SAFETY CLIMATE IN CONSTRUCTION INDUSTRY THE CASE OF GAZA STRIP

Moheeb E. Ibrahim[1], Khalid A. M. Al Hallaq[2], Adnan A. Enshassi[3]

1: Professor of construction management, Cairo University, moheeb@elsaidconsult.com
2: Lecturer, Civil Eng. Dept., IUG, Palestine, Khalaq@iugaza.edu.ps.
3: Professor, Civil Eng. Dept, Palestine, enshassi@iugaza.edu.ps

ABSTRACT

The construction industry plays an important role in the social and economic development in Palestine. Safety in the construction industry is considered a major issue in developed and developing countries. Palestine's construction suffers recently from poor safety and health conditions as safety rules do not exists and work hazards at the workplace are not perceived.
The main objective of this paper is to investigate the perceptions of construction workers regarding safey climate and safety behavior work in Gaza Strip construction sites. It will also explore the relationship between personal characteristics of constuction workers and safety climate/safe work behavior. Furthermore, the relationship between safety climate and safe work behavior will be explored. The methodology adopted in this paper was based on comprehensive questionnaire targeting the construction workers. 300 questionnaires were distributed and 246 questionnaires were collected and then analyzed to achieve the research objectives.
It was found that construction workers have positive attitude and perception towards safety climate and safe work behavior. There exist a positive relationship between safety climate and safe work behavior. There is an impact of experience, field of work, smoking habit, and job on safety climate. In contrast, the personal characteristics; marital status, direct employer, educational level, family members to support, skill levels have no influence on safety climate. There exist a relationship between personal characteristics age, experience, field of work, smoking habit, educational level, and job on the field safe work behavior. On the other hand no impact of marital status direct employer, family members to support, skill levels, and safety training received on safe work behavior.

KEYWORDS: Safety, Construction Industry, Construction Workers, Gaza Strip.

I. INTRODUCTION

Culture in general, and safety culture in particular, is often characterized as an enduring aspect of the organization with trait-like properties and which is not easily changed. Lee [1] argues that “constructive attitudes among the workforce, because they result from all other contributory features, are probably the most important single index of the effectiveness of a safety culture. Pidgeon [2] proffers an anthropological definition of a safety culture “it is culture that lies at the heart of the ideal-typical pattern of events leading up to large-scale failures of foresight, provides the conceptual foundation for an anthropological definition of a safety culture as being the set of assumptions, and their associated practices, which permit beliefs about danger and safety to be constructed”.

Climate, on the other hand, can be conceived of as a manifestation of organizational culture exhibiting more state like properties [3]. Mearns et al. [4] propose that safety culture will have an influence on safety climate and it could be argued that a ‘good’ safety culture will be promoted and maintained by a ‘good’ safety climate and vice versa. Climate can be viewed as a temporal state measure of culture, which is reflected in the shared perceptions of the organization at a discrete point in time [5]. Cox and Cox [6] argue that employee attitudes are one of the most important indices of safety culture and climate, as attitudes are often framed as a result of all other contributory features of the working environment. Lee [1] also proposes that attitudes towards safety are one of the basic components of a safety culture. Neal et al., [7] argued that general organizational climate is an important part of the matrix from which specific evaluations about safety originate [7]. It is widely accepted that unsafe behavior is intrinsically linked to workplace accidents. A positive correlation exists between workers’ safe behavior and safety climate within the construction site environments. Construction workers’ attitudes towards safety are influenced by their perception of risk, management, safety rules and procedures [8].

The construction industry experienced a disproportionately high rate of disabling injuries and fatalities for its size [9]. Safety is one of the most difficult issues facing the construction industry in the Gaza Strip. The accident rate in construction is highest when compared with other industries. Statistics have remained reasonably constant over six years, it has the construction industry generally accounting for nearly 20% of all industrial injuries [10].The construction industry of Palestine has a very poor site safety record in comparison to other countries. There are no government regulations that managing construction safety which widely influence the safety performance or behavior. Furthermore, there are serious commitment problems towards safety of all levels of management. The objective of this paper is to explore and investigate safety climate and behavior in Gaza Strip construction industry.

II. LITERATURE RIVIEW

The concept of work climate in actually predates culture by about 40 years. The earliest explicit reference to climate made in an organizational setting in a study of the effect of leadership on the ‘social climate’ in groups of boys, although they did not define the concept. Zohar [11] coined the term safety climate in an empirical investigation of safety attitudes in manufacturing industry, and defined it as a summary of moral perceptions that employees share about their work environments. Recently, Niskanen [12] defines safety climate as a set of attributes that can be perceived about particular work organizations and which may be induced by the policies and practices that organizations impose upon their workers. Therefore, the definitions of safety climate are clearly related to those of safety culture. Guldenmund [13] points out that shared aspects are stressed in both sets of definitions. The main differences in the definitions are that whereas safety culture is characterized by shared underlying beliefs, values, and attitudes towards work and the organization in general, safety climate appears to be closer to operations, and is characterized by day-to-day perceptions towards the working environment, working practices, organizational policies, and management.

