AENSI Journals

Australian Journal of Basic and Applied Sciences

ISSN:1991-8178

Journal home page: www.ajbasweb.com

Safety Climate as a Driver of Change of Positive Safety Culture in a Malaysian Manufacturing Plant

[1]Siti Fatimah Bahari and [2]Norashikin Mahmud

[1]*Universiti Teknologi Malaysia, Department of Human Resource Development, Faculty of Management, 81300 Skudai, Johor, Malaysia.*
[2]*Universiti Teknologi Malaysia, Department of Human Resource Development, Faculty of Management, 81300 Skudai, Johor, Malaysia.*

ARTICLE INFO

Article history:
Received 30 September 2014
Received in revised form
17 November 2014
Accepted 25 November 2014
Available online 6 December 2014

Keywords:
Safety climate, safety culture, manufacturing

ABSTRACT

Background: It has been widely agreed that the positive changes in safety climate score over a period of time would further improve the underlying elements of organisational safety culture. **Objective**: Therefore, this study attempts to examine changes on employee perception on safety climate over a period of time. **Design:** A quantitative approach, using a longitudinal panel design was employed. This research design is appropriate when research questions and hypotheses are effected by how things vary over time. **Method***:* Participants recruited for this study were production workers in one of A Malaysian electric and electronic manufacturing plant. Approval has been granted by the senior management that survey could be conducted among their production workers in two departments at two times period (Time 1 and Time 2). A safety climate survey that has been developed by Cheyne, A., Cox,S., Oliver, A., Tomas, J.M., (1998) was used as the instrument of this study. The response rate was 83% (N=330) in Time 1 and 98% (N=402) in Time 2. Data has been analyzed using a one-way between-groups multivariate analysis of variance (MANOVA). **Results:** There was a statistically significant difference in safety climate dimensions when the data from Time 1 were compared to the data in Time 2, with an overall Pillai's trace of .602 (df = 696); partial eta squared = 0.602. The mean scores indicated that Time 2 reported slightly higher levels on all Safety Climate dimensions; i.e., Management Action (M= 33.40, SD = 2.65), Management Attitude (M= 25.31, SD = 2.32) and Safety Versus Production (M= 16.32, SD = 2.60) compared to Time 1. **Conclusion**: The significant changes on all safety climate dimensions in Time 2 suggest that there were changes in the underlying safety culture in this plant. An implication of this finding is the possibility that the changes in the safety climate suggest that employees viewed or perceived safety climate as important for them to better understand safety in the workplace. They believe that their workplace provides such a supportive safe working environment. This finding will be contributes to the Malaysian national agenda in moving towards a preventative culture by the year 2016. However, this study is limited to one single plant/industrial sector. Therefore, more research on safety climate and safety culture should be conducted in all industrial settings in Malaysia.

© 2014 AENSI Publisher All rights reserved.

To Cite This Article: Siti Fatimah Bahari and Norashikin Mahmud., Safety Climate as a Driver of Change of Positive Safety Culture in a Malaysian Manufacturing Plant. ***Aust. J. Basic & Appl. Sci.,*** *8(23): 108-112, 2014*

INTRODUCTION

The theoretical and empirical progression of safety culture (climate) has been derived from the trends of organisational culture and climate (Yule, 2003). A debate has developed over the difference between 'safety culture' and 'safety climate' as there exists considerable arguments among authors within and across industries on how safety culture and safety climate should be defined. Clarke (2000) argues that no one has developed an independent framework or attempted to operationalise safety culture on the basis of theoretical roots. However, Hopkins (2006) states that although it is possible to identify theoretical development of safety culture concepts, most efforts attempt to deliberate over the empirical issues confining safety climate. As a result these two terms were unable to be distinguished clearly within the safety literature as it does not present a unanimous definition, and also the terms safety culture and safety climate appear to be used interchangeably despite a different "etymology" (Cox and Flin, 1998; Hopkins, 2006). In much the same way, Guldenmund (2000) argue that the distinction between these two term perhaps more on "terminological fashion" as researchers use the term climate in 1970s whereas researchers in the 1980s adopted the term culture.

Corresponding Author: Siti Fatimah Bahari, Universiti Teknologi Malaysia, Department of Human Resource Development, Faculty of Management, 81300 Skudai, Johor, Malaysia.

