

# Influencing Factors and Promotion Strategies of Enterprise Safety Management Effectiveness

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**Abstract**—In order to deeply explore the influencing factors of corporate safety behavior management efficacy, this paper utilizes Chinese engineering corporations as research objects, the paper explores the impact of corporate safety culture and safety training investment on corporate safety management effectiveness, also the interacting impact of corporate safety culture and safety training investment on corporate safety management efficacy. The empirical results show that corporate safety culture and safety training investment both have a positive impact on corporate safety management effectiveness, also the interacting effect is positive. The research in this paper therefore provides new solutions and perspective for improving the effectiveness of corporate security behavior management, which has great significance for management practice.

## 1 Introduction

What comes with the increasing complexity of engineering and technology is a significant rise on the pressure of enterprise safety management. Frequent safety incidents have caused huge social and economic losses. Therefore, enterprise safety management has become one of the priorities of industrial and academic communities and government departments. This paper discusses the influencing factors and provides a reference for enterprises to improve safety management, which is of great importance for the sound development of engineering enterprises.

In the