A. Dimensions of Safety Climate

Dimensions of safety climate are the major features or levels of safety climate [14]. Many researchers attempt to construct the dimensions of safety climate. The first attempt was constructed by Zohar who examined eight factors: the importance of safety, effects of required work place on safety, status of safety committee, status of safety officer, effects of safe conduct on promotion, level of risk at the work place, management attitudes to safety, and the effect of safety conduct on social status. In 1993 Donald and Canter [15] developed the Safety Attitude Questionnaire (SAQ) to measure attitude, which comprised of 16 scales. The rationale was that surveying workers' safety attitudes, using questionnaires as measurement instruments, appear to be similar to management safety audits. The Safety Attitude Questionnaire was used in safety research in more than 40 companies over 6 years, and found to be a valid and reliable instrument in predicting safety performance. Coyle et al. [16] suggested that no universal set of safety climate factors existed. Health and Safety Executive of the United Kingdom (HSE) developed a Health and Safety Survey Tool which include 10 factors: organizational commitment and communication, line management commitment, supervisor's role, personal role, fellow worker influence, competence, risk taking behavior and some contributory influences, some obstacles to safe behavior, permit-to-work, and reporting of accidents and near misses [17]. Williamson et al. [18] concluded a safety climate measure including four measuring attitudes and four perceptions. Dedobbeleer and Beland [19] tested two factor models. The first factor was labeled management commitment to safety and consisted of: workers' assessment of management's attitude toward safety practices and workers' safety, workers; perception of foremen's behavior, availability of equipment, and safety training at the time of initial employment. The second factor was workers' involvement in safety comprised of: workers perceived susceptibility to injury in the next year, risk taking at work, personal control over safety at work, and the existence of regular job safety meetings [19]. Flin et al. [20] identified the common features of safety climate by reviewing 18 safety climate reports published from 1980 to 1998. From these reports, he found that the frequency used themes for describing the dimensions of safety climate were management, safety system, risk, work pressure, competence, and procedures. Another similar study was conducted by Guldenmund [13] and the output of reviewed 15 safety reports were management, risk, safety arrangements, procedures, training, and work pressure. Glendon and Litherland explored the safety climate in a road construction industry. Through factor analysis, it was found that safety climate dimensions were: communication and support, adequacy of procedures, work pressure, personal protective equipment, relationships, and safety rules [21]. Mohamed [2002] identified 10 dimensions to describe the safety climate in construction site environment. These dimensions were: commitment, communication, safety rules and procedures, supportive environment, supervisory environment, workers' involvement, personal appreciation of risk, appraisal of work hazards, work pressure, and competence. Fang et al. [23] listed ten safety climate factor structure including: safety attitude and management commitment, safety consultation and safety training, supervisor's role and worker's role, risk taking behavior, safety resources, appraisal of safety procedure and work risk, improper safety procedure, worker's involvement, worker's influence, and competence.

B. Safety Climate and Safety Behavior

Safety climate is regarded as a safety culture manifestation in behaviour expressed in the attitude of employees [24]. Eagly and Chaiken [25] discussed the impact of employee's attitude on individual safety behavior. Sawacha et al. [26] conluded that safety climate has a positive influence on uindividual safety behavior. Neal et al. [27] developed a model to explain the organizational climate and safety climate on individual safety behavior using structural equation modeling. Glendon and Litherland [21] explored the relationship between safety climate and individual safety behavior in a road construction firm, but the study failed to prove any relationship between safety climate and the individual behavior. Mohamed [22] indecated a significant relationship between the safety climate and safe work behavior. Other studies concluded positive correlation betwwen safety climate scores with ranking of safety practice and accident prevrntion programs [28], [29]. Fang et al. [23] found statistically significance relationship between safety climate and some personal characteristics and individual safety behavior. In his PhD. Research study, Ali [8] studied the linkage among workers' attitudes, perceptions and their intentional behavior. The binary logistic regression depicted a statistically significant relationship between workers' perception and preferred behavior.

