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PERCEPTION OF BUILDING CONSTRUCTION WORKERS TOWARDS SAFETY, HEALTH AND ENVIRONMENT

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Abstract

The construction industry is known as one of the most hazardous activities. Therefore, safety on the job site is an important aspect with respect to the overall safety in construction. This paper assesses the safety level perception of the construction building workers towards safety, health and environment on a construction job site in Kuala Lumpur, Malaysia. The above study was carried out by choosing 5 selected large building construction projects and 5 small building construction projects respectively in and around Kuala Lumpur area. In the present study, an exhaustive survey was carried out in these 10 project site areas using a standard checklist and a detailed developed questionnaire. The checklist comprised 17 divisions of safety measurements which are considered and perceived to be important from the safety point of view and was assessed based on the score obtained. The questionnaire comprised the general information with 36 safety attitude statements on a 1-5 Likert scale which was distributed to 100 construction workers. The results of the checklist show the difference of safety levels between the large and small projects. The study revealed that the large projects shown a high and consistent level in safety while the small projects shown a low and varied safety levels. The relationship between the factors can be obtained from the questionnaire. They are organizational commitment, factor influencing communication among workmates, worker related factors, personal role and supervisors' role factors, obstacles to safety and safe behavior factors and management commitment at all levels in line with the management structure and risk taking behavioral factors. The findings of the present study revealed invaluable indications to the construction managers especially in improving the construction workers' attitude towards safety, health and environment and hence good safety culture in the building construction industries.

Keywords: Construction Building Workers, Construction Job Site, Safety, Health and Environment, SPSS.

1. Introduction

Developing a proactive safety culture may take long time and require spending of large sum of money for planning, investigating and implementing into each level within the organization. However, it is worthy of being compared with invaluable health and life of human beings. Once it succeeds, the relative rewards will be achieved in terms of competitive advantage, quality, reliability and profitability within organisation. Hinze [1] advocated the idea that safety is no luxury but a necessity. In recent years, many construction companies have recognised this importance that the establishment of good safety culture can help controlling and reducing the construction costs and increase the efficiency of their ongoing operations in long term. Unfortunately, many of them not really known as to establish a form of safety culture same as the culture of a country or a society [2]. Safety culture relates to the humanitarian aspects as well as safety as an integral component. The interactive relationships between people's behavior, their attitudes and perceptions they hold, and the situation or environment in work place should be taken into account [3].

Safer behaviour is reflected by good attitude. Many accidents/incidents that occurred in the workplace especially in the building construction sites were due to inadequate adherence of workers to work procedures. The workers must realize that they play an important role contributing in the accomplishment of the building construction. The awareness and perception of the workers toward safety, health and their working environment are important aspects to enhance the building construction to the better condition to the workers themselves. This paper describes the findings from a structured questionnaire survey, observations and interviews on the safety level and perception of building construction worker towards safety, health and environment.

The concept of worker safety climate and how workers perceive the safety climate of their workplace was raised as an issue about 25 years ago [4]. At that time, it was recognized that successful injury control programs are based on a strong management commitment to safety, including the status of safety officers within the organization, worker training, regular communication between management and workers, general housekeeping, and a stable workforce. Safety climate, considered a subset of overall organization climate, is one way of identifying characteristics that might distinguish between employers with high or low injury rates. Psychological climate has been identified as yet another dimension of employees' perception of the organization in which they work, though the dimensions of this measure include items such as trust, cohesion, pressure, innovation, and fairness, among others [5]. Dedobbeleer and Beland [6] studied the workplace safety climate measurements in various industrial sectors including construction.

The term "safety culture" has many definitions according to the past researchers and they are summarised as follows:

1. Perception and beliefs, behaviour and management systems are the elements which combine to form an organization "safety culture" [7].
2. "Safety culture" is the "collective behaviours of people in the organization that over time becoming patterns, typical or habit". Employees always behave

in ways that the company requires them to, without considering why they need to do [8].

