794
4	Peer support	4	0.916	0.900	0.806
5	Relationship	4	0.900	0.900	0.771
6	Role	5	0.901	0.901	0.676
7	Change	2	0.998	0.987	0.640
Total	-----	30	0.934	0.927	0.748

A close watch on the mean score results reveals that the employees belonging to experience groups 15-20yrs have relatively higher demand ,low control and low manager support at work and demand –control/support model of Karasek and Theorell hold good for this group(Karasek,1998).

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 chemical 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 employees irrespective of their experience, working in manufacturing 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 chemical industries . Relatively higher level of demand, low control and low support were noticed among the employees belonging to 15-20yrs. The factor model proposed is good in representing work stress in the chemical industries.

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