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The influence of organizational factors on safety in Taiwanese high-risk industries

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ABSTRACT

Organizational theorists have recently begun to pay research attention to the workforces of emerging countries in Asia, especially the greater China regions. However, little research has focused on the influence of organizational factors on safety in these countries. This study hypothesized that organizational factors, characterized as safety leadership perspective (management commitment, blame culture) and safety climate perspective (harmonious relationships), would influence group-level safety management, which would in turn influence individual level safety awareness and practices. To test this hypothesis, a safety climate questionnaire was distributed to ten Taiwanese plants in high-risk industries. Structural equation modeling (SEM) was used to analyze the linkages among organizational level factors, work-group-level factors, and workers' safety awareness and practices. We found that safety leadership style and organizational harmony in Taiwanese high-risk industries can exert significant influences on work-group processes, which in turn have greater effects on individual safety awareness and practices. These findings and implications can serve as a basis for safety improvement in areas of the greater China region.

1. Introduction

One analysis of recent safety accidents of large-scale complex systems indicates that 30–40% of accidents can be attributed to organizational factors (Hollnagel & Woods, 2005). In the past several decades, organizational factors have been found by several safety climate studies to serve as antecedents of accidents and injuries (Flin, Mearns, O'Connor, & Bryden, 2000; Hofmann & Stetzer, 1996; Lee & Harrison, 2000; Tomas, Melia, & Oliver, 1999; Zohar, 1980), and have become leading indicators of performance in evaluating occupational safety climate (Flin et al., 2000).

Recently, the workforces of emerging countries in Asia, especially the greater China areas (including China, Hong Kong, and Taiwan) have drawn attention from organizational theorists; however, they have paid little attention in safety management field. With an increase in moving foreign operated factories from developed countries to emerging countries in greater China areas, the influence of organizational factors on safety in these areas is becoming an increasing important management issue. After review previous studies of safety management (Guldenmund, 2000; Seo, 2005), we found little research has focused on how organizational factors in greater China areas might affect operational safety in high-risk industries.

Therefore, this study attempts to investigate relationships between organizational factors and safety awareness and practices in greater China areas. Taiwanese high-risk industries, including chemical processing plants and semiconductor and steel foundries, were chosen as samples. For a long time, Confucianism exerts a strong influence in greater China region, which can also be called as "guanxi-oriented culture". Previous research indicated the characteristics of guanxi-oriented culture, such as emphasizing on harmonious working relationships, loyalty and the maintenance of hierarchical order, exert strong influences on organizational structure, the interaction among members, and relationship between leaders and subordinates (Helmreich & Merritt, 1998; Hofstede, 1980, Hwang, 1987; Tsui & Farh, 1997; Tsui, Wang, Xin, Zhang, & Fu, 2004; Westwood, 1997). Taiwan is a region in which a guanxi-oriented culture associated with Confucian dynamism has been found to be important (Hofstede & Bond, 1988). Exploring the influence of organizational factors on safety management in Taiwanese high-risk industries might provide implications of safety management programs in some other guanxi-oriented counties where Confucianism continues to exert an influence.

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2. Theoretical framework and hypotheses

2.1. Identifying organizational level factors

To meet the purpose of this research, we attempted to identify organizational level factors from the perspectives of safety leadership and safety climate, which have often been mentioned by prior studies (Barling & Zacharatos, 1999; Hofmann & Morgeson, 1999; Neal & Griffin, 2002; Neal, Griffin, & Hart, 2000; Zohar, 1980). In a guanxi-oriented culture, the leadership style tends to be paternalistic, a style of leadership that combines strong discipline and authority with fatherly benevolence and moral integrity couched (Farh & Cheng, 2000). An ideal paternalistic leader should also demonstrate holistic concern for their subordinates' personal and family well-being (Farh & Cheng, 2000). Therefore, we identified two organizational factors related to safety climate in Taiwan, management commitment and blame culture. Management commitment to safety is considered critical to employee safety performance (Wiegmann, Zhang, von Thaden, Sharma, & Mitchell, 2002; Zohar, 1980), and is thought to play an important role in safety climate research in different cultures (Guldenmund, 2000). Management commitment to safety in a guanxi-oriented culture may exert a strong influence on the interaction among members and relationship between leaders and subordinates. Therefore, we will explore the roles of management commitment on safety management.