However, in order to measure safety culture or to change safety culture within an organisation, such a distinction is important (Weigmann, Thaden, Sharma and Gibbons, (2004). In a similar vein, Mearns *et al*. (2003) describes safety climate as a manifestation of safety culture, stating that climate is directly measurable while culture is too abstract to be measured directly. Moreover, climate refers to a situation at a particular point in time while culture refers to a more lasting phenomenon (Hale, 2000). It can be implied that measuring safety climate helps to identify underlying problems that occur within organisations and facilitates the improvement of safety culture since a stable positive safety culture could not exist instantly. Therefore, it seems reasonable to deduce that measuring safety climate will raise aspects of the culture to a certain degree.

Safety Climate as a Driver of Change of Positive Safety Culture:

Clarke (2000) argues that there were not much direction on how organisations should achieve a positive safety culture although much has been discussed on the benefit of having a positive safety culture. There is still lack of theoretical basis on determining what constitutes of positive safety culture for organisations (Glendon *et al*. 2006). In order to understand how safety climate play a role as influencing for changing underlying safety culture, several safety culture models has been reviewed. Most of safety culture models are adapted and adopted from organizational culture models. Several authors have conceptualised safety culture using the Three-Level Organization Culture Model introduced by Schein Edgar (1992) (Clarke, 2000; Guldenmund, 2000). Clarke (2000) proposes safety culture model, which is adapted from Schien's organizational culture model. Clarke defines safety culture as "representation the basic values, beliefs and assumptions concerning safety that are embedded in the organization" and defined safety climate as "the subjective perceptions of organizational members of the conditions of their work environment." (Clarke,2000; p75). Based on the empirical evidence reviewed and existing theories, she proposes a number of aspects of organizational safety culture onto Schien's three-level model. Table 1, illustrate the three levels of safety culture namely; 1) Surface level; 2) Intermediate level; 3) Deepest level. According to Clarke (2000), at the deepest level of the safety culture model is the basic understanding that safety is the overriding priority. This core assumption is manifested in many ways. The manifestation of the core assumption involves all organizational members' (managers, supervisors and workers) attitudes toward safety (the intermediate level). Finally at the surface level, it is manifested as safety related organizational strategy, structures, artifact, and practices, as well as organizational members' norm and practice.

Table 1: Aspects of Organizational Safety Culture.

Surface Level (norms and artifacts)	Intermediate Level (beliefs and values)	Deepest Level (Core Assumptions)
Safety policy documents Safety information system Safety training Safety rules and procedures Quality and maintenance of equipment Accident reporting Near-miss/incident reporting Safety representatives and committees Managers' actions (e.g. setting a good example on safety suggestions, policy-practice consistency) Supervisors' actions (e.g. elevating safety concerns to managers, discipline)	Managers' attitudes (e.g. safety vs production priority, blaming workers for accidents) Supervisors' attitudes (e.g. supervisor fairness towards safety complaints) Workers' safety attitudes • Personal beliefs about risk and safety • Personal involvement • Individual responsibility • Evaluation of safety measures • Evaluation of work environment	Understanding that safety is overriding priority.

Source: Clarke, S. (2000) Safety culture: underspecified and overrated?, International Journal of Management Reviews, 2(1): 65-90.

Using the same Schein organisational culture model, Guldenmund (2000) defines safety culture as "those aspects of the organizational culture which will impact on attitudes and behaviours related to increasing or decreasing risk" (Guldenmund, 2000:p251). He didn't provide safety climate definition but discussed espoused values, which operationalised as safety attitudes (second layer of Schien's model). He adopted Schein's three-level model of organizational culture, Eagly & Chaiken's (1993) model of attitude, and the architecture of attitudes toward safety proposed by Cox & Cox (1991) to develop a safety culture conceptual framework (see table 2).