3. Safety culture is an environment in which people do their tasks safely and for the right reasons [9].

Gellor [10] investigated a safety triad theory (see Fig. 1) in which he thought that a "Totally Safety Culture" should maintain a continuous monitoring process to three domains which are "environment", "person" and 'behaviour". The "person" reflects the competency of a worker where as the "behaviour" illustrates the attitudes of workers in carrying out job safely in a "specific environment'. Those three domains are dynamics and interactive and the change in either one factor will eventually influence the other one. Once people choose to act safety, they act themselves into safe thinking and the corresponding behaviours often result in some environmental change.

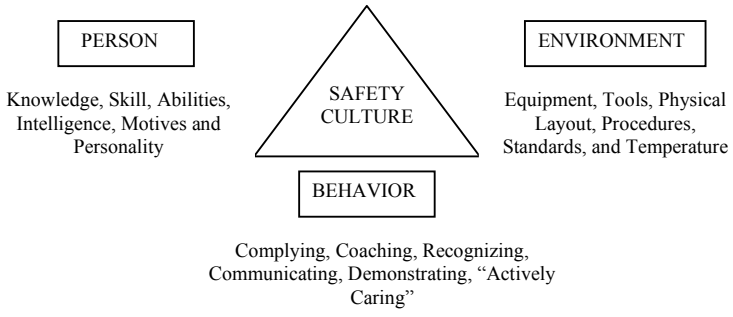

Fig.1. Gellor's Safety Triad

2. Research Methodology

The current study was conducted using a checklist and questionnaire that are developed as discussed below.

2.1 Check List

The projects for the survey were selected at random in Kuala Lumpur area, based on the fact that they were under construction at the time of the survey. The survey included 2 types of projects which are 5 of large building construction projects and 5 of small building construction projects.

The large building construction projects included several offices and commercial buildings whereas the small building construction projects consisted mainly of residential buildings and housings. A standard checklist used in the observation survey included items which are perceived to be important from a safety point of view on the construction site. The checklist consists of 17 divisions and 96 items distributed among the different divisions.

Each item within a division was evaluated as `yes' or `no' depending on its existence in the job site. Each `yes' was given a score of 100 and each `no' was given a score of 0. The division score was calculated using the following expression:

$$\frac{\sum\left[no\ \ of'Yes'\times 100 + no\ \ of'No'\times 0\right]}{no\ \ of\ \ applicable\ \ items}$$

Items not applicable for a particular project were ignored and not used in the calculation. Each project was scored by obtaining the average of the applicable division scores within that project

The projects were then assessed based on the following scale: 0-59% as poor, 60-69% as fair, 70-79% as good, 80-89% as very good, 90-100% as excellent.

2.2 Questionnaire

A questionnaire survey was developed for construction personnel who had been selected randomly from 5 different construction sites. The questionnaires are divided into 2 parts; Part 1 which consists of general information and Part 2 which consists of 36 attitude statements on a 1-5 Likert scale. The elements highlighted in the questionnaire cover the historical factor (F1), organizational commitment and communication (F2), reporting of accidents and near misses (F3), line management commitment (F4), supervisor's role (F5), personal role (F6), workmates' influence (F7), risk taking behaviour and some contributory influence (F8) and obstacles to safe behaviour (F9).

All the data collected from the survey were analysed using a Statistical Package for Social Sciences Version 10.0 (SPSS 10.0).

3. Results and Discussions

3.1 Checklist

The checklist tries to assess the safety of the site by considering only the unsafe conditions existing in the work site irrespective of either small or large projects. Table 1 shows the safety levels, average safety scores, variance and standard deviation of large and small projects in respectively. It is obvious that the safety level in large projects is high. This could be due to the fact that most of the projects surveyed were constructed by large well known firms which apply their own safety codes and practices. In addition, most of these construction companies have a safety administration department as an important part of their organizational structure.

