

# AN ASSESSMENT OF SEAFARERS' STRESS USING JOB DEMAND–CONTROL MODEL

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## Abstract

The study examines the influence of factors responsible for seafarer's occupational stress based on Job Demand-Control model. The job demand-control model is one of the most recognized models in occupational stress research. The occupational stress tradition focused on stressors at work, such as high workload, work pace, role conflict, and role ambiguity. Karasek's<sup>[11]</sup> job demand-control model has had a large influence on the job design and occupational stress, because it is quite practical and testable. In Karasek's model, workplace stress is a function of how demanding a person's job is and how much control (skill discretion and decision authority) the person has over their own responsibilities. The study had classified the Job Demand-Control attributes into five manageable factors by using Factor analysis. The stress incurred by the deck side seafarers and the engine side seafarers were then compared by testing the hypotheses by using one way ANOVA.

Keywords: Job Demand-Control, Stressors, Decision Latitude, Skill discretion

## Introduction

Stress is involved in an environment that is perceived as presenting demand which threatens to exceed the person's capabilities and resources for meeting it, under conditions where he or she expects a substantial differential in the rewards and costs from meeting the demand versus not meeting it (McGrath, 1976)<sup>[13]</sup>. From the documented evidence, it is clear that as far as work life is concerned extreme stress is so aversive to employees that they will try to avoid it by withdrawing either psychologically (through disinterest or lack of involvement in the job etc.) physically (lethargy etc.) or by leaving the job entirely (Beehr and Newman, 1978)<sup>[3]</sup>. It predisposes the individual to develop several psychosomatic illnesses; in contrast, the absence of extreme stress would result in more satisfied, happy, healthy and effective individual.

However, the stress one experiences in the job vary from mild to severe depending upon one's physiological, psychological and social make up (Caplan R, Cobb S, French J, (1975)<sup>[4]</sup>).

Occupational Stress is stress involving work. Stress is defined in terms of its physical and physiological effects on a person, and can be a mental, physical or emotional strain. It can also be a tension or a situation or factor that can cause stress. Occupational stress occurs when there is a discrepancy between the demands of the environment / workplace and an individual's ability to carry out and complete these demands. Often a stressor can lead the body to have a physiological reaction which can strain a person physically as well as mentally. One of the main causes of occupational stress is work overload.

Stressors at the individual level have been studied more than any other category. Role

conflicts, role ambiguity, role overload and under load, are widely examined individual stressors (Mc Grath 1976<sup>[13]</sup>; Newton and Keenan, 1987<sup>[14]</sup>). It is also reported by many researchers that the low job satisfaction was associated with high stress (Rodriguez, I., Bravo, M.J., Peiro, J.M., & Schaufeli, W.B. (2001)<sup>[15]</sup>).

The Job Demand-Control (JDC) model was introduced by the sociologist Karasek (1979)<sup>[11]</sup>, who drew attention to two research ways of life, namely the occupational stress directions (e.g., Kaplan H. B. (1996)<sup>[10]</sup>; Kahn, R. L, Byosiere Ph. (1992)<sup>[9]</sup>) and the job redesign convention (e.g., Hackman, J.R. and Oldham, G.R. (1980)<sup>[7]</sup>). In both research studies, attempts were made to relate psychosocial job characteristics to employee health. The occupational stress tradition focused on "stressors" at work, such as high workload, work pace, role conflict, and role ambiguity. The job redesign tradition focused mainly on job control, as it's primary aim was to inform the (re)design of jobs in order to increase the effectiveness, motivation, satisfaction, and activity participation at workplace. According to Karasek (1979)<sup>[11]</sup>, the relations between job demands placed on the discretion available to the employee to decide how to meet these demands (that is, job control) contributes significantly to the prediction of stress and active learning.

