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The Relationships among Working Conditions, Safety Climate, Safe Behaviors and Occupational Accidents: An Empirical Research on the Marble Workers

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Abstract

This study investigates the relationships among the safety climate, working conditions safety behaviors, occupational accidents and injuries. However, in the literature there are limited studies being paired with these relationships. In this respect, study conducted in four marble factories in Burdur city of Turkey, finds that there are significant relations among the variables. Based on the findings, significant relationships have been observed between safety climate and safety behaviors. Moreover, safety climate perceptions, working conditions perceptions and safety behavior levels of the marble workers differ depending on whether they have had occupational accident & injuries in organization or not.

Keywords: *Safety climate, Safety behaviors, Working conditions, Occupational accidents, Occupational injuries*

1. Introduction

It is estimated that two million people in worldwide die every year due to work-related diseases and work-related accidents (Kanten, 2012: 156) and it is also estimated that approximately 100 million occupational injuries occur worldwide each year (Chau et al., 2008: 380). However, the number of studies focusing on health and safety is not enough. In last two decades, less than 1% of organizational research has focused on issues concerning occupational health and safety (Barling et al., 2002: 488; Mullen, 2004: 275). This statistic is very low considering the significant social and economic costs associated with occupational safety. In light of these social and economic costs resulting from workplace accidents, it is critical that researchers better understand the events preceding work-related injuries, as well as the organizational factors that may affect an individual's safety behavior at work (Mullen, 2004: 275).

Occupational safety aims to prevent the accidents caused by the unsafe behavior of the employees and/or the unsafe work environment, and to create a safe working environment. Traditionally, safety research has focused on identifying individual attributes, such as personality traits or attitudes that are associated with accident proneness (Neal and Griffin, 2006: 946).

Generally the causes of occupational accidents are classified as unsafe conditions and unsafe behaviors (Sadullah and Kanten, 2009: 923-925). In this context, safety researches accept that safety climate may affect employee safety behavior, either directly or indirectly. Perceptions of organizational climate are seen as critical determinants of an individual's behavior in the workplace, mediating the relationships between objective characteristics of the work environment and the individual's response to this environment. However, a satisfactory physical working environment is a significant predictor of good safety performance as well as a healthy workforce (Bjerkan, 2010: 448-449). Working conditions and organizations are elements that contribute to work accidents. So work safety requires that safe working conditions should not create significant risk of people being rendered unfit to perform their work. Health and safety at work is therefore aimed at creating conditions, capabilities, and habits that enable the worker and his or her organization to carry out their work efficiently and in a way that avoids events which could cause them harm (Garcia-Herrero et al., 2012: 1760). The purpose of this study is to investigate the relationships among working conditions, safety climate, safe behaviors and occupational accidents in Turkish Marble Firms.

2. Literature Review

Recent safety literature has emphasized the organizational nature of industrial accidents and empirical work has focused on the identification of organizational, managerial and environmental factors that influence accident causation (Clarke, 2006: 414). Researchers have increasingly recognized that industrial accidents are caused by a dynamic interaction between factors in the social and physical environments, that is, characteristics of the individual and the organization as well as technical forces (Bjerkan, 2010: 446).

Perceptions of organizational climate are seen as critical determinants of an individual's behavior in the workplace, mediating the relationships between objective characteristics of the work environment and the individual's response to this environment (Bjerkan, 2010: 448). Researchers (Glendon and Litherland, 2001; Seo, 2005; Neal and Griffin, 2006; Johnson, 2007; Zhou et al., 2008; Sadullah and Kanten, 2009) have also demonstrated a link between safety climate and safe behaviors. However, the safety climate literature has examined the link between safety climate and safety outcomes, such as compliance with safe working practices and occupational accidents (Sadullah and Kanten, 2009: 924). Safety climate is considered to be a sub-component of the safety culture construct (Cooper and Phillips, 2004: 497). Generally, safety culture is a set of prevailing indicators, beliefs and values in relation to safety that an organization possesses. Meanwhile, safety climate is a concept that can be seen as the current surface features of a safety culture, which are discerned from the employees' attitudes and perceptions (Zhou et al., 2008: 1407). The two concepts are related but they are not synonymous. Safety climate is a term used to describe shared employee perceptions of how safety management is being operationalized in the workplace, at a particular moment in time. Safety climate is considered to be a sub-component of the safety culture construct (Cooper and Phillips, 2004: 497).