In addition, leaders in guanxi-oriented societies are inclined to reprimand subordinates for poor performance (Farh & Cheng, 2000), they may not necessarily praise them for jobs well done. Blame culture, from a western cultural perspective, may have a negative effect on the safety operation of large, complex systems in the workplace. However, there is very little empirical evidence of what influence blame culture exerts in these environments. In this study, we were interested in exploring how blame culture affect the safety performance of workers.

A guanxi-oriented culture tends to be collectivist (Helmreich & Merritt, 1998; Hofstede, 1980). Members in these guanxi-oriented cultures place a very high priority on harmonious working relationships (Ho & Chiu, 1994; Hwang, 1987; Tsui & Farh, 1997; Westwood, 1997). The term, guanxi, refers to a special kind of relationship characterized by implicit rules of obligations and reciprocities (Hwang, 1987; Xin & Pearce, 1996; Yeung & Tung, 1994). Maintaining the harmonious interpersonal relationships, reciprocity and face (a kind of reputation, status or dignity) can be seen as a necessary mechanism for coping with highly non-codified social order and getting things done (Hwang, 1987; Shi & Westwood, 2000; Westwood, 1997). Therefore, we would like to explore the influence of harmonious relationships on safety management in the present study.

2.2. Hypotheses

From the concepts how an organization operates, we found top-level management makes policies to determine strategic goals and the means to achieve the goals in an organization. They formulate operating procedures to provide tactical policy action guidelines. Line managers in the work-group-level execute policies and procedures, give directives to frontline workers, and supervise the work process to ensure safe and reliable operation (Zohar & Luria, 2005). Therefore, this study postulated that organizational factors would influence group processes, which in turn would affect safety practices and safety awareness (Helmreich & Merritt, 1998; Takano, Kojima, Hasegawa, & Hirose, 2001). Fig. 1 is a graphical depiction of the relationships between organizational factors and safety performance, and specified hypotheses are described as follows.

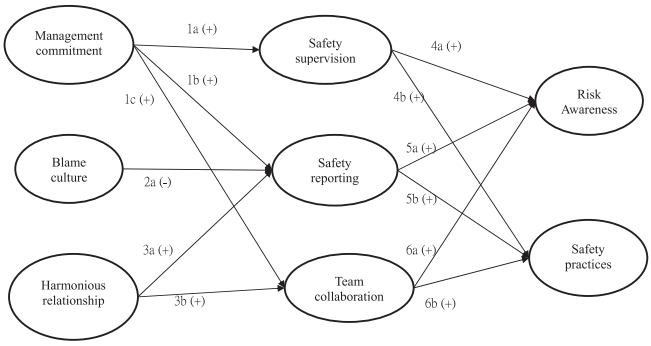

Fig. 1. The proposed structural model of the present research.

2.2.1. Linkage between organizational level factors and work-group-level factors

Upper management's commitment to safety indicates upper- and middle-level management identifies safety as a core value of company and demonstrates positive and supportive safety attitudes. Because Taiwan is characterized as having a paternalistic guanxi-oriented corporate culture, upper managers are expected to act like fathers of a family and therefore set good examples for their subordinates (Farh & Cheng, 2000). Upper managers in Taiwanese plants who consider safety important actively participate in safety activities and frequently express their own concerns about safety in their companies (Hsu, Lee, Wu, & Takano, 2008). Greater upper management commitment to safety should be positively related to the supervisory practices of the company's line managers (Hsu et al., 2008; Simard & Marchand, 1994), making them more serious about safety supervision, including task instructions and progress monitoring. We proposed the following hypothesis.

Hypothesis 1a. In companies higher management commitment to safety will be positively related to safety supervision of line managers.

Furthermore, in a patriarchic guanxi-oriented culture, the authority and power of the upper manager is accepted as natural, proper, absolute, paramount, unchallengeable and inviolate (Farh & Cheng, 2000; Westwood, 1997). When upper managers are perceived as having a high commitment to safety, employees may want to meet upper management expectations by increasing their willingness to report safety problems and improving team interaction such as coordination and communication among team members (Wiegmann et al., 2002). Therefore, the following hypotheses were proposed.