The job demand-control (JDC) model has contributed to the study of occupational stress by providing a theoretical framework to explain the relation between the psychosocial characteristics of the work environment and health outcomes. It consists of two basic dimensions viz., decision latitude and psychological demands. Decision latitude consists of two theoretically distinct concepts,

skill discretion and decision authority, that are often combined for analysis. Skill discretion describes the degree to which the job involves the development of an individual's special abilities. Decision authority incorporates an individual's ability to make decisions about his or her job and to influence the work group or company policy or both. The psychological demands dimension refers to whether there is enough time to get the job done, the amount of work, and the presence of conflicting demands.

### Objectives

The research had 2 core objectives:

- To examine via a factor analysis whether the dimensions of the job demand-control model hold true
- To test the significant association between the job demand - control factors with regard to the job categories such as deck side and engine side seafaring jobs.

In order to achieve the objectives, the research study uses the following two working hypotheses:

H<sub>0D</sub>: There is no significant difference between the JDC factors and the Deck side seafarer's job

H<sub>0E</sub>: There is no significant difference between the JDC factors and the Engine side seafarer's job

### Methodology

#### Sampling

The target population was considered as seafarers of Indian origin who were working at various levels/job categories on the deck

side (Master, Chief Officer, 2<sup>nd</sup> / 3<sup>rd</sup> Officer, Bosun) and engine side (Chief Engineer, 2<sup>nd</sup>/ 3<sup>rd</sup>/ 4<sup>th</sup> Engineer) of foreign going merchant vessels. The total sample size considered for the study was 385, which is arrived by using the sampling formula suggested by Cochran (1963)<sup>[5]</sup> with 95% confidence level and  $\pm 5\%$  precision. The sample responses were obtained by using quota sampling. Seafarers stress was measured by a five-point scale (likert scale) from 1 (strongly disagree) to 5 (strongly agree). The modified version of JDC questionnaire was administered to 550 seafarer respondents and the completed responses were obtained from 416 respondents, of which 385 respondents were considered for further study after scrutiny.

#### Measure of Occupational Stress

#### Factor Analysis

The items used to measure the occupational environment were congruent with items from the Job Demand–Control model that were originally used in constructing the dimensions of psychological demand, physical demand, decision authority, skill discretion, and hazardous work environment. A principal component analysis (factor analysis) of these items suggested a 4-factor solution. All items were retained for a varimax rotation.

Factor 1 consisted of items related to hazardous working conditions (see Table 2).

Factor 2 is best described by the decision latitude dimension of the demand–control model with the 2 subscales “skill discretion” and “decision authority.” However, the “skill discretion” dimension consisted of 5 items. The “decision authority” dimension was measured by 3 items (see Table 2).

Factor 3 consisted of items related to physical demands. It included the physical exertion from the model, measured by 4 items. Two items that are normally found among psychological demands - “working very hard” and “working very fast” - loaded highest on factor 3 physical demands. “Repetitiveness of work” also loaded on factor 3; this item moved from the skill discretion subscale to physical demands. Most items loaded unequivocally on this factor, except that “having to move or lift very heavy objects” also had a relatively high loading on hazardous working conditions (factor 1). “Working long periods with body in physically awkward positions” also had an almost equally high loading on “hazardous working conditions” (see Table 2). “Repetitiveness of work” also had a relatively high loading on “psychological demands” but not on “skill discretion” (decision latitude, factor 2), where it was originally situated in the demand–control model.

Factor 4, psychological demands, is measured by 3 items (see Table 2). All 3 items have a uniformly high loading on this factor.

The factor analysis of occupational stress variables confirmed the general structure of the job demand–control model, but certain items were distributed somewhat differently along the dimensions of the model. Thus, five job scales were formed by adding the response values of items that loaded together on the factors; the five scales were hazardous work environment, skill discretion, decision authority, physical demand, and psychological demand.

