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Safety culture level among workers in the selected manufacturing plant

Junaidah Zakaria¹, Che Rosmani Che Hassan², Mahar Diana Hamid³, Ezrin Hani Sukadarin⁴, Zakaria Razak⁵

¹Department of Chemical Engineering, Faculty of Engineering, University of Malaya, 56000, Kuala Lumpur

⁴Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang Kuantan Pahang Malaysia

⁵Kaneka Malaysia Sdn. Bhd, Lot 123-124, Jalan Gebeng 2/3, Gebeng Industrial Estate, 26080 Kuantan Pahang Malaysia

*rosmani@um.edu.my

Abstract: Workers in the manufacturing industry face many safety risks due to the nature of the job. The state of safety and health performance determine by examining the safety climate factors which reflects workers' perception of the psychological aspect in safety culture domain. This study aimed to assess the safety culture level and its contributing factor to the safety culture in a selected chemical manufacturing plant. Survey data was collected from 309 employees in a factory located in Kuantan Pahang. They were randomly selected and represent two groups, namely executive and technician. A standardized climate questionnaire was used and answered by the respondents within 20 to 30 minutes. Sixty-five percent of the total respondents agree that the safety culture level at their workplace is high, and another 35% revealed that it is moderate. Perceived safety climate and personal attitude among two groups employee were compared using an Independent Sample t-test. Results revealed a significant difference between groups ($t=7.428$, $P=0.007$) for management commitment, ($t=6.133$, $P=0.014$) for safety rules and procedures, ($t=15.823$, $P=0.001$) for supportive environment, ($t=10.949$, $P=0.001$) and lastly for physical work environment, ($t=6.067$, $P=0.014$). A Pearson correlation coefficient was computed to assess the relationship between safety culture factors and demographic information of the respondents. There was a positive correlation between safety rules and procedures and level of education, $r = 0.135$, $p = 0.018$, and Involvement and years of working experience, $r = 0.165$, $p = 0.004$. Increases in the level of education were found correlated with increases in perceived safety rules and procedures while increases of years of working experience was directly correlated with increases in involvement to safety in the organization.

Keywords: safety culture, manufacturing, factors

1. Introduction

To develop a good safety culture and to find the best way to sustain is now a challenge to any organization. It is revealed that workers' behaviour and attitude towards safety play a vital role and have a specific impact on overall safety culture in an organization [1,2,3]. Initially, the concepts of safety culture were first originated from an organizational culture study and consist of multiple factors, shared by groups of people and last but not least, it is functional [4]. Generally, the word attitude represents a



personal feeling or opinion to respond positively or negatively towards certain object, idea or situation. Also, [6,7,8] describe attitude as an evaluation of an object and can be expressed as like, dislike, pleasant or unpleasant, good or bad and lastly harmful or beneficial. In short, the attitude of individual deals with particular things or situations and may influence how he or she deals with it. Positive attitudes to interpersonal aspects such as teamwork, leadership capability, stress level, and effective communication were the central elements in improving safety culture [7].

In order to investigate what is the important factor that makes up a positive and good safety culture, there is a need to return to the roots of culture [9]. Safety culture framework based on Cooper [2] had demonstrated the differences between three interrelated aspects of safety culture, specifically: psychological elements which refer to 'what people feel', behavioural elements which are a concern with 'what people do' and lastly situational factors which relate to 'what the organizations have'. Additionally, according to [10], by assessing employees perception on what their safety concern all about can represent the current safety culture level at the organization, which also known as safety climate. Safety culture assessment at the workplace can be accomplished using general methods such as conducting a survey and questions individual attitudes and perceptions towards the current safety culture at their organization. Further to that, workplace and facilities observation can also be conducted to assess workers behaviours and working conditions as well as examining the documents used in the organization, for example, the examination of safety procedures, event records, and accident databases.

In the effort to make more improvements, safety managers and directors are exploring organizational and psychological factors in the workplace using other approaches. One of the most noticeable factors is safety climate assessment [11,12,13]. A study conducted by [14] shows that factors contributing to organizational safety involve safety climate and perceptions of workers towards corporate policies and procedures about safety. Theoretically, the safety climate provides a framework to guide the safety behaviour of employees in such a way that they develop perceptions and expectations regarding safety behaviour outcomes and, thus, behave accordingly. A study conducted by [15] had identified three-factor to represent the safety climate model consisting of management concerns, management commitment, and workers' involvement. This paper aims to assess the level of present safety culture in one of the chemical manufacturing industries. Group differences among production and non-production workers in terms of safety attitudes and risk perception were evaluated.

2. Methods

2.1 Survey questionnaires

Safety Climate Questionnaires by [16] was used in this study and it measured four dimensions of general attitudes dimensions as follows:

- i. Organizational context which represent management overt commitment to safety, efficiency of communication, relative status of health and safety issues within the organization and also efficacy and necessity of rules and procedures placed by the organization.
- ii. Social environment which represent nature of social environment in term of support as well as everyone involvement when focusing issues pertaining to safety.
- iii. Personal appreciation represent the individual's view of their own health and safety management and need for feel safe while performing task.
- iv. Work environment represent existing physical work environment at the workplace.