Hypothesis 1b. In companies higher management commitment to safety will be positively related to the employees' willingness to report safety problems.

Hypothesis 1c. In companies higher management commitment to safety will be positively related to collaboration among team members.

In patriarchal guanxi-oriented cultures, employees are often blamed or punished for their mistakes or for violating safety rules (Farh & Cheng, 2000). Blame culture refers to the tendency for management to punish employees when they make mistakes. Reason (1997) has suggested that blame culture might discourage employees from reporting workplace safety problems and thus have a negative effect on employees' safety performance. To avoid blame or punishment from the management, employees may selectively decide what news to report, sharing the good news and hiding problems. Therefore, we postulated the following hypothesis.

Hypothesis 2a. In companies that tend to blame or punish workers for their mistakes will be negatively associated with the willingness to report safety problems.

Previous studies have indicated that maintaining harmonious relationships is an important social value embedded in guanxi-oriented cultures (Ho & Chiu, 1994; Hwang, 1987; Westwood, 1997). Having a harmonious relationship refers to the extent to which there is a harmonious atmosphere among coworkers and supervisors in an organization. Helmreich and Merritt (1998) found that Taiwanese pilots placed high value on maintaining good relationships with managers and coworkers. Valuing harmony in relationships in the workplace encourages members of an organization to develop good interpersonal relationships and mutual trust (Tsui & Farh, 1997). And trust among employees should in turn increase the willingness to report safety problems in the workplace (Reason, 1997), and also facilitate group processes, e.g., team being well-coordinated and openly sharing safety information (Hsu et al., 2008). Therefore, we proposed the following hypotheses.

Hypothesis 3a. In companies with greater harmony among team members is positively related to the willingness to report safety problems among team members.

Hypothesis 3b. In companies with greater harmony among team members is positively related to collaboration among team members.

2.3. Linkage between work-group-level factors and individual level factors

Simard and Marchand (1994) have maintained that employee safety performance improves when supervisors promote safety frequently. When supervisors give more feedback and spend more time monitoring safety in the workplace, safety performance is improved (Mattila, Hyttinen, & Rantanen, 1994). Therefore, an increased in task instruction and progress monitoring might encourage employees to comply with the safety procedures and regulations and increase the safety awareness. We proposed the following two hypotheses.

Hypothesis 4a. In companies more safety supervision will be positively related to safety awareness among the employees.

Hypothesis 4b. In companies with more safety supervision will be positively related to safety practices among the employees.

Furthermore, safety reporting is critical to safety performance (Reason, 1997; Wiegmann et al., 2002). According to Reason (1997), safety reporting facilitates an information sharing and organizational learning for incidents occurring in the workplace, proactively preventing future incidents and accidents. Safety reporting might lead to an increase in employee safety awareness and employee safety practices. Therefore, the following hypotheses were proposed.

Hypothesis 5a. In companies more safety reporting will be positively related to safety awareness of employees.

Hypothesis 5b. In companies more safety reporting will be positively related to safety practices of employees.

Finally, team collaboration plays an important role in the safe operation of process control systems and is assessed by communication and coordination among team members. Several accidents in high-risk systems have been related to teamwork failures (Helmreich & Merritt, 1998). With good team collaboration, it is more likely that a group-level safety climate will be established (Lee & Harrison, 2000). This should in turn increase employee safety awareness and improve employee safety practices.

Hypothesis 6a. In companies greater collaboration among team members will be positively related to safety awareness of employees.

Hypothesis 6b. In companies greater collaboration among team members will be positively related to safety practices of employees.

3. Method

3.1. Participants

The participants in this study were frontline workers serving in high-risk industries in Taiwan. They were the workers in four chemical processing plants, five steel foundries, and one semiconductor foundry. We used a stratified random sampling method to select the participants; thus, the number of samples randomly selected from a department was proportional to the sizes of their departments. The questionnaires were administered during work hours. The investigators described the procedures of the study, and the process was supervised by a research team. Questionnaires were completed anonymously and collected immediately by investigators who promised absolute confidentiality. Finally, three hundred twelve samples (312) were drawn from chemical plants, 289 from steel foundries, and 89 from semiconductor foundries. Respondent characteristics are shown in Table 1.