C. Personal Characteristic and Safety Climate

When conducting research, many studies have collected personal information about the respondents such as age, gender, marital status, education level, working experience in the industry. These demographic factors can influence safety climate and consequently influence the individual safety behavior [9]. Lee and Harrison [30] investigated risk perceptions to safety by using a 120-item questionnaire in three nuclear power stations in UK. Major differences by gender, age, shift/days and work area were found to be linked with prior accident involvement of the employees. Glendon and Litherland [21] found six-factor structure of safety climate in a road construction organization. Sttistical tools were used to compare the factor structures of two subgroups: construction vs. maintenance workers. The study identified differences in the safety climate of job sub-groups on two of the factors: 'relationships' and 'safety rules'. Siu et al. [31] investigated age difference in safety attitudes and safety performance of Hong Kong construction workers with data collected from 374 Chinese construction workers on 27 construction sites. Their study found that older workers were exhibiting more positive attitudes to safety. Fang et al. [23] used logistic regression to explore the relationship between safety climate and personal characteristics. Statistically eight personal characteristics namely age, marriage status, family responsibility, education level, safety knowledge, alcohol drinking habit, employee of prime contractor or subcontractor, and breaking safety procedures or not at work, were found to be related to good or bad safety climate. Five variables including gender, work experience with the company, work experience in the construction industry, whether injured or not, and smoking habit were found to have no influence on safety climate. Nonetheless, Cooper and Philips [32] suggest that; differences in types of work activity and other site situational condition are much more important in climate research than personal demographical variables such as age, job experience, or accident involvement. This finding makes sense as safety climate measures tend to capture employee's perceptions about how safety is operated on site. Safety climate does not tend to measure how the prevailing safety climate affects them as 'individual' who have longer work experience, older or younger workers. Nonetheless, empirical justification for using personal demographics as a validation technique is required if safety climate research is to continue progressing. Safety climate, its dimensions and demographic factors are reviewed above that are to provide the base for describing the present research including safety climate and its relationship with perceptual safety performance. Ali [8] invistigated the relationship between personal characteristics ans safety climate. An interesting finding related to the positive relationship between work experience and the perception of risk, which was found while analyzing the workers' attitudes and perceptions questionnaire. The descriptive analysis showed that, in majority of the cases, higher risk perception was associated with experienced laboring.

III. METHODOLOGY

A questionnaire survey was conducted in this study. The questionnaire is an effective data collection mechanism where the researcher knows exactly what is required, and how to measure the variables of interest. Since the survey is confined to Gaza Strip, which is a relatively small area, the questionnaires were administered personally at work places of crews.

The design of questionnaire for this research was developed to measure safety climate in the construction industry which is the most popular method of measuring safety management performance. Recent investigations by Flin et al. [21], McDonald et al. [35], Mohamed [23], Ali [8], Fang et al. [24], Chouhdry [33], Lin et al. [36], Choudhry et al. [34], and Abdullah et al. [35] have made a significant contribution towards developing the structured questionnaire survey adopted for this research study. This survey was conducted to investigate the construction workers' attitudes, perceptions, and behavior-based safety in Gaza Strip construction sites. For this research study, the questionnaire survey was developed and including three parts: background information, safety climate, and safety behavior survey. The background information includes age, marital status, experience in the field of work, experience in current company, field of wok, employer, smoking habit, education level, family members to support, job, safety training, and training courses attended. The developed questionnaire of safety climate comprised of thirty three (33) statements. These statements were modified to reflect the nature and culture of Gaza Strip. Workers were asked to endorse the statement using a five-point Likert-type scale (from 1 = "strongly disagree" to 5 = "strongly agree"). To measure safety behavior, 2 items from the work of Brown et al. (2000) and reused by Mohamed (2002) are selected to test the extent the respondents and their coworkers follow of safety procedures for the jobs that they perform. A total number of 246 questionnaires were completed which represent the perception of construction workers in Gaza strip. The questionnaires were reviewed and checked out and the sample size was reduced to 209 respondents due to misunderstanding of the statements or ticking the same options in all the questions.

IV. RESULTS AND ANALYSIS

A. Personal Characteristics

Table 1 showed the personal characteristics which represented the independent variables. Most of questioned workers were less than 32 years old (which is relatively young), married, skilled with less than 10 years of experience, work in buildings, work with main contractors, smoke even at work time, below secondary educational level, and support three or more family members. It was found that the majority of the workers have never received any safety training. This needs serious procedures and reviews to be undertaken to have programs in occupational safety and raise safety awareness to minimize injuries and fatalities in the Gaza Strip construction industry.

Table (1): Selected Personal Characteristics

Number	Variable	Options	Percentage %
1	Age	Less than 18 years	12
		18 to less than 25 years	27.8
		25 to less than 32 years	31.6
		32 to less than 39 years	15.8
		39 years or more	12.9
2	Marital status	Single	34
		Married	66
3	Experience at the construction industry	Less than 3 years	35.4
		3 to less than 10 years	30.1
		10 to less than 17 years	25.4
		17 years or more	9.1
4	Experience in the current Company	Less than 1 year	35.4
		1 to less than 5 years	34.4
		5 to less than 15 years	16.7
		15 years or more	6.7
5	Field of work	Buildings	67.5
		Roads	23.
		Water and sewage	5.7
		Others	2.9
6	Employer	Contractor	55
		Subcontractor	38.3
		Others	6.7
7	Smoking habit	Smoke even at work time	53.1
		Smoke, but not at work time	16.7
		Do not smoke	30.1
8	Educational level	Below primary	24.4
		Primary	25.8
		Secondary	38.8
		Diploma	4.3
		College or higher	6.7
9	Family members to support	None	18.2
		1-2	11
		3-4	21.1
		5-6	25.8
		7 or more	23.9
10	Skill levels	Skilled worker	53.1
		Simi-skilled worker	23
		Unskilled worker	23.9
11	Safety training received	Yes	29.7
		No	70.3

B. Safety Climate and Safety Behavior

The most important factor with highest rank will be discussed and the factor of the lowest rank will be explained as shown below.