Safety assessment scores in small projects varied widely with the maximum safety score of 71.88% (good) and the minimum of 55.63% (poor). These differences could be due to not implementing the Standard Safety Code and the lack of set rules and regulations for contractors to be followed. All safety measures were taken at the initiative of the contractors. It is clear that the safety level in large projects is higher than the safety level in small projects. The safety level among small projects showed wide variation with some projects showing good scores and others having a dismal performance. The large projects, however, showed a consistent level in safety. Table 2 shows the divisions' average score and their ranks for both large and small projects. From the survey it was found that the following divisions had low safety levels in small project areas: (1) cartridge operated tools, (2) concrete formwork, (3) sandblasting and (4) fire prevention.

Table 1. The Safety Level, Average Safety Score, Variance and Standard Deviation in Large and Small Projects.

Project no	Large projects		Small projects	
	Safety score	Rating	Safety score	Rating
1	84.17	very good	64.79	Fair
2	92.08	Excellent	57.50	Poor
3	75.83	Good	71.88	Good
4	81.25	very good	55.63	Poor
5	87.50	very good	62.50	Fair
Average safety score	83.46		59.97	
Variance	33.16		842.38	
Standard deviation	5.76		29.02	

Table 2. Division Safety Average Scores and Ranks for Large and Small Projects

Division no	Divisions	Large project		Small project	
		Average score	Rank	Average score	Rank
1	Fire prevention	80.57	11	64.57	12
2	Housekeeping	88.00	4	85.33	3
3	Scaffold/mobile tower	89.50	3	84.50	5
4	Sandblasting	84.80	9	54.40	13
5	Cartridge operated tools	73.60	17	12.00	15
6	Power tools/machine	76.80	14	NA	NA
7	Excavation	87.00	7	87.00	2
8	Heavy equipment	92.00	1	88.00	1
9	Concrete formwork	76.00	15	36.00	14
10	Gas/electric welding	80.00	12	65.33	11
11	Health and welfare	84.00	10	79.33	6
12	Compressed gas	74.00	16	NA	NA
13	Transportation	86.40	8	68.00	8
14	Air compressors	87.20	6	75.20	7
15	Cranes and lifting	91.00	2	85.00	4
16	Safety administration	88.00	4	66.86	10
17	Temporary electric	80.00	12	68.00	8

NA = Not Applicable

A ranking of the division provides a valuable input to managers in deciding the risk level reduction of building construction from the proper perspective and perception of construction workers.

3.2 Questionnaire

3.2.1 Reliabilities of the worker's perception survey

Before examining the results of the findings, the internal consistency reliability of the safety culture survey was tested. Referring to Table 3, almost all of the coefficient alphas (where $\alpha \geq 0.5$) regarding the perceptions were acceptable except perception of line management commitment (F4, $\alpha = 0.4423$). One of the reasons for low reliability results for ''line management commitment'' may be due to insufficient number of statements in the questionnaire for the reliability

analysis. Moreover, distractions and misunderstandings would increase people's tendencies to make random errors and simple mistakes, which affected the reliability of the survey. However, the acceptably high α for all scales show that the instrument used has demonstrated high reliability.

Table 3: Means, Standard Deviations and Coefficient Alphas for all Factors

Factors	Alpha, α	Mean scores	Standard deviation
F1	0.8534	2.0100	0.6154
F2	0.6831	3.4719	0.5529
F3	0.8035	3.9200	0.6806
F4	0.4423	2.9267	0.9108
F5	0.8931	3.8400	0.8671
F6	0.5709	2.8843	0.6148
F7	0.7316	3.6080	0.5287
F8	0.8204	3.0760	0.8044
F9	0.7979	2.6080	0.8336

3.2.2 Factor analysis

Factor analysis refers to a variety of statistical techniques whose common objective is to represent a set of variables in terms of a smaller number of hypothetical variables. In this paper, factor analysis was used to identify and interpret non-correlated clusters of routine management variables that dominate the workplace safety. The Statistical Package for Social Science (SPSS v.10) was utilized to conduct factor analysis and other statistical analysis. Test of factorability was performed on SPSS for windows using Kasier-Meyer-Olkin's (KMO) measure of sampling adequacy. The result of KMO test for all the variables was 0.771, which is acceptable for the analysis [11].