The data were collected in this study is a part of a larger research project to explore the significance of behaviour based safety approach to improving safety performance in organizations. Permission to conduct the study in the industry was obtained through the organization legal approval. As the participants' first language is Malay, the questionnaires were translated into the Malay language, by a certified translator. A group of panel experts had validated the Malay translated version for its content validity and reliability to ensure that the questionnaires in the survey are suitable to be used during actual data collection. The 43 items of the translated safety climate questionnaires were Pre-tested among ten persons similar to the target group. They had been observed while answering and were asked to read all the questions carefully and provide any feedback in regards to the questions.

2.2 Sample

Respondents in this study were randomly selected. They are workers working in the chemical manufacturing industry. The name list was obtained from the Human Resource department. They were then categorized into two groups, the Executives (Human Resource department, engineer and supervisors) and Technicians (production workers).

2.3 Questionnaire Procedures

Workers selected for this study were asked for voluntary participation, with participation being taken as consent. The structured interview had been used to run the survey and workers were placed in a designated room. Introduction and briefing about the survey had been conducted by the researcher and participants were given 10 to 15 minutes to complete the survey. The scale ranged from totally disagree (1), via the middle option, agree nor disagree (3), to agree (5). Some of the items were negatively worded. For example, a score of 2 on a negatively worded item is reverse to a score of 4. Next, scores are averaged for each item, across the whole groups. These average items used to calculate the dimension scores. Dimensions have different numbers of items and, therefore, scores are standardised before plotting and comparing these dimensions. Converting the scores to a 1 to 10 scale can be achieved by dividing the actual score by the total possible score and then multiplying by 10. Once dimension scores are computed for each respondent, average scores can be computed. Lastly, from the total score for each dimension, it has been categorized into four categories which are below average, average, good and excellent to represent the safety culture level.

3. Results

3.1 Respondent's background information

Three hundred and nine workers were involved in the study, which represents 130 executive and 168 technician level. Respondents include male (68.5%), female (31.5%). The age range is between 26-35 years old, and the majority of them had a diploma certification

Table 1. Frequency distribution for socio-demographic information among respondents

Factors	Frequency	%
Group		
Executive	130	42.0
Technician	179	58.0
Gender		
Male	94	30.4
Female	215	69.6
Age		
16-25	68	22.0
26-35	160	51.8
36-45	57	18.4
46-65	24	7.8
Education level		
LCE/SRP (secondary)	5	1.6
SPM/STPM (secondary)	76	24.6
Diploma (tertiary)	133	43.0
Bachelor degree (tertiary)	81	26.2
Masters (tertiary)	14	4.6
Work experience (years)		
1-5	199	64.1
6-15	40	12.9
16-25	58	19.1
Above 25	12	3.9

N=309

3.2 Results of safety culture dimension score

Table 2 shows safety culture dimension score for each item among the two groups. The lowest score for both groups was the personal appreciation of risk which refer to how individuals view the risk associated to work they perform.

Table 2. Total dimensions' score for each item

Dimensions score	Mean Score	
	Technician	Executive
Organizational context		
Management commitment	7.44	7.63
Communication	7.39	7.52
Priority of safety	7.94	8.04
Safety rules and procedures	7.19	7.46
Social environment		
Supportive environment	6.54	6.74
Involvement	7.35	7.41
Individual appreciation		
Personal priorities and needs for safety	8.77	8.86
A personal appreciation of risk	5.47	5.34
Work environment		
Physical work environment	6.61	6.89

N=309

3.3 Results of Independent Sample t-test

There was a statistically significant difference between the group as determined by Independent Sample t-test ($t=7.428$, $p=0.007$) for management commitment ($t=6.133$, $p=0.014$) for safety rules and procedures ($t=7.428$, $p=0.007$) supportive environment ($t=15.823$, $p=0.001$) and physical work environment ($t=10.949$, $p=0.001$). Results also revealed that the mean score for these five factors was higher among the Executives as compared to the Technician.