As illustrated in Table (2), the Relative Importance Index (RII) of the statement "Safety rules and procedures are made available to protect us from accidents" equals (79.9%), Test-value = 10.42, and P-value < 0.0001 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this statement is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this statement. The RII of statement 19 "I find working with certain amount of risk exciting" equals (55.0%), Test-value = -1.04, and P-value = 0.149 which is greater than the level of significance $\alpha = 0.05$. Then the mean of this statement is insignificantly different from the hypothesized value 3. It is concluded that the respondents are not sure about this statement. The RII of the field "Safety Climate" equals (70.6%), Test-value = 7.63, and P-value < 0.0001 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to field of "Safety Climate" and they have a positive perspective regarding the components of "Safety Climate". These results are coherent and positively promising for "Safety Climate" given that the average of RII of the field "Safety Climate" is 70.6%.

Table (2): RII and Test Value for "Safety Climate"

No.	Statement	RII	RII (%)	SD	Test value	P-value	Rank
1.	Management clearly considers safety to be equally as important as production.	3.42	68.5	1.13	4.79	< 0.0001*	24
2.	Management acts decisively when a safety concern is raised.	3.69	73.7	1.00	8.36	< 0.0001*	8
3.	Management acts quickly to correct safety problems.	3.48	69.6	1.13	5.82	< 0.0001*	21
4.	Management encourages feedback from site workers on safety issues.	3.55	71.0	1.04	7.01	< 0.0001*	17
5.	Management continues to bring safety information to site employees' attention.	3.77	75.4	0.94	9.13	< 0.0001*	6
6.	Management operates an open-door policy on safety issues.	3.65	72.9	1.06	7.31	< 0.0001*	12
7.	**Safety rules and procedures are made available to protect us from accidents.**	**4.00**	**79.9**	**0.96**	**10.42**	**< 0.0001***	1
8.	I am aware of my trade relevant safety rules & Procedures.	3.84	76.9	0.95	9.71	< 0.0001*	4
9.	Safety inspections are carried out on regular basis.	3.37	67.4	1.10	5.16	< 0.0001*	28
10.	I am encouraged to report unsafe condition.	3.51	70.1	1.19	5.83	< 0.0001*	20
11.	I am usually engaged in regular safety talks with supervisors.	3.39	67.7	1.08	4.99	< 0.0001*	26
12.	My supervisors have positive safety behavior.	3.53	70.6	1.14	5.43	< 0.0001*	19
13.	I am involved with safety issues at work.	3.45	69.0	1.01	6.25	< 0.0001*	23
14.	I am involved in informing management of important safety issues.	3.37	67.4	1.32	4.11	< 0.0001*	29
15.	Construction sites are dangerous places.	3.66	73.1	1.21	6.20	< 0.0001*	11
16.	My job carries a considerable level of risk.	3.53	70.6	1.23	5.54	< 0.0001*	18
17.	I believe some rules are really necessary	3.63	72.6	1.15	8.07	< 0.0001*	13

No.	Statement	RII	RII (%)	SD	Test value	P-value	Rank
	to get the job done safety.						
18.	I am rarely worried about being injured on the job.	3.18	63.7	1.32	1.66	0.048 *	30
19.	**I find working with certain amount of risk exciting.**	**2.75**	**55.0**	**1.43**	**-1.04**	**0.149**	**33**
20.	I am sure it is a matter of time before I am involved in an accident.	3.12	62.5	1.36	1.68	0.046 *	31
21.	I believe safe work habits improve production.	3.77	75.3	1.03	9.18	< 0.0001*	7
22.	I believe safety is the number first priority in my workplace.	3.67	73.5	1.08	7.27	< 0.0001*	9
23.	I am encouraged to raise any safety concern.	3.38	67.7	0.99	4.26	< 0.0001*	27
24.	I received adequate training to perform my job safety.	3.46	69.2	1.11	5.29	< 0.0001*	22
25.	I am capable of identifying potentially hazardous situations.	3.93	78.5	1.10	9.17	< 0.0001*	2
26.	I believe that prevention of accidents is the responsibility of everyone.	3.91	78.3	1.08	9.07	< 0.0001*	3
27.	I am given enough time to get the job done safely	3.58	71.6	1.19	5.01	< 0.0001*	15
28.	Under work pressure it is normal for me to take shortcuts at my expense of safety	3.07	61.4	1.43	0.32	0.376	32
29.	Working with defective equipment is not allowed under any circumstances.	3.59	71.8	1.21	5.88	< 0.0001*	14
30.	Personal protective equipment are useful in increasing the safety level.	3.80	76.0	1.05	8.46	< 0.0001*	5
31.	I always get the equipment I need to do the job safety.	3.56	71.3	1.09	6.15	< 0.0001*	16
32.	There are always enough people available to get the job done safely.	3.42	68.3	1.09	4.44	< 0.0001*	25
33.	I am clear about what my responsibilities are for health and safety.	3.66	73.2	1.04	7.77	< 0.0001*	10
	Safety Climate	**3.53**	**70.6**	**0.60**	**7.63**	**<0.0001***	