3.2. Materials and measures

This study also used a safety climate survey questionnaire, adapted from a safety climate tool developed by Takano et al. (2001) and Takano, Tsuge, Hasegawa, and Hirose (2004). The initial questionnaire was divided into three categories: organizational climate, safety management, and individual performance. Each questionnaire item uses a 5-point Likert scale, with answers ranging from 1 (strongly disagree) to 5 (strongly agree), indicating the degree to which the respondent agreed with statement of certain opinions. The reliability and validity of Taiwanese-version

Table 1
Profile of respondents from frontline employees.

Demographic variable	All ($N = 690$)	
	Frequency	(%)
Gender		
Male	649	94
Female	41	6
Age		
21–30	41	6
31–40	179	26
41–50	242	35
51–60	214	31
>61	14	2
Job categories		
Plant services	62	9
Shop floor	580	84
Other	48	7
Work experience		
<5 years	62	9
6–10	83	12
11–15	117	17
16–20	159	23
21–25	145	21
>25	124	18

questionnaire has been demonstrated in earlier studies of different high-risk industries (Hsu, 2005; Hsu et al., 2008). To meet the needs of this study, the items on that questionnaire were reorganized into the eight factors under categories defined by our above-mentioned hypotheses at organizational level, group level, and individual level. These eight factors are characterized in detail as follows.

Organizational level factors were divided into three factors: management commitment, blame culture, and harmonious relationships. Management commitment included six items designed to measure the extent to which upper- and middle-level management identifies safety as a core value and demonstrates positive and supportive safety attitudes. Blame culture consisted of three items designed to measure the extent to which management blamed employees for making mistakes or for unsafe behavior. Harmonious relationship consisted of five items designed to measure the extent to which there was a harmonious work atmosphere among coworkers and supervisors in their organization. Work-group-level factors were divided into three factors: safety supervision, safety reporting, and team collaboration. Safety supervision consisted of six items designed to measure the extent to which supervisors continually provided instructions and monitored employee safety. Safety reporting consisted of three items designed to measure the extent to which employees were willing to honestly report safety problems. Team collaboration consisted of four items reflecting the extent of collaboration, including coordination and communication, among team members. Individual level factors were divided into two factors: risk awareness and safety practices. Risk awareness consisted of four items measuring employee perception of risk at work. Safety practices consisted of five items measuring employee risk-taking and compliance to safety rules and procedures. All the items of eight factors are listed in Appendix.

3.3. Data analysis

A common analytical technique used for scale development is to split the data at random into two subsamples, and then to use the first subsample to explore the factor structure using exploratory factor analysis (EFA) and the second subsample to confirm the factor structure using confirmatory factor analysis (CFA) (Gerbing & Hamilton, 1996; Ghiselli, Campbell, & Zedeck, 1981; Joreskog & Sorbom, 1993). To ensure the maximum internal consistency reliability of the constructs, researchers suggested the reliability indicators should be calculated not only the Cronbach alpha coefficient (Churchill, 1991; Nunnally, 1978), but also the composite reliability index and the average variance extracted (AVE) (Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2007; Hair, Anderson, Tatham, & Black, 1998).

The validity of the constructs will follow the procedures of concept validity analysis recommended by prior research (Fernández-Muñiz et al., 2007; Hair et al., 1998), which can be conducted by studying the content validity, convergent validity and discriminant validity. Content validity refers to the degree to which individual scale items cover the range of meanings included in the concept. In this case, the constructs were refined by means of in-depth interviews with safety experts and a pilot test in various companies (Hsu, 2005; Hsu et al., 2008). The convergent validity of a concept indicates the extent to which two measures of the same concept are correlated. This convergent validity can be analyzed by using the standardized lambda coefficients and t-values. Research suggested these coefficients must exceed 0.5 and t-values superior to 1.96 are required (Anderson & Gerbing, 1988). Discriminant validity evaluates the degree to which two conceptually similar concepts differ, which can be verified by estimating the confidence interval of the correlation existing between the proposed constructs. Research suggested no interval of correlation containing 1.0 has good discriminant validity (Anderson & Gerbing, 1988).