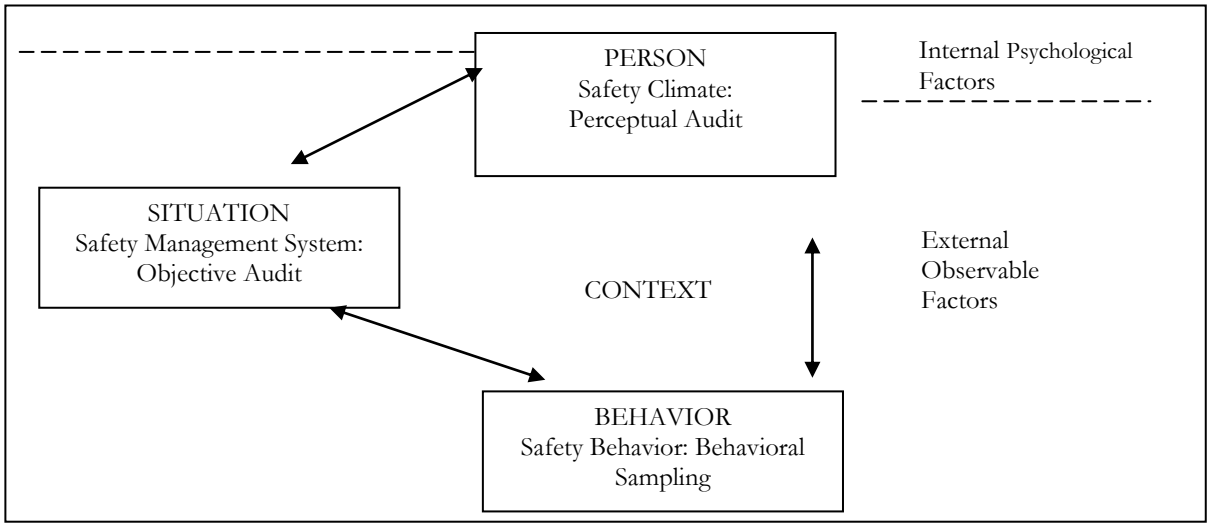
In his model, safety culture is also conceptualized in three levels. The core level is the basic assumptions, which are unconscious and unspecific as it only understood by the members. At the middle level are the espoused values, which are operationalized as attitudes (for example, hardware, software, people and behaviour). At the surface level are the visible manifestations of culture (for example, statements, meetings, inspection reports, dress codes, personal protective). He also suggests that, the basic assumption lead the creation of safety attitudes and safety attitudes, which then influence behaviour through intention. However, he didn't mention what kind of method could be used in assessing each levels of safety culture although he argued that each level of this model can be studied separately.

Table 2: Levels of Culture, Their Visibility and Examples Thereof.

Levels of culture	Visibility	Examples
1. Outer layer – artifacts	Visible, but hard to comprehend in terms of underlying culture.	Statements, meetings, inspection reports, dress codes, personal protective equipment, posters, bulletins.
2. Middle layer – espoused values/attitudes regarding: - hardware - software - people/live ware - risks	Relatively explicit and conscious.	Attitudes, policies, training manuals, procedures, formal statements, bulletins, accident and incident reports, job descriptions, minutes of meetings.
3. Core – basic assumptions regarding: - the nature of reality and truth - the nature of time - the nature of space - the nature of human nature - the nature of human activity - the nature of human relationships	Mainly implicit: obvious for the members, invisible, pre-conscious.	Have to be deduced from artifacts and espoused values as well as through observation.

Source: Guldenmund, F.W. (2000) The nature of safety culture: a review of theory and research, 34:215-257

Using different model to conceptualise safety culture, Cooper (2000) proposes a reciprocal safety culture model adapted from Bandura's (1986) model of reciprocal determinism. This model consists of three elements: 1) Subjective internal psychological factors, 2) observable ongoing safety-related behaviours, 3) objective situational features (see Figure 1). He claims that the reciprocal model provides a practical framework to analyze safety culture in a manner in which "the holistic, multifaceted nature of the safety culture construct can be more fully examined in depth". He also suggested a quantitative method to measure safety culture in a straightforward way. Referring to his model in Figure 1, the internal psychological factors (for example, attitudes and perceptions) can be assessed using safety climate questionnaires; the actual ongoing safety-related behaviour be assessed using behaviour checklists; and the situational features be assessed using safety management and system audits (Cooper, 2000).



Source: Cooper, M.D. (2000) Towards a Model of Safety Culture, Safety Science, 36: 111-136.

Fig. 1: Reciprocal Safety Culture Model.

Having discussed the above safety culture model it can be summarised that safety culture could be assessed using quantitative method and using safety climate survey. Although Guldemnund (2000) argue that, there were no satisfying safety culture (or climate) model in safety research, the available model is considered as important to illustrate the framework of safety culture. Nielsen *et al*. (2008) claim that although the differences between safety climate and safety culture continue to be indefinite, they can be differentiate to a certain degree in theory and in practice. The discrepancy between safety climate and safety culture is in practice often more a question of interpretation than operationalization (Mearns and Flin, 1999). Many researchers agreed that safety climate has been commonly accepted to provide an indicator of the underlying safety culture (Cox & Flin, 1998; Mearns *et al*. 2001; Mearns *et al*., 2003; Hopkin, 2006).