Table (3) shows the RII of field safe work behavior. The RII of the statement “I follow all of the safety procedures for the job that I perform” equals 62.9%, Test-value = 7.09, and P-value = <0.0001 which is smaller than the level of significance α = 0.05. The sign of the test is positive, so the mean of this statement is significantly greater than the hypothesized value 50%. It is concluded that the respondents agreed to this statement.
The RII of the statement “My coworkers follow all of the safety procedures for the job that they perform” equals 59.0%, Test-value = 5.85, and P-value = <0.0001 which is smaller than the level of significance α = 0.05. The sign of the test is positive, so the mean of this statement is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this statement. The RII of the filed “Safe work behavior” equals 61.0%, Test-value = 6.41, and P-value = <0.0001 which is smaller than the level of significance α = 0.05. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 50%. It is concluded that the respondents agreed to field of “Safe work behavior”. The results in Table (3) show a relatively low percentage of agreement 61% on having “Safe Work Behavior” on construction sites. Although this is a statistically positive result, it needs to be boosted

up, given the adverse consequences of lack of commitment to safety rules and procedures on site. In terms of safe work behavior, construction workers do follow safety procedures to a percentage up to 62.9% and their colleagues on site to 59% percentage. However, the results should be much higher, as workers should follow no-tolerance safety procedures, which if not existed, could lead to serious injuries and risks on site, negatively affecting the construction industry.

Table (3): RII and Test Value for "Safe Work Behavior"

No	Statement	RII	RII %	SD	Test value	P-value	Rank
1.	I follow all of the safety procedures for the job that I perform	3.15	62.9	23.34	7.09	< 0.0001*	1
2.	My coworkers follow all of the safety procedures for the job that they perform.	2.95	59.0	23.73	5.85	< 0.0001*	2
	Safe work behavior	**3.05**	**61.0**	**23.17**	**6.41**	**< 0.0001***	

C. Factor Analysis

Questionnaire responses were checked using the statistical package for the social sciences (SPSS) version 19.0 to ensure completeness, consistency, and reliability prior to data processing. The data gathered using the first part of the survey was factor-analyzed to examine the inter-relationships among the 33 statements in attempt to reduce the number of statements into a small number of factors. First data suitability was assessed using a measure of sampling adequacy. Table (4) shows the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. KMO test is used to predict if data are likely to factor well. Kaiser (1974) recommended accepting values greater than 0.5 as acceptable. For these data, KMO = 0.767, which fall into the region of being superb; so, we would be confident that factor analysis is appropriate for these data. Bartlett's test of sphericity tests the null hypothesis that the original correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. A significant test indicates that the correlation matrix is not an identity matrix; therefore, there are some relationships between the variables that may be included in the analysis. For these data, Bartlett's test is highly significant (P-value < 0.001), and therefore factor analysis is appropriate.

Table (4): KMO and Bartlett's Tests for Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.767**
Bartlett's Test of Sphericity	Approx. Chi-Square	3,672.610
	Df	528
	P-value	< 0.001

Table (5) lists the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS has identified 23 linear components within the data set. The eigenvalues associated with each factor represent the variance explained by the particular linear component and SPSS also displays the eigenvalue in terms of the percentage of the variance explained (so, factor 1 explains 29.854 % of total variance). It is clear that the first few factors explain relatively large amounts of variance (especially factor 1) whereas subsequent factors explain only small amounts of variance.