After confirming the measurement model, structural equation modeling (SEM) was used to examine hypothetical relationships among organizational factors and safety performance. The study used several goodness-of-fit indices to evaluate CFA and SEM, as suggested by Joreskog and Sorbom (1993), Bentler and Bonett (1980) and Maruyama (1998): chi-square (χ^2), normed fit index (NFI); non-normed fit index (NNFI); comparative fit index (CFI); incremental fit index (IFI); and root-mean-squared error of approximation (RMSEA). Bentler (1992) suggested that NFI, NNFI, CFI, IFI scores of 0.90 or more are indicative acceptable data fit. A RMSEA value up to 0.05 indicates a good-model fit, a value of 0.08 or less indicates a reasonable model fit, and a value greater than 0.10 indicates poor model fit (Joreskog & Sorbom, 1993).

4. Results

4.1. Measurement model

Maximum likelihood extraction and varimax rotation techniques were employed for exploratory factor analysis (EFA). At the organizational level, three factors (management commitment, harmonious relationship, blame culture) had eigenvalues greater than 1, accounting for 49% of the total variance (19%, 16%, and 14%, respectively). At the work-group level, three factors (safety supervision, team collaboration, safety reporting) had eigenvalues greater than 1, accounting for 45% of total variance (21%, 15%, and 9%, respectively). At the individual level, two factors (safety practices and safety awareness) had eigenvalues greater than 1, accounting for 42% of total variance (24% and 18%, respectively). According to the results of confirmatory factor analysis (CFA), the overall measurement model fit was assessed as $\chi^2\,(601) = 1623.87$ ($p < 0.01$). Since χ^2 is affected by sample size, other fit indices had to be used. The RMSEA values of 0.070 (less than 0.08) indicated that the measurement model had a reasonable model fit. Others indices (NFI = 0.92; NNFI = 0.93; CFI = 0.94; IFI = 0.94) were greater than 0.9 (as mentioned criteria in data analysis section), also indicating that the measurement model was acceptable.

Descriptive statistics and Cronbach's alpha coefficients among the various factors can be found in Table 2. Cronbach's alpha coefficient of each factor was greater than 0.6. The composite reliability index and AVE of factors can be found in Table 3. The composite reliability index of each factor was greater than 0.6, and that the most AVE values are close to 0.5. The results indicated that internal consistency reliability indicators of the measure model were confirmed to have acceptable reliability (Bagozzi & Yi, 1988; Churchill, 1991; Nunnally, 1978). Table 3 also showed that all standardized lambda coefficients exceeded 0.5 and t-values were greater than 1.96, confirming the convergent validity of the factors. Table 4 revealed that no interval includes the value 1.0, thereby

Table 2
Descriptive statistics and Cronbach's alpha for all constructs.

Constructs	*M*	SD	Cronbach's alpha
Management commitment	3.96	0.67	0.87
Blame culture	3.62	0.71	0.68
Harmonious relationship	3.89	0.58	0.82
Safety supervision	3.93	0.64	0.86
Safety reporting	3.70	0.50	0.63
Team collaboration	3.97	0.51	0.70
Risk awareness	3.90	0.55	0.75
Safety practices	4.17	0.48	0.83

Table 3
Measurement scales of first-order confirmatory factor model.

Constructs	Standardized lambda (λ)	*t*-Value	Composite reliability	AVE
Management commitment			0.86	0.51
Commitment 1	0.71	20.70		
Commitment 2	0.72	21.01		
Commitment 3	0.63	17.87		
Commitment 4	0.66	19.14		
Commitment 5	0.81	25.62		
Commitment 6	0.75	22.31		
Blame culture			0.66	0.41
Blame 1	0.56	12.69		
Blame 2	0.69	17.84		
Blame 3	0.65	13.31		
Harmonious relationship			0.82	0.50
Harmonious 1	0.61	17.53		
Harmonious 2	0.73	21.25		
Harmonious 3	0.78	23.07		
Harmonious 4	0.71	20.31		
Harmonious 5	0.68	19.14		
Safety supervision			0.85	0.49
Supervision 1	0.62	17.49		
Supervision 2	0.73	22.01		
Supervision 3	0.72	21.49		
Supervision 4	0.68	19.76		
Supervision 5	0.78	24.05		
Supervision 6	0.67	19.62		
Safety reporting			0.66	0.40
Reporting 1	0.58	14.37		
Reporting 2	0.63	15.77		
Reporting 3	0.69	17.15		
Team collaboration			0.71	0.38
Collaboration 1	0.53	14.43		
Collaboration 2	0.71	20.86		
Collaboration 3	0.63	17.33		
Collaboration 4	0.57	15.60		
Risk awareness			0.76	0.45
Awareness 1	0.60	16.08		
Awareness 2	0.72	20.06		
Awareness 3	0.67	18.51		
Awareness 4	0.68	18.73		
Safety practices			0.84	0.53
Practices 1	0.72	19.71		
Practices 2	0.82	23.76		
Practices 3	0.68	18.52		
Practices 4	0.74	20.26		
Practices 5	0.67	18.25		