Australian Journal of Basic and Applied Sciences, 8(23) Special 2014, Pages: 108-112

It has been argued that the concept of safety culture and safety climate cannot be treated separately as they are actually complementary but independent concepts. Despite other approaches were suggested and conducted to measure safety culture, (i.e., interviews and focus groups, safety audit, projective technique, observation) safety climate survey based on safety attitudes and perceptions was the most predominant employed by previous researchers. Glendon *et al*. (2006) claim that safety climate acts as a driver of changing the underlying safety culture. They also suggest that safety culture could be accessed directly through the use of safety climate surveys or indirectly through successful safety interventions (Glendon *et al*. 2006). Therefore it can be claimed that changes in safety climate can have an impact or influence on changing the safety culture.

Given the overall support in the literature, the current study hypothesizes that positive changes in safety climate score over a period of time indicate significant positive changes in safety culture improvement. There will be a significant positive changes in safety over a period of time, therefore indicates significant changes of safety culture.

Methodology:

Instrumentation:

For the purpose of this study, a safety climate survey that has been developed by Cheyne, A., Cox,S., Oliver, A., Tomas, J.M., (1998) was used as the instrument of this study. This comprised 30 items representing five first-order factors: safety management (14 items, for example "my line manager listens to my concerns about safety and health");personal involvement (5 items, for example "everyone plays an active role in safety matters"); communication (5 items, for example "there are good communications here about safety issues which affect me"); individual responsibility (3 items, for example "I look out for others' safety"); and, safety standards and goals (3 items, for example "minor/trivial accidents are tolerated as part of the job"). Details of the validation of this instrument in Malaysian context has been discussed in Bahari and Clarke (2013) in the article "Cross-validation of an employee safety climate model in Malaysia, Journal of Safety Research 45 (2013) 1–6.

Participants:

Participants recruited for this study were production workers in one of Malaysian electric and electronic manufacturing plant. Approval has been granted by the senior management that survey could be conducted among their production workers in two departments at two times period (Time 1 and Time 2). The response rate was 83% (N=330) in Time 1 and 98% (N=402) in Time 2. The majority of the respondents were female, aged 21-30, with only two over 50, had worked for the company 1-5 years and were permanent employees. Respondents worked in one of the two departments surveyed, producing flexible flat cable (74%) or enamel wire (26%). The nature of the tasks performed and working conditions for all participants were very similar and did not differ between departments.

Results:

A one-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate mean differences in Safety Climate scores for Time 1 and Time 2. Three dependent variables were used which were the following safety climate factors; Management Action, Management Attitude and Safety Priority. The independent variable was time: Time 1 and Time 2. Prior to performing MANOVA, preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance covariance matrices, and multicollinearity. There were no serious violations noted and the analysis was deemed possible to proceed with.

There was a statistically significant difference in safety climate dimensions when the data from Time 1 were compared to the data in Time 2, with an overall Pillai's trace of .602 (df = 696); partial eta squared = 0.602. When the results for the dependent variables were considered separated (ANOVA), all factors reached statistical significance, using a Bonferroni adjusted alpha level of .017. These were Management Action, F (1,698) = 261.11, p = .000, partial eta squared = .272; Management Attitude, F (1,698) = 217.512, p = .000, partial eta squared = .238; Safety Priority, F (1,698) = 323.55.25, p = .000, partial eta squared = 0.314. As shown in Table 34, an inspection of the mean scores indicated that Time 2 (2009) reported slightly higher levels on all Safety Climate dimensions; i.e., Management Action (M= 33.40, SD = 2.65), Management Attitude (M= 25.31, SD = 2.32) and Safety Versus Production (M= 16.32, SD = 2.60) compared to Time 1. The results therefore seem to support hypothesis 4, as the safety climate score in Time 2 is better than in Time 1.

Table 3: Employees' Perceptions of Safety Climate in Time 1 and Time 2.