Table (5): Total Variance Explained

Statement	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.852	29.854	29.854	9.852	29.854	29.854	5.360	16.242	16.242
2	3.308	10.025	39.880	3.308	10.025	39.880	4.485	13.591	29.833
3	2.885	8.741	48.621	2.885	8.741	48.621	4.472	13.552	43.384
4	2.256	6.837	55.458	2.256	6.837	55.458	3.058	9.267	52.651
5	2.084	6.314	61.772	2.084	6.314	61.772	3.010	9.121	61.772
6	1.443	4.374	66.146						
7	1.162	3.520	69.666						
8	1.064	3.224	72.890						
9	1.045	3.166	76.056						
10	0.813	2.464	78.520						
11	0.764	2.317	80.837						
12	0.709	2.150	82.986						
13	0.576	1.747	84.733						
14	0.539	1.632	86.366						
15	0.496	1.503	87.868						
16	0.449	1.361	89.229						
17	0.416	1.262	90.491						
18	0.385	1.167	91.658						
19	0.360	1.091	92.749						
20	0.340	1.030	93.779						
21	0.319	0.967	94.746						
22	0.278	0.841	95.587						
23	0.248	0.753	96.340						
24	0.197	0.597	96.937						
25	0.174	0.527	97.464						
26	0.164	0.497	97.961						
27	0.126	0.382	98.343						
28	0.120	0.363	98.706						
29	0.116	0.351	99.057						
30	0.091	0.276	99.333						
31	0.087	0.264	99.597						
32	0.085	0.256	99.854						
33	0.048	0.146	100.000						

Figure (1) shows the Scree Plot, which leads to five factors, because the regression line is severe up to component 5 and becomes almost straight line after that. The eigenvalues associated with these factors are again displayed with the percentage of variance explained in the column labeled "Extraction Sums of Squared Loadings" In the final part of the table (labeled "Rotation Sums of Squared Loadings"), the eigenvalues of the factors after rotation are displayed. Rotation has the effect of optimizing the factor structure and one consequence for these data is that the relative importance of the five factors is equalized. After extraction, factor 1 accounts for 16.242% of variance (compared to 13.591%, 13.552%, 9.267% and 9.121% respectively).

A principal component analysis was then conducted to reveal the presence of five distinct factors. To obtain interpretable results from these three factors, a varimax rotation was also performed.

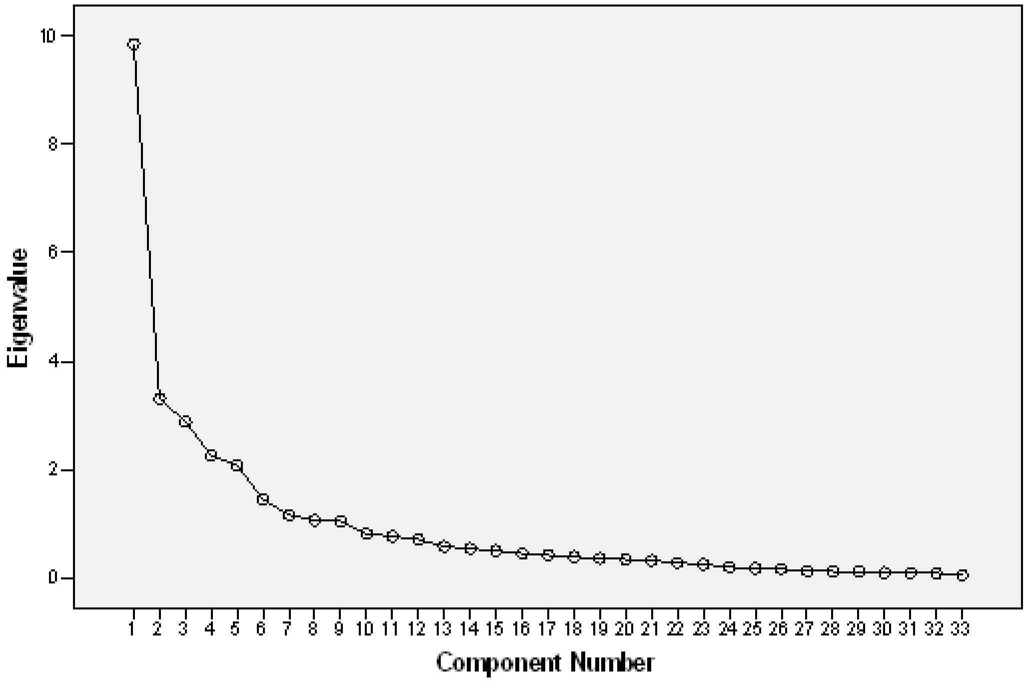

Figure (1): The Scree Plot

D. Factor Interpretation

The five-factor solution accounted for about 61.772% of the total variance Table (6). The factors were then examined to identify the number of items that were loaded on each factor. The five-factor solution, with respective loading scores is presented in Table (6) Reliability scores (Cronbach's alpha), for the factors range from 0.642 to 0.880 indicating adequate internal consistency. The results were assessed and numbered in a descending order of the amount of variance to determine the underlying features. Each factor was subjectively labeled in accordance with sets of individuals items.

The first factor, (Work Environment and Competence), accounted for 16.242% of the total variance and comprises 9 items indication the workers' degree of (Work Environment and Competence). The majority of items had a relatively high factor loading (> 0.70).