Nine common factors out of 39 variables were extracted through factor analysis with the cumulative up to 58.54%. The rotated component matrix (also called factor structure matrix) is a matrix of coefficients, where the coefficients refer to the correlations between factors and variables, as shown in Table 4**.** The realistic meaning of a factor can be synthesized by combining those of the variables which have relatively high cross-factor loadings on it. The foremost five factors, identified by factor analysis, are interpreted as follows:

Component 1 is an organisational commitment and communication and workmates' influence related factor. According to factor analysis theory, the first factor accounts for the largest part of total variance of the cases. This confirms that the perception of the workers is mostly influenced by the management effort towards safety matters such as the safety training, safety meeting and has sufficient resource available for safety. Workmates can influence other worker to work safely and vice-versa.

Component 2 is a worker related factor. There is strong relationship between the historical factors of the worker and reporting of accidents and near misses. This is reinforced that the worker's experience, age and background of safety training

related to the tendency to reporting any accidents or near misses happen on the site. Their perception on the accidents and near misses reporting is high due to their awareness of the importance of safety on the construction site as any of their experience, age and background of safety training is increased.

Table 4: Rotated Component Matrix (Extraction Method: Principal Component Analysis)

Component	1	2	3	4	5	6	7	8	9	10	11
F1: V1.1	0.43	**0.52**	0.19	0.49	-0.11	0.16	-0.14	0.02	0.21	-0.02	-0.12
V1.2	0.33	**0.49**	0.15	0.55	0.03	-0.16	-0.11	0.23	0.11	-0.10	-0.08
V1.3	0.28	**0.58**	0.19	0.52	0.06	-0.08	-0.08	0.10	0.23	-0.10	-0.08
F2: V2.1	**0.74**	0.17	0.06	0.41	-0.15	0.15	0.13	0.10	-0.11	0.13	0.14
V2.2	0.59	0.23	-0.22	-0.24	-0.36	0.05	0.03	0.27	-0.12	-0.02	0.10
V2.3	0.59	0.46	0.08	0.11	-0.06	0.14	-0.04	-0.02	-0.17	0.15	0.20
V2.4	**0.79**	0.24	0.05	-0.34	-0.11	-0.09	-0.08	0.05	0.08	0.18	0.10
V2.5	**0.62**	0.38	0.38	-0.26	-0.20	0.04	-0.19	-0.04	0.04	0.05	0.12
V2.6	-0.36	-0.35	0.43	0.15	-0.36	0.23	0.39	-0.03	-0.00	0.23	-0.06
V2.7	**0.69**	0.26	-0.12	-0.03	0.03	0.08	-0.00	0.07	0.18	0.35	0.15
F3: V3.1	0.35	**0.59**	0.00	-0.11	0.23	0.11	0.13	-0.47	-0.10	0.06	-0.05
V3.2	0.20	**0.47**	-0.06	0.13	0.34	0.17	0.22	-0.59	-0.09	0.18	-0.05
F4: V4.1	-0.12	-0.14	0.13	-0.09	**0.28**	0.55	0.29	0.34	0.28	0.04	0.22
V4.2	0.20	-0.15	-0.07	0.10	0.19	0.53	-0.07	-0.12	0.42	-0.31	0.25
V4.3	0.13	0.12	0.21	-0.06	**0.33**	0.42	-0.21	0.15	-0.06	0.08	-0.54
F5: V5.1	0.63	-0.02	**0.50**	-0.11	0.10	-0.05	0.02	-0.04	-0.31	-0.25	0.11
V5.2	0.64	-0.05	**0.42**	-0.32	0.10	-0.05	0.10	-0.21	-0.13	-0.21	0.04
F6: V6.1	-0.71	0.03	-0.11	-0.02	-0.10	0.12	0.35	-0.03	0.06	0.16	0.07
V6.2	-0.55	0.02	0.18	-0.13	-0.20	-0.20	-0.37	-0.22	0.26	0.27	0.22
V6.3	-0.31	0.34	-0.20	-0.47	0.29	0.07	0.17	0.06	0.28	-0.02	0.09
V6.4	-0.15	0.62	0.01	-0.49	-0.23	0.05	0.01	0.04	-0.02	0.22	0.03
V6.5	-0.57	0.29	**0.51**	-0.07	-0.29	-0.08	-0.07	0.05	-0.05	-0.14	0.15
V6.6	0.13	0.12	0.17	0.06	-0.38	-0.28	0.39	-0.33	0.30	-0.31	-0.10
V6.7	0.20	0.39	-0.23	-0.21	-0.32	-0.18	0.29	0.06	0.33	-0.18	-0.27
F7: V7.1	**0.74**	-0.42	0.28	0.13	0.05	-0.08	0.02	0.04	0.14	0.18	-0.04
V7.2	**0.71**	-0.42	0.27	-0.06	0.04	-0.12	0.19	-0.04	0.15	0.24	-0.05
V7.3	0.54	-0.05	-0.25	0.26	-0.22	0.05	0.51	0.11	-0.21	0.06	-0.11
V7.4	0.57	0.12	-0.10	0.06	0.34	-0.25	0.29	0.16	-0.13	-0.04	0.22
V7.5	0.24	0.26	0.07	-0.32	0.39	-0.46	0.08	0.35	0.04	0.12	-0.20
F8: V8.1	-0.57	0.37	-0.23	0.13	-0.38	0.22	0.05	0.16	-0.11	0.07	0.02
V8.2	-0.61	0.53	-0.25	-0.03	0.06	0.15	-0.02	-0.06	-0.15	-0.18	0.02
V8.3	-0.73	0.38	-0.10	0.13	0.10	-0.05	0.10	0.08	-0.22	-0.09	0.15
V8.4	-0.66	0.18	0.44	-0.18	**0.16**	0.06	0.18	0.17	-0.05	-0.08	-0.00
V8.5	-0.57	0.25	0.60	-0.19	**0.17**	0.02	0.16	0.11	0.05	-0.01	-0.07
F9: V9.1	-0.72	0.06	0.39	**0.29**	0.04	0.03	0.07	-0.05	-0.09	0.23	-0.11
V9.2	-0.52	0.06	-0.47	0.03	0.12	-0.19	-0.02	-0.10	0.11	0.19	-0.17
V9.3	-0.33	0.05	-0.05	**0.46**	0.36	-0.46	0.12	0.03	0.08	0.07	0.33
V9.4	-0.78	-0.07	0.29	**0.23**	-0.06	-0.07	0.06	-0.03	0.04	0.04	0.02
V9.5	-0.78	0.18	0.26	-0.04	0.05	-0.15	0.04	-0.01	0.04	0.12	0.04