confirming the discriminant validity of the factors. Thus, the concept validity of measurement model can be confirmed.

4.2. Structural model

According to the results of SEM, the overall fit indices of the structural model was assessed as χ^2 (614) = 3328.63 ($p < 0.01$). Because χ^2 tends to be affected by sample size, we used other fit indices. The values of RMSEA were 0.078 (less than 0.08), indicating the structural model was reasonable. Other indices (NFI = 0.92; NNFI = 0.93; CFI = 0.93; IFI = 0.93) were greater than 0.9, indicating that the structural model had an acceptable fit. In summary, test results indicate that the structural model was adequate. The coefficients of all original structural paths were significant except the path from blame culture to safety reporting. The effect of blame culture on safety performance may be mediated by other variables.

Table 4
Discriminant validity of first-order confirmatory factor model.

Constructs	Correlation	Standard error	Confidence interval
Management commitment–blame culture	0.40	0.05	0.30–0.50
Management commitment–harmonious relationship	0.53	0.03	0.47–0.59
Management commitment–safety supervision	0.86	0.02	0.82–0.90
Management commitment–safety reporting	0.37	0.04	0.29–0.45
Management commitment–team collaboration	0.60	0.03	0.54–0.66
Management commitment–risk awareness	0.59	0.03	0.53–0.65
Management commitment–safety practices	0.38	0.05	0.28–0.48
Blame culture–harmonious relationship	0.34	0.04	0.26–0.42
Blame culture–safety supervision	0.43	0.03	0.37–0.49
Blame culture–safety reporting	0.11	0.04	0.03–0.19
Blame culture–team collaboration	0.32	0.05	0.22–0.42
Blame culture–risk awareness	0.32	0.05	0.22–0.42
Blame culture–safety practices	0.14	0.04	0.06–0.22
Harmonious relationship–safety supervision	0.58	0.03	0.52–0.64
Harmonious relationship–safety reporting	0.37	0.05	0.27–0.47
Harmonious relationship–team collaboration	0.67	0.03	0.61–0.73
Harmonious relationship–risk awareness	0.61	0.03	0.55–0.67
Harmonious relationship–safety practices	0.35	0.04	0.27–0.43
Safety supervision–safety reporting	0.37	0.04	0.29–0.45
Safety supervision–team collaboration	0.64	0.03	0.58–0.70
Safety supervision–risk awareness	0.63	0.03	0.57–0.69
Safety supervision–safety practices	0.40	0.04	0.32–0.48
Safety reporting –team collaboration	0.38	0.05	0.28–0.48
Safety reporting –risk awareness	0.36	0.04	0.28–0.44
Safety reporting–safety practices	0.47	0.04	0.39–0.55
Team collaboration–risk awareness	0.66	0.03	0.60–0.72
Team collaboration–safety practices	0.52	0.04	0.44–0.60
Risk awareness–safety practices	0.42	0.04	0.34–0.50

We found a higher correlation coefficient between blame culture and supervision. Therefore, we tried to add the path of blame culture and supervision in structural model. The fit indices of the modified model were χ^2 (613) = 3329.07, $p < 0.01$, RMSEA = 0.078, NFI = 0.92; NNFI = 0.93; CFI = 0.93; and IFI = 0.93, indicating it was an acceptable model. The differences (χ^2_{diff}) between hypothetical model and modified model were not significant, suggesting that the modified model was a better choice. The standardized path coefficients in the modified model are presented in Fig. 2.