Safety Climate Dimensions	Time 1		Time 2		Differences
	Mean	SD	Mean	SD	
Management Action	29.13	4.20	33.38	2.68	4.25
Management Attitude	21.99	3.46	25.25	2.34	3.26
Safety Priority	13.65	3.01	17.63	2.83	3.98

Note: SD=standard deviation

Discussion and Conclusion:

The finding of this study is consistent with those of other longitudinal studies, and suggests that over a period of time a safety climate has been improved significantly (Nielsen *et al*. 2008; Tharaldsen *et al*. 2008). The notion of the safety climate as a 'driver' of the underlying safety culture has important and powerful implications for the findings in this study (Glendon *et al*. 2006). In this study, the significant changes on all safety climate dimensions (Management Action, management attitude ans safety Priority) in Time 2 suggest that there were changes in the underlying safety culture in this manufacturing plant. This conception seeks to understand how changes in safety climate influence the underlying safety culture. Furthermore, the safety climate has been commonly accepted as providing an indicator of the underlying safety culture (Cox and Flin, 1998). Therefore, significant improvements in safety climate factors directly influenced an improvement in the positive safety culture within organisations. An implication of this finding is the possibility that the changes in the safety climate suggest that employees viewed or perceived safety climate as important for them to better understand safety in the workplace. They believe that their workplace provides such a supportive safe working environment. Safety has high priority in this manufacturing plant and the level must be characterised as good. The management are the most responsible and accountable party for providing a safer workplace to their employees. This finding will contribute to the Malaysian national agenda in moving towards a preventative culture by the year 2020. With regards to this matter, this study can claim to be the earliest reported on safety climate changes in Malaysia-based manufacturing plants. In order to achieve a national agenda, more research on safety climate and safety culture should be conducted in all industrial settings, whether this means high-risk or low-risk organisations. Findings from the research conducted would help Malaysia as a developing country to improve and achieve the mission that was outlined in its OSH Master Plan 2015. This finding will be contributes to the Malaysian national agenda in moving towards a preventative culture by the year 2016. However, this study is limited to one single plant/industrial sector. Therefore, more research on safety climate and safety culture should be conducted in all industrial settings in Malaysia.

REFERENCES

Bahari, S.F., S. Clarke, 2013. Cross-validation of an employee safety climate model in Malaysia. *Journal of Safety Research*, 45: 1-6.

Cheyne, A., S. Cox, A. Oliver, J.M. Tomas, 1998. Modelling safety climate in the prediction of levels of safety activity. *Work & Stress, 12*(3): 255-271.

Clarke, S., 2000. Safety culture: underspecified and overrated? *International Journal of Management Review, 2*(1): 65-90.

Cooper, M.D., 2000. Towards a Model of Safety Culture. *Safety Science, 36:* 111-136.

Cox, S., T. Cox, 1991. The structure of employee attitudes to safety: a European example. *Work & Stress, 5*(2): 93-106.

Cox, S., R. Flin, 1998. Safety culture: philosopher's stone or man of straw? *Work & Stress, 12*(3): 189-201.

Eagly, A.H., S. Chaiken, 1993. The psychology of attitudes. Harcourt Brace Jovanovich, Forth Worth.

Guldenmund, F.W., 2000. The nature of safety culture: a review of theory and research. *Safety Science, 34:* 215-257.

Hale, A.R., 2000. Culture's confusion. *Safety Science, 34:* 1-14.

Hopkins, A., 2006. Studying organisational cultures and their effects on safety. *Safety Science, 44:* 875-889.

Mearns, K., S.M. Whitaker, R. Flin, 2001. Benchmarking safety climate in hazardous environments: a longitudinal, interorganizational approach. *Risk Analysis, 21*(4): 771-786.

Mearns, K., S.M. Whitaker, R. Flin, 2003. Safety climate, safety management practices and safety performance. *Safety Science, 41:* 641-680.

Nielsen, K.J., K. Rasmussen, D. Glasscock, S. Spangenberg, 2008. Changes in safety climate and accidents at two identical manufacturing plants. *Safety Science, 46:* 440-449.

Tharaldsen, J.E., E. Olsen, T. Rundmo, 2008. A longitudinal study of safety climate on the Norwegian continental shelf. *Safety Science, 46:* 427-439.

Weigmann, D.A., H. Zhang, T.V. Thaden, G. Sharma, A. Mitchell, 2002. *A synthesis of safety culture and safety climate research*. New Jersey: Federal Aviation Administration.

Yule, S., 2003. *Senior management influence on safety peformance in the UK and US energy sectors.* Unpublished Doctoral, University of Aberdeen.