A satisfactory physical working environment is a significant predictor of good safety performance as well as a healthy workforce (Rundmo, 1992; Bjerkan, 2010: 449). Recent research (Glasscock et al., 2006; Sobeih et al., 2009; Hilton and Whiteford, 2010; Garcia-Herrero et al., 2012) findings indicate that working conditions are predictors of occupational accidents. Working conditions are associated with occupational accidents and injuries. Empirical studies on associations among working conditions and occupational accidents and injuries are, however, scarce. Especially, in marble firms this association is crucial due to heavy physical working conditions. The purpose of this study therefore is determined in this context to investigate the relationships among the working conditions, safety climate, safe behaviors, occupational accidents and injuries of marble workers. In order to test the relationships among variables hypotheses shown below are developed:

H1: There is a significant relationship between safety climate and the safety behaviors.

H2: There is a significant relationship between safety climate and the working conditions.

H3: There is a significant relationship between working conditions and the safety behaviors.

H4: Safety climate perceptions of employees differ depending on whether they have had occupational accident in organization or not.

H5: Working conditions perceptions of employees differ depending on whether they have had occupational accident in organization or not.

H6: Safety behavior levels of the employees differ depending on whether they have had occupational accident in organization or not.

H7: Safety climate perceptions of employees differ depending on whether they have had occupational injury in organization or not.

H8: Working conditions perceptions of employees differ depending on whether they have had occupational injury in organization or not.

H9: Safety behavior levels of the employees differ depending on whether they have had occupational injury in organization or not.

3. Research Methodology

3.1. Sample and Procedures

The sample used for the study consists approximately 280 staff, who served in various positions in 4 marble firms in Burdur, which are determined via convenient sampling method. The 240 questionnaires returned from hotels and accepted as valid, and included in the evaluation scope.

3.2. Measuring Instrument

Questionnaire survey method is used for data obtainment. Measures used in the questionnaire are adapted from questionnaires used in the studies from literature. The variables used in the safety climate; are taken from Glendon and Litherland's (2001) study and translated into Turkish. The variables in the safety behaviors are taken from Seo (2005) and Størseth's (2006) study. And the variables in the working conditions measure are taken from Garcia-Herrero et al. (2012) study. For answers to the statements of survey, a Likert-type metric, that is, expressions with five intervals has been used. Anchored such; "*1- strongly disagree, 2- disagree 3-neither agree nor* *disagree, 4- agree, 5-strongly agree"*. There are also 7 demographic questions in the questionnaire. As a result of the conducted pilot study, it's observed that the items in the factor analysis, where (n=30) was applied, displayed a proper distribution, in accordance with the theoretical characteristics

3.4. Statistical Methods

The data obtained from the study, have been evaluated via SPSS for Windows 15.0 program. After the confirmatory Factor Analysis performed in order to test the validity of measures, the internal consistency coefficients (Cronbach's Alpha) have been calculated separately for each measure. The correlation analysis and independent-samples T test methods have been used to determine the presence of interdependency among variables and to test the research hypotheses; and for the explanation of relationships between variables, which are determined by means of correlation analysis, the multi-dimensional regression analysis has been utilized.

4. Research Findings

4.1. Demographical Findings

56% of employees, which participated in the research, are male, and 44% are female. 66% of the employees whose responses were included in the evaluation is under the age 34 while others (44%) are between the ages of 34 and older ages. 65% of employees completed only primary education; 28% graduated from high schools (Lycéé). 92% of employees are blue collar and 8% are white collar. 40% of employees worked more than four years in this firm.