The second factor, (Communication), accounted for 13.591 % of the total variance and comprises 7 items indication the workers' degree of (Communication). The majority of items had a relatively high factor loading (> 0.70).

The third factor, (Safety Involvement and Awareness), accounted for 13.552 % of the total variance and comprises 8 items indication the workers' degree of (Safety Involvement and Awareness). The majority of items had a relatively high factor loading (> 0.60).

The fourth factor, (Safety Beliefs and Confidence), accounted for 9.267 % of the total variance and comprises 5 items indication the workers' degree of (Safety Beliefs and Confidence). The majority of items had a relatively high factor loading (> 0.570)

The fifth factor, (Supportive Environment), accounted for 9.121 % of the total variance and comprises 4 items indication the workers' degree of (Supportive Environment). The majority of items had a relatively high factor loadings (>0.70).
Table 5 showed the five-factors solution. The number in front of each statement represents the sort of the statement in the original questionnaire.

Table 6: The five-factor solution

Factor	Corresponding items	Variance %	Eigenvalue	Cronbach's alpha
1	23, 24, 26, 27, 29, 30, 31, 32, 33	16.242	9.852	0.880
2	1, 2, 3, 4, 5, 10, 11	13.591	3.3	0.885
3	9, 13, 14, 15, 18, 19, 20, 28	13.552	2.885	0.827
4	16, 17, 21, 22, 25	9.267	2.256	0.642
5	6, 7, 8, 12	9.121	2.084	0.758

E. Relationship between Personal Characteristics and Safety Climate/Behavior

Kruskal-Wallis test was used to examine the relationship between personal characteristics and safety climate/safe work behavior. The test showed that there is an impact of experience in the construction industry, experience in the current company, field of work, smoking habit, and safety training received on safety climate. In contrast, the personal characteristics; age, marital status, direct employer, educational level, family members to support, skill levels have no influence on safety climate. The findings indicated that age, experience in the construction industry, experience in the current company, field of work, smoking habit, and educational level influence safe work behavior. On the other hand, the other characteristics; marital status, direct employer, family members to support, skill levels, and safety training received on safe work behavior.

F.Relationship between Safety Climate and Safe Work Behavior

The Spearman correlation coefficient 0.318 means that there exist a positive relationship between Safety Climate and Safe work behavior. Since P-value < 0.0001 which is smaller than 0.05, then we conclude that there is sufficient evidence to conclude that there is statistically significant relationship between Safety Climate and Safe work behavior at the 5% level.

Table (7): Relationship between Safety Climate and Safe work Behavior

	Safe Work Behavior	
	Correlation Coefficient	P-value
Safety Climate	0.318 **	< 0.0001*

* Correlation is significant at 5% level

V. CONCLUSIONS

This paper attempted to explore the relationship between personal characteristics and safety climate/safety behavior and that between safety climate and safe work behavior. A survey questionnaire was developed including personal characteristics, safety climate, and safe work behavior to measure construction workers' perception and attitudes and to test individual and coworkers safety behavior. It was found that there is a positive perspective of safety climate, the results were coherent and promising, but more efforts should be done to raise shared responsibility for safety issues. In terms of safe work behavior, construction workers do follow safety procedures to a percentage up to 62.9% and their colleagues on site to 59% percentage. However, the results should be much higher, as workers should follow no-tolerance safety procedures, which if not existed, could lead to serious injuries and risks on site, negatively affecting the construction industry. The findings illustrated that the workers with more experience and received safety training have more positive perception of the safety climate. Besides, workers' type of work and smoking habit are important for safety climate. While the results implied that age, marital status, direct employer, educational level, family members to support, skill levels have no impact on safety climate. It is recommended to enhance workers safety culture and to improve safety climate that may lead to better perception and behave more safely. The results indicated that the workers, who are older, with more experience, do not smoke, and more educated have better safe work behavior. On the other hand, the other characteristics; marital status, direct employer, family members to support, skill levels, and safety training received give no influence on safe work behavior. The research emphasize that safety climate has a positive impact on safety behavior. However, it is recommended to raise safety awareness of construction workers through training programs and by following safety rules and procedures.

VI. REFERENCES

[1] Cox, S. and Cox. T. (1991) “The Structure of Employee Attitudes to Safety: A European Example”. Work and Stress, 5(2), pp. 93-106.

[2] Pidgeon, N. (1991). Safety culture and risk management in organizations. In Journal o Cross Cultural Psychology (pp. 129-140).

[3] Schein, E.H. (1985) Organizational Culture and Leadership. Jossey-Bass, Oxford.

[4] Mearns, K., Flin, R., Gordon, R. and Fleming, M. (1998) “Measuring Safety Climate on Offshore Installations”. Work and Stress, 12, pp. 238-254.

[5] Cox, S.J. and Cheyne, A.J.T. (2000) “Assessing Safety Culture in Offshore Environments”. Safety Science, 34, pp. 111–129.