Component 3 is a relationship between personal role and supervisors' role. Workers will work more safely with a supervisor who is seen as someone who respects their workers and their contribution, and who is stimulated by a distinct company policy on safety. This is because they see their supervisor regards safety equally important as production.

Component 4 is obstacles to safe behaviour factor. The physical condition may be the main obstacles to safe behaviour factor. The worker's tasks sometimes very difficult that make them have to ignore the safety procedure. Some tasks require a long period with head or arms in physically awkward positions.

Component 5 is a line management commitment and risk taking behaviour factor. This stress is the importance of line management's viability and participation with the worker. Line management involvement such as relationship with worker, talk on safety and advice on safety matter is related to the worker's safety behaviour and safety motivation.

4. Conclusions

Construction safety survey study on the job site revealed that the safety level in construction sites varies with the project size. Large projects, constructed by large international firms, have much better safety level and safety records than smaller ones. This indicates the need for implementing a safety standard to monitor and enforce safety requirements at work sites. Also the results indicate that large projects have little variation in safety levels, while small projects have a wide variation in their safety performance.

Although there are many factors affecting perception of building construction workers towards safety, health and environment, the main factor perceived by the worker is organisational commitment and communication. Good organizational commitment and communication is highly associated with effective accident reporting, high line management commitment, active supervisor's role and active personal role. Active personal role to safety and health resulted in greater influence among workmates' and low obstacles to safety behaviour.

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