Table 3. Independent Sample t-test

Variable	n	Mean	SD	t	Sig-p
Organizational context					
<i>Management Commitment</i>					
Executive	130	3.809	0.465	7.428	0.007*
Technician	168	3.783	0.376		
<i>Communication</i>					
Executive	136	3.866	0.528	2.047	0.154
Technician	171	3.790	0.484		
<i>Priority of Safety</i>					
Executive	137	4.162	0.518	0.339	0.561
Technician	171	4.295	0.494		

<i>Safety Rules and Procedures</i>					
Executive	134	4.001	0.570	6.133	0.014*
Technician	169	3.812	0.634		
Social environment					
<i>Supportive environment</i>					
Executive	135	4.003	0.355	15.823	0.001*
Technician	169	3.933	0.469		
<i>Involvement</i>					
Executive	135	3.709	0.582	0.781	0.378
Technician	169	3.701	0.522		
Personal appreciation					
<i>Personal Priorities and Need for Safety</i>					
Executive	137	4.495	0.386	3.536	0.061
Technician	168	4.421	0.452		
<i>Personal Appreciation of Risk</i>					
Executive	137	2.643	0.465	0.124	0.725
Technician	172	2.674	0.467		
Work environment					
<i>Physical Work Environment</i>					
Executive	137	3.547	0.441	10.949	0.001*
Technician	172	3.372	0.563		

N=309

3.3 Results for perceived safety culture level among workers and correlations analysis

Table 4 represents the respondents' perceived safety culture level based on the questionnaire. From the total score of safety culture level, it has been categorized into four categories which are below average, average, good and excellent. Results indicate that 63% of the total respondents generally agree that their company have an excellent safety culture. From the correlation analysis, there was a positive correlation between safety rules and procedures and level of education, $r = 0.135$, $p = 0.018$, and involvement and years of working experience, $r = 0.165$, $p = 0.004$.

Table 4. Safety culture level

Variables		Frequency	%
Safety culture level	Below average	13	4.2
	Average	94	30.4
	Good	194	63
	Excellent	8	8

Table 5. Correlations analysis

IV	DV	r	p
Education level	Safety rules and procedures	0.135	0.018*
Year of working	Involvement	0.165	0.004*

Pearson correlation coefficient

* $P < 0.05$

4. Discussion

The primary purpose of this study was to assess the safety culture level and compare safety climate perception between Executive and Technician levels in one of the chemical manufacturing industries. Five components of safety culture level were assessed, including organizational context, social environment, personal appreciation, work environment and lastly own attitude. The results of the t-test managed to reveal a significant difference in safety climate perception among respondents. Five out of ten safety climate factors; management commitment, safety rules and procedures, supportive environment, and physical work environment were found to have a significant difference between

Executive level and Technician level of workers. Safety climate is a specific form of organizational climate that describes individual perceptions of the value of safety in the work environment or as a "snapshot of safety culture"[17].

In this study, technicians seemed to be more involved in incidents than executives since all of them are production workers, including temporary workers. Hence, their perceptions towards safety climate were slightly different compared to executives level in which most of them are permanent workers. To explain this, [18] had stated that employees' psychological perceptions with their organization represent their beliefs about the shared responsibilities between that employees and his or her organization. In a study conducted by [19] report that temporary workers evaluate commitment to safety more negatively, and are less interested and more sceptical about it than permanent workers. In a study conducted by [20] suggested that employees try to make sense of their environment by using hierarchically adjusted referents. Permanent employees are more likely to have a broad relational contract with their organization and are committed to safety policies, rules and procedures.

On top of that, this study also revealed a significant correlation between safety climate factors which are rules, procedures and level of education, $r = 0.135$, $p = 0.018$, as well as involvement and years of working experience, $r = 0.165$, $p = 0.004$. Increases in the level of education correlated with improvements in perceived safety rules and procedures while increases in years of working experience are correlated with increases in involvement to safety in the organization. As displayed in the results section, the mean score for safety rules and procedures was higher among the executive group. It is understood that workers perceptions of safety climate should be distinguished from perceptions of their knowledge, motivation and behaviour that influence safety in the workplace

In a longitudinal study conducted by [21] proved that workers skills and knowledge regarding safety were improved through training methods and findings also show that workers perceptions improved when they conducted a follow-up session. Experience and job role was found to be highly significant with safety climate perception among respondents in a study conducted by [22] in the manufacturing setting. A positive association between organizational support and compliance with safety procedures. Workers with relatively higher supportive perceptions expressed more compliant with safety rules and procedures. Perceived safety culture level among respondents was overall good. Majority of them generally quite satisfied with the current safety culture at their organization. Referring to [1], when safety culture is relatively good, it indicates that the organization is more likely to have good safety-related policies and procedures.

5. Conclusion

Safety climate has been recently recognised as a fundamental and important solution in improving the safety culture of many industries. The present research work explored the safety climate perception between two groups of workers working at the chemical manufacturing plant. Even though there was a significant difference in safety climate perception among workers at the factory, the overall level of safety culture is generally reasonable. This indicated that the management adopted a good system to monitor and control safety and health aspects in the workplace. Initiatives made to improve safety to the next level also seems significant. Fostering safety climate can improve employees' safety behaviours to achieve and enhanced safety outcomes. To ensure this, it is crucial that organizations have in place policies, procedures, and practices that can be perceived by their employees as conducive to safe working environments. However, this is not a straightforward task because the concept of safety climate is predicated upon the notion of shared perceptions of the organizational climate.

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