[6] Lee, T. (1998). Assessment of safety culture at a nuclear reprocessing plant. In Work and Stress 12 (pp. 217–237).

[7] Neal, A., GriYn, M.A., Hart, P.M., 2000. The impact of organizational climate on safety climate and individual behavior. Safety Science 34, 99–109.

[8] Ali T. (2006). Influence of National Culture on Construction Safety Climate in Pakistan, PhD thesis, School of Engineering. Griffith University.

[9] Hinze, J. (1997). Construction Safety. New Jersey: Prentice Hall Publications.

[10] Ministry of Labor (2003). A statistical study for fatalities and injuries in Gaza Strip for the period from 1998 to 2003.

[11] Zohar, D. (1980). Safety climate in industrial organizations: theoretical and applied implications. Journal of Applied Psychology 65, (pp. 96–102).

[12] Niskanen, T. (1994). Safety climate in the road administration. In Safety Science 17, (pp. 237–255).

[13] Cabrera, D. I. et al. (1998). The role of safety climate in a safety management system. In Safety Management: The Challenge of Change. Oxford, UK: Elsevier.

[14] Guldenmund, F. (2000). The Nature of Safety Culture: A Review of Theory and Research. In Safety Science 34, (pp. 215-257).

[15] Glendon, A.I. and Stanton, N.A. (2000) “Perspectives on Safety Culture”. Safety Science, 34(1-3), pp. 193-214.
[16] Donald, I., Cantaer, D. and Chalk, J. (1991) “Measuring Safety Culture and Attitudes”. Proceedings of the 1st International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production. Society of Petroleum Engineers.
[17] Coyle, I., Saleeman, S.D. and Adams, N. (1995) “Safety Climate”. Journal of Safety Research, 26, pp. 247-254.
[18] Health and Safety Executive (HSE). Health and safety climate survey tool: Process guidelines, HSE, London.
[19] Williamson, A.M., Feyer, A.M., Cairns, D. & Biancotti, D. 1997, ‘The Development of a Measure of Safety Climate: The Role of Safety Perceptions and Attitudes’, Safety Science, vol. 25, pp. 1–3.
[20] Dedobbeleer, N. and Beland, F. (1991) “A Safety Climate Measure for Construction Sites". Journal of Safety Research, 22, pp. 97-103.
[21] Flin, R., Conner, P.O. and Bryden, R. (2000) “Measuring Safety Climate: Identifying the Common Features”. Safety Science, 34 (1-3), pp. 177-192.
[22] Glendon, A.I. and Litherland, D.K. (2001) “Safety Climate Factors, Group Differences and Safety Behavior in Road Construction”. Safety Science, 39 (3), pp. 157-188.
[23] Mohamed, S. (2002). Safety Climate in Construction Site Environments. In J. Construction Engineering and Management, 128(2), pp. 375-383.
[24] Fang, D., Chen, Y., and Wong, L. (2006). Safety climate in construction industry: A case study in Hong Kong. J. Construction Engineering and Management 132(6),(pp. 573-584).
[25] Cox, S. and Flin, R., (1998) “Safety Culture: Philosopher's Stone or Man of Straw?” Work and Stress, 12, pp. 189-201.
[26] Eagly, A.H. and Chaiken, S. (1993) The Psychology of Attitudes. Harcourt Brace Jovaovich Fort Worth.
[27] Sawacha, E., Naoum, S. and Fong, D. (1999). “Factors Affecting Safety Performance on Construction Sites”. International Journal of Project Management.17 (5), (pp. 309–315).
[28] Cox, S., Cox, T., 2001. The structure of employee attitudes to safety: a European example. Work and Stress 5 (2), (pp. 93-106).
[29] Clarke, S. (2006). The relationship between safety climate and safety performance: a meta- analysis review. Journal of Occupational Health Psychology 11 (4), (pp. 315–327).
[30] Lee, T., Harrison, K., 2000. Assessing safety culture in nuclear power stations. Safety Science 34 (1–3), (pp. 61–97).
[31] Siu, Oi-Ling., Phillips, D.R. and Leung, Tat-Wing. (2003) “Age Difference in Safety Attitudes and Safety Performance in Hong Kong Construction Workers”. Journal of Safety Research, 34, pp. 199-205.
[32] Cooper, M.D. and Phillips, R.A. (2004) “Exploratory Analysis of the Safety Climate and Safety Behavior Relationship”. Journal of Safety Research, 35, pp. 497-512.
[33] Chouhdry, R. (2007). Exploratory Study of the Safety Culture in Construction. PhD thesis, Management Science and Engineering, Tsinghua University.
[34] Chouhdry, R., Fang, D., and Lingard, H. (2009). Measuring Safety Climate of a Construction Company. J. of Construction Engineering and Management (9), pp. 890-899.