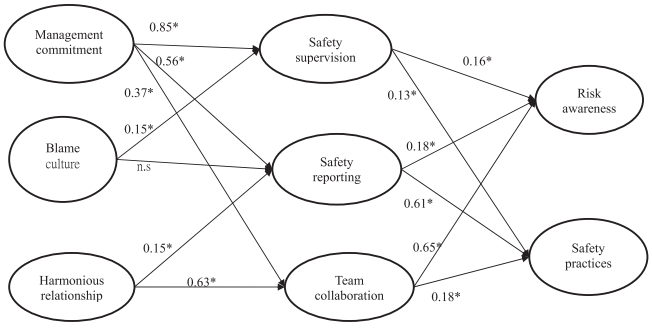

Fig. 2. Results of the structural model with standardized path coefficients. *$p < 0.01$.

5. Discussion

To summarize the results, we found that in companies (a) with more management commitment to safety have significantly positive effects on safety supervision line managers, the willing of safety reporting, and team collaboration, which in turn have significantly positive effects on safety awareness and employee safety practices among the employees; (b) with more harmonious relationships have significantly positive relationships on safety reporting and team collaboration, which in turn have significantly positive effects on safety awareness and employee safety practices among the employees; (c) tendency to blame or punish workers for their mistakes has significantly effect on safety supervision line managers, which in turn have significantly positive effects on safety awareness and employee safety practices among the employees.

These results are in line with those reported by other safety climate studies, which indicated that management's involvement and commitment to safety in safety management processes have critical influences on safety performance (Dedobbeleer & Beland, 1991; Flin et al., 2000; Zohar, 1980). In addition, these results are consistent with the prior research (Hsu et al., 2008; Von Thaden, Li, Li, & Lei, 2006), which indicated traditional social values, social harmony and reciprocity in guanxi-oriented culture play important roles in influencing safety management and employees' safety attitudes and behavior. Contrary to our hypothesis, we did not find in companies that tended to blame or punish workers for their mistakes have significantly effect on the willingness of work to report safety problems. The effect of blame culture on safety reporting may be moderated by other variables, such as harmonious relationships.

This study has several practical implications for improving safety climate in Taiwanese high-risk industries as well as in paternalistic guanxi-oriented companies. First, the leadership style of Taiwanese management tends to be top-down paternalistic leadership (Farh & Cheng, 2000; Hsu et al., 2008). Although we found such leadership can increase positive effects on safety awareness and safety practices, we suggest that any safety improvement program for Taiwanese plants should place increased emphasis on the importance of behavior-based safety (DeJoy, 2005; DePasquale & Geller, 1999). To improve the safety performance, employees should be empowered by management. When people feel be empowered, their sense of personal responsibilities and accountability are increased and perform actively caring behavior (Geller, 2001). Therefore, management may consider taking bottom-up involvement approach to enhance safety management besides top-down directive safety leadership.

Secondly, blame culture can also have a positive effect on safety supervision in guanxi-oriented companies. Geller (2001) indicates blaming an individual or group for an injury-producing incident is not consistent with a systems approach to safety. Instead, an incident provides an opportunity to gather facts from all aspects of the system which might have contributed to the incident. Therefore, management should turn their thoughts from faulting finding to fact finding. Reward systems might consider focusing on workplace hazards rather than human errors. Avoid mentioning the people involved in an incident, as a means of saving the face, can be more acceptable to employees in harmonious organizations.

Thirdly, as above-mentioned states, maintaining the harmonious relationship is an important social value embedded in guanxi-oriented cultures (Ho & Chiu, 1994; Hwang, 1987; Westwood, 1997). However, maintaining the harmonious relationship should transfer effectively into building trust relationships. Building a trust relationship is a prerequisite of improving teamwork effectiveness (Geller, 2001). Good interpersonal relationships can increase group cohesiveness, which facilitates group collaboration, information sharing, and safety reporting. Therefore, safety training should put more emphasis on how the trust relationship of teamwork is built. They may develop effective team training program on safety through implementing Crew Resource Management (CRM). CRM has been widely used to improve the operation of teamwork (Helmreich & Foushee, 1993). It emphasizes the role of human factors in high-stress, high-risk environments, and encompasses team training as well as interactive group debriefings and measurement of team performance.