4.2. Factor and Reliability Analysis

In the study, before performing the relationship analysis between dimensions, the structural validity and reliability levels of measures have been tested. First, data of the variables related to safety climate have been put into factor analysis and the varimax rotation has been obtained. In the principal component analysis, the Kaiser-Meyer-Olkin test result (KMO value, 948) and the result of Barlett test (8284.630; $p<0.01$) are significant. As a result of the varimax rotation of the data related to safety climate variables, removing the items with factor loadings under 0.40 from the analysis, nine factor solutions has been obtained. Emerged factors, explain 77.486% of the total variance. The findings on the resultant factors, factor loadings, explained variances, and internal consistency coefficients calculated for each factor (measure) are summarized in Table 1.

Table 1: Rotated Factor Loadings with Calculated Safety Climate Measures

Factor 1: Adequacy & sufficiency of procedures and investigations (explained variance = 14.552 %; Cronbach's Alpha= 0.936)	
1. PPE use is monitored to identify problems areas	0.613
2. Knowing that other staff are waiting for the completion of task which required concentration can be accommodated within normal work activity	0.704
3. An affective documentation management system ensures the availability of procedures 0.594	
4. Procedures are technically accurate	0.691
5. Procedures are complete and comprehensive	0.725
6. Procedures are written in clear; unambiguous language appropriate to users' needs	0.681
7. The investigation system is regularly reviewed and updated to ensure that it is achieving its objectives	0.563
8. A systematic process is used to identify which jobs and tasks have the greatest priority with regard to the development of procedures	0.491
Factor 2: Informing through training (explained variance = 9.519 %; Cronbach's Alpha = .881)	
9. Workload adjustment which have to made at short notice can be accommodated without adversely affecting work	0.696
10. An adequate system exists for transmitting critical information regarding the state of the system during shift change over	0.739
11. Effective training is provided on skills specific to individual tasks and equipment	0.657
12. Potential errors, consequences and recovery points are identified in training	0.469
Factor 3: Adequacy of training and support (explained variance= 9.333 %; Cronbach's Alpha= 0.884)	
13. Training is carried out by individuals with relevant operational experiences	0.440
14. Training includes skills practice for emergency	0.634
15. Provisions are made to minimize the isolation of one employee from other's well-being	0.712
16. Employees are encouraged to support and look out for each other's well-being	0.725
17. Aspects of company policy are effectively communicated to individuals	0.625
Factor 4: Workload (explained variance= 9.117 %; Cronbach's Alpha= 0.872)	
18. Distractions can be accommodated without adversely affecting work	0.698
19. Time schedules for completing work projects are realistic	0.699
20. Workload is reasonably well balanced	0.628
21. Frustration's that arise from factors outside staff control can be accommodated without adversely affecting work	0.526
Factor 5: Labor-management relation (explained variance=8.499 %; Cronbach's Alpha= 0.889)	
22. Management trust the staff in this organization	0.685
23. Good working relationship exist in this company	0.764
24. Staff are confident about their future with company	0.646
25. Morale is good	0.621
Factor 6: General safety (explained variance= 8.201 %; Cronbach's Alpha= 0.930)	
26. Safety rules are adhered to even under production pressures	0.791
27. Safety rules can be implemented without conflicting with established work practices	0.773
28. Safety rules practical to apply in all situations	0.672
Factor 7: Communication (explained variance= 7.562 %; Cronbach's Alpha= 0.883)	
29. There are adequate opportunities for staff to express their views about operational problems	0.589
30. There are adequate opportunities to discuss important policy issues	0.724
31. Consultation is adequate when changes in working practices are proposed	0.715
32. Meeting take place where causes of operational problem are openly discussed	

between engineers and management	0.428
Factor 8: Maintenance and spares (explained variance= 5.858 %; Cronbach's Alpha= 0.901)	
33. Critical spare parts are available from stock	0.472
34. The time required to obtain spare parts is known and acceptable	0.638
35. Appropriate back-up equipment is readily available	0.595
Factor 9: Absence of work pressure (explained variance= 4.846 %; Cronbach's Alpha= 0.839)	
36. Staff are adequate time carry out individual and concurrent tasks	0.558
37. There are sufficient staff to carry out the required work	0.683
38. There is sufficient "thinking time" to enable staff to plan and carry out their work to an adequate standard.	0.431

Extraction method: Principal component analysis – Rotation method: Varimax rotation

After applying factor analysis to the data of working conditions variables, for the principal component analysis, the result of the Kaiser-Meyer-Olkin test (KMO value, 0.801) and the Barlett test result (2670.063; $p<0.01$) are found significant. Six factors solution has been achieved as a result of varimax rotated factor analysis. Resultant factors, explain 68.350% of the total variance. The findings on the resultant factors, factor loadings, explained variances, and internal consistency coefficients calculated for each factor are summarized in Table 2.