#### Cronbach's<sup>[6]</sup> Alpha Reliability Test

The scales such as hazardous work environment, skill discretion, decision

authority, physical demand, and psychological demand have good internal consistency reliability (Cronbach alpha coefficients of

0.92, 0.86, 0.78, 0.77 and 0.74 respectively). (See Table 1)

Table 1: Cronbach's Alpha Values

Factors	Cronbach's Alpha
Hazardous Work Environment	0.92
Skill Discretion	0.86
Decision Authority	0.78
Physical Demand	0.77
Psychological Demand	0.74

Job Demand-Control factors	Factor Loading			
	Factor 1	Factor 2	Factor 3	Factor 4
	Hazardous Work	Control	Physical Demand	Psychological Demand
1. My job exposes me to dangerous work methods.	.88	-.09	.10	.01
2. My job exposes me to machinery/equipment.	.86	-.03	.14	.04
3. My job exposes me to things placed/stored dangerously	.82	-.11	.06	-.01
4. My job exposes me to fire, burns, or shocks.	.81	-.02	.07	.08
5. My job exposes me to excessive noise.	.72	-.07	.15	-.01
6. My job exposes me to air pollution, fumes or other things	.76	-.03	.07	-.01
7. My job exposes me to the risk of catching diseases	.55	-.02	.02	-.16
8. My job exposes me to other people's cigarette smoke.	.49	-.21	.01	-.05
9. I have an opportunity to develop my own special abilities. (skill discretion).	-.09	.78	-.01	.10
10. I have a lot to say about what happens on my job (decision authority).	-.08	.72	.02	.17

Job Demand-Control factors	Factor Loading			
	Factor 1	Factor 2	Factor 3	Factor 4
	Hazardous Work	Control	Physical Demand	Psychological Demand
11. My job requires a high level of skill (skill discretion).	-.05	.69	.04	-.18
12. My job requires me to be creative (skill discretion).	-.04	.68	.02	-.11
13. I get to do a variety of different things on my job (skill discretion).	-.03	.64	.03	.03
14. On my job, I have very little freedom to decide how I do my work (decision authority).	.17	.55	.21	-.15
15. My job requires that I learn new things (skill discretion).	-.09	.54	.07	-.28
16. My job allows me to make a lot of decisions on my own (decision authority).	-.08	.51	-.01	-.04
17. My job requires lots of physical effort.	.29	.04	.77	.04
18. My work requires rapid and continuous physical activity.	.35	-.18	.74	.11
19. I am required to move/ lift very heavy objects on my job.	.43	-.13	.57	.21
20. My job requires working very hard.	-.13	.32	.56	-.33
21. My job requires working very fast.	-.07	.19	.53	-.32
22. My job involves a lot of repetitive work.	-.01	-.02	.28	-.22
23. I have enough time to get the job done.	-.01	.02	-.02	.72
24. I am free from conflicting demands that others make.	-.01	-.02	.07	.69
25. I am not asked to do an excessive amount of work.	-.01	-.01	-.17	.65
Note. In each column, factor loadings in boldface were grouped together in the analysis as a single factor.				

TABLE 3—One way ANOVA between the job categories and JDC factors

Job Demand-Control (JDC) Factors	Deck Side		Engine Side	
	F-ratio	p-value	F-ratio	p-value
Hazardous Work	3.025	0.039	5.954	0.003
Skill Discretion	3.121	0.019	3.648	0.024
Decision Authority	3.917	0.022	3.977	0.030
Physical Demand	5.187	0.004	5.523	0.003
Psychological Demand	4.527	0.043	3.276	0.033

**ANOVA Interpretation**

One way ANOVA was conducted on the selected Job demand-control factors as against the deck side and engine side job categories. The comprehensive results of one way ANOVA are presented in Table 3. It is evident that the p-values for all the JDC factors with regard to deck side and engine side job categories are less than 0.05. To study in detail, the JDC factors are considered individually:

**Hazardous Work JDC factor**

The p-values for the Hazardous work JDC factor and the Deck side/Engine side job categories are less than 0.05 and hence the null hypothesis is rejected. It essentially means that the deck side and the engine side work environments are exposed to hazardous ways of accomplishing the set tasks. It is interesting to note that the p-value with regard to the engine side (0.003) is much less than the p-value of the deck side (0.039) and it shows that the engine side seafarers are exposed to more hazardous work nature than the deck side seafarers. The engine side seafarers are typically exposed to dangerous

work methods, heat producing machinery & equipments, fire, shock, excessive noise, fumes and other related hazardous factors. It can be inferred that the engine side seafarers are exposed to more stress than the deck side seafarers.

**Skill Discretion JDC factor**

The p-values for the Skill Discretion JDC factor and the Deck side/Engine side job categories are less than 0.05 and hence the null hypothesis is rejected. It means that the deck side and the engine side seafarers possess the required skill discretion abilities towards the achievement of their tasks. It is interesting to note that the p-value with regard to the deck side (0.019) is almost close to the p-value of the engine side (0.024) and it shows that the seafarers in general have the skill discretion abilities such as opportunity to develop themselves, requirement of high level of skill, accomplishing variety of tasks, learning new things & to be creative in the job.

**Decision authority JDC factor**

The p-values for the Skill Discretion JDC factor and the Deck side/Engine side job categories are less than 0.05 and hence the null hypothesis is rejected. It means that the deck side and the engine side seafarers have their decision authority abilities towards the achievement of their tasks in an effective manner.

**Physical Demand JDC factor**

The p-values for the Control JDC factor and the Deck side/Engine side job categories are less than 0.05 and hence the null hypothesis is rejected. It means that the deck side and the engine side seafarers have their reasonable input on the physical demands towards the achievement of their tasks. The p-value with regard to the deck side (0.004) is almost close to the p-value of the engine side (0.003) and it shows that the seafarers put-in lots of physical efforts in accomplishing their tasks such as continuous physical activity, working faster, doing repetitive tasks and other related physical demand factors.

**Psychological Demand JDC factor**

The p-values for the Psychological JDC factor and the Deck side/Engine side job categories are less than 0.05 and hence the null hypothesis is rejected. The p-value with regard to the deck side (0.043) is slightly higher than the p-value of the engine side (0.033) and it shows that the deck side seafarers are put under more psychological stress than the engine side counterparts since the deck side seafarers may not always get enough time to make decisions during the hour of the need whereas the engine side seafarers may get some amount of time to accomplish their tasks.

**Conclusion**

The study elicits the factors of Job Demand-Control Model viz., hazardous work environment, skill discretion, decision authority, physical demand, and psychological demand by using Factor analysis. The hypotheses were tested by using one way ANOVA with regard to the JDC factors.

The study reveals that the engine side seafarers are typically exposed to dangerous work methods, fire, shock, excessive noise and other related hazardous factors than the deck side seafarers. It can be concluded that the engine side seafarers have more stress than the deck side seafarers with regard to hazardous work environment factor.

The study found that the seafarers in general have the skill discretion abilities such as self development abilities, high skill levels, accomplishing variety of tasks, & learning new things. Even though this factor does not have a direct implication on the stress but it can be considered as a sort indirect stress factor since the requirement of developing the higher skill sets may entice higher stress in the seafaring job.

The findings of the study revealed that the seafarers in general possess the decision authority abilities.

The study reveals that the seafarers put-in lots of physical efforts in accomplishing their tasks and these factors make them more stressful.

The study found that the deck side seafarers have more stress with regard to psychological demand than the engine side seafarers. As the deck side seafarers have to have their focus on navigating the ship, the

psychological stress level will definitely be higher than the engine side seafarers.

#### Limitations

The study was basically conducted to identify the seafarers stress by using Karasek's<sup>[11]</sup> Job Demand-Control model. The original JDC model was modified for the current study with only 25 attributes. The study was conducted strictly around the JDC model and the true stressors of seafaring job may not have been fully identified. In order to identify the seafarer's stressors to the fullest extent possible, it is advisable to combine JDC model with other job stress related models such as Effort Reward Imbalance model, Job Content Questionnaire, and few others.

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