The current study has several potential limitations. One limitation is that this study is a cross-sectional study. It clearly limits the degree of inference on relationships among organizational factors. To determine the relationships, longitudinal studies should be performed to study the effects over time. The second limitation is that our samples are drawn from workers in Taiwanese high-risk industries only. Although people in other greater China regions share the same cultural characteristics as Taiwanese, they differ in some extent. Therefore, further comparative studies in other greater China regions are needed. Thirdly, the group and organizational structure of the sample is not incorporated in the analysis. Conducting the study within a single strong culture might actually reduce the variance in variables and therefore reduce the chance of observing important effects. Finally, some cultural factors, such as paternalistic leadership and guanxi-oriented culture, are not conducted in the analysis. Paternalistic leadership has been found to have a significant effect on employees' behavior in guanxi-oriented cultures (Farh & Cheng, 2000; Westwood, 1997). What effect these factors may have on safety climate may need further study. Nevertheless, the empirical framework of this study is valuable because it provides a systematic method of investigating how organizational factors influence employees' awareness and practices through work-group-level factors in a guanxi-oriented culture.

6. Conclusion

This study identifies the valuable mechanisms through which organizational level factors influence individual awareness of safety and safety practices in Taiwanese high-risk industries. Our results support our hypotheses that safety leadership style (management commitment, blame culture) and organizational harmony (harmonious relationships) can exert significant influences on work-group processes, which in turn have greater effects on individual safety awareness and practices. The findings and implications of this study can be used to improve safety management programs to accommodate organizational characteristics inherent in guanxi-oriented cultures.

Appendix

Questionnaire items for this research

1. *Management commitment to safety (6 items)*
   - 1.1 Management places a high priority on safety operations in company.
   - 1.2 Management cares about the safety welfare of their employees.
   - 1.3 Management works to upgrade the safety of its facilities or reduce safety problems.
   - 1.4 Management provides resources to prevent the occurrence of safety-related incidents.
   - 1.5 Management gets personally involved in safety training.
   - 1.6 Management holds quality management activities about safety at workplace.
2. *Blame culture (3 items)*
   - 2.1 Management seldom praises employees for good safety behavior.

2.2 Management punishes employees involved in safety-related incidents or near misses.
2.3 Management blames employees for making mistakes, regardless of whether or not an incidence occurs.

3. *Harmonious relationship (5 items)*
3.1 Supervisors and workers can discuss any issue openly in the workplace.
3.2 Team members maintain a harmonious atmosphere among themselves.
3.3 A high priority is placed on maintaining harmonious relationships at work.
3.4 There are good interpersonal relationships in the workplace.
3.5 The team members at workplace are open-minded.

4. *Safety supervision (5 items)*
4.1 Supervisor revises related safety rules periodically.
4.2 Supervisor frequently holds safety training activities in the workplace.
4.3 Supervisor frequently moves around inspecting the workplace.
4.4 Supervisor diligently reviews the safety behaviors of the employees.
4.5 Supervisor reports cases or shares safety-related experiences in the workplace.
4.6 Supervisor makes ongoing safety instruction at workplace.

5. *Safety reporting (3 items)*
5.1 Coworkers are willing to report workplace safety problems to management.
5.2 I often report to management or coworkers when receiving useful safety information.
5.3 Coworkers are willing to making reports to upper management regarding safety mistakes of other coworkers.

6. *Team collaboration (4 items)*
6.1 Team members help each other finish their work.
6.2 There are good communications among team members.
6.3 There are clear task assignments among team members.
6.4 Teamwork is well-coordinated.

7. *Risk awareness (4 items)*
7.1 I am aware of coworkers who do not comply with the safety rules and procedures.
7.2 I ask my supervisors when I have safety concerns at work.
7.3 I stop working if I am not sure that it is safe to continue.
7.4 When in doubt about safety is in question, I proceed with great caution.

8. *Safety practices (5 items)*
8.1 I comply with safety rules and procedures.
8.2 I routinely review standard operating procedures before starting work.
8.3 I actively look for areas in which the facilities may be unsafe.
8.4 I keep myself in a good mental and physical state.
8.5 I often disregard safety rules or procedures in order to catch up on work.

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