Table 2: Rotated Factor Loadings with Calculated Working Conditions Measures

Factor 1: Exposed to harmful effects (explained variance = 16.017 %; Cronbach's Alpha=0.872)	
1. Exposed to vibrations from manual tools, machines, vehicles	0.605
2. Exposed to emissions of ultraviolet light, infrared light, microwaves laser, x rays, gamma rays, radioisotopes, etc.	0.865
3. Handling of harmful or toxic substances	0.862
4. Breathing in harmful or toxic powders, fumes, aerosols, gases or vapors at work	0.853
5. Handling the materials that might be infectious, such as wastes, body fluids, laboratory materials	0.691
Factor 2: Exposed to temperature, humidity and noise (explained variance = 11.461%; Cronbach's Alpha = 0.830)	
6. Exposed to temperature at work	0. 784
7. Exposed to humidity at work	0. 861
8. Exposed to noise at work	0. 819
Factor 3: Heavy physical effort (explained variance= 11.236%; Cronbach's Alpha= 0.791)	
9. Adopting painful or tiring positions (bending down, crouching, kneeling, etc.).	0.574
10. Lifting or moving heavy loads	0.816
11. Using considerable strength	0.795
12. Staying in the same position	0.667
Factor 4: Complexity of task and working quickly (explained variance= 10.968%; Cronbach's Alpha= 0.772)	
13. Paying close or very close attention	0.558
14. Performing highly repetitive tasks of very short duration	0.725
15. Attending to several tasks at the same time	0.816
16. Performing complex, complicated or difficult tasks	0.771
Factor 5: Non-ergonomic conditions (explained variance=9.729%; Cronbach's Alpha= 0.718)	
17. Working in areas which are difficult to get your hands into	0.698
18. Having to use very uncomfortable chairs	0.857

19. Performing your work with inadequate lighting	0.662
Factor 6: Getting monotonous (explained variance= 8.939%; Cronbach's Alpha= 0.729)	
20. Performing repetitive movements of the hands or arms	0.721
21. Having little space to work comfortably	0.795
22. Having to reach tools or other items which are either in very high places or very low places, or having to stretch your arms	0.629

Extraction method: Principal component analysis – Rotation method: Varimax rotation

The internal consistency coefficients (Cronbach's Alpha) of the nine factors that comprise the safety climate are as follows: 0.93; 0.88; 0.88; 0.87; 0.88; 0.93; 0.88; 0.90 and 0.84. Internal consistency coefficients of the six factors that comprise the working conditions are as follow: 0.87; 0.83; 0.79; 0.77; 0.72 and 0.73. Internal consistency coefficient for all 16 items that measure the safety behaviors of the employees is computed also as 0.71. According to the factor and reliability analysis findings, it can be stated that the resultant factors (measures) measure a single feature, which is in accordance with the theory, and they have an acceptable reliability levels, suitable for social science discipline.

4.3. Findings on the Research Hypotheses

According to correlation analysis findings, "safety climate" have a significant relation (r= 741, p<0.01) with the "safety behaviors". According to correlation analysis findings support hypothesis H1. However, there is no statistical relationship between "working conditions" and "safety climate" and there is no statistical relationship between "working conditions" and "safety behaviors". Therefore, hypothesis H2 and Hypothesis H3 rejected.

Table 3.The Correlations among Working Conditions, Safety Climate and Safety Behaviors

	1	2	3	Means
1. Working Conditions	1			3.358
2. Safety Climate	0.40	1		3.383
3. Safety Behaviors	-0.12	0.741**	1	3.295

** p<0.01

According to the R square determination coefficient value, given table 4; 62% of variance in "safety behaviors" is explained by the three factors of "safety climate". Correlation between the dependent and independent variables are statistically significant. Three factors of the safety climate influence the safety behaviors of the employees.

Table 4. Effects of Safety Climate upon Safety Behaviors

	R²	F	β	P	
Safety Climate	.627	131.960			
Adequacy & sufficiency of procedures and investigations			.400	.000	
Maintenance and spares			.296	.000	
Workload			.166	.007	**

p<0.01

The positive beta values show that the increase in independent variables leads to an increase in safety behaviors of employees, or a decrease in independent variables results in a decrease in safety behaviors of employees. Safety climate factors that most influenced the safety behaviors positively were “adequacy & sufficiency of procedures and investigations” (β= 0.400, $p<0.01$); “maintenance and spares” (β= 0.296, $p<0.01$); “workload” (β= 0.166, $p<0.01$).

According to independent samples t test findings, given table 5; show that safety climate perceptions and working conditions perceptions of employees differ on whether they have had occupational accident in organization or not. However, safety behavior levels of the employees also differ on whether they have had occupational accident in organization or not. This findings support hypothesis H4, hypothesis H5 and Hypothesis H6.

Table 5. Independent Samples T Test for Experienced Occupational Accident

	Experienced occupational accident in this organization	N	Mean	t	Sig.
Safety behaviors	Yes	75	3.175	-2.289	.023
	No	165	3.355		
Working conditions	Yes	75	3.477	2.616	.009
	No	165	3.303		
Safety climate	Yes	75	3.164	-2.957	.003
	No	165	3.492		

Another independent samples t test findings given table 6; show that safety climate perceptions and working conditions perceptions of employees differ on whether they have had occupational injury in organization or not. However, safety behavior levels of the employees also differ on whether they have had occupational injury in organization or not. This findings support hypothesis H7, hypothesis H8 and Hypothesis H9.

Table 6. Independent Samples T Test for Experienced Occupational Injury

	Experienced occupational injury in this organization	N	Mean	t	Sig.
Safety behaviors	Yes	106	3.158	-3.370	.001
	No	134	3.403		
Working conditions	Yes	106	3.451	2.701	.007
	No	134	3.284		
Safety climate	Yes	106	3.168	-3.763	.000
	No	134	3.554		

5. Conclusion

This study aimed to explain the relationships among the safety climate, working conditions, safety behaviors and occupational accidents. Empirical evidence support research hypotheses and indicate that (1) There is a significant relationship between safety climate and the safety behaviors; (2) Safety climate perceptions of employees differ depending on whether they have had occupational accident in organization or not; (3) Working conditions perceptions of employees differ depending on whether they have had occupational accident in organization; (4) Safety behavior levels of the employees differ depending on whether they have had occupational accident in organization or not; (5) Safety climate perceptions of employees differ depending on whether they have had occupational injury in organization or not; (6) **W**orking conditions perceptions of employees differ depending on whether they have had occupational injury in organization or not; (7) Safety behavior levels of the employees differ depending on whether they have had occupational injury in organization or not. However, no relationship between the safety climate and working conditions has been observed. Similarly, no relationship between the working conditions and safety behaviors has been observed also.

Elements of safety climate emerge as predictors of unsafe behaviors or occupational accidents in numerous empirical studies and it is becoming accepted that a favorable safety climate is essential for safe operation. Despite the limitations, this study contributes to the literature by revealing the relationship between safety climate and safety behaviors. A large number of studies have demonstrated that perceptions of work safety climate are positively correlated with safety behaviors and that both these factors and working conditions are correlated with occupational accidents and injuries. The results of this study are therefore in line with previous research in the field that indicates that safety climate, safety behaviors and perceived working conditions are correlated with occupational accidents and injuries. As far as I am concerned, the most important message from this study is that safety climate perceptions, working conditions perceptions and safety behavior levels of the marble workers are related to the occupational accidents and injuries in their organizations. However, further researches can be conducted with different and larger samples. New researches, an expanded new model including some mediating variables may be developed and explained via structural equation modeling (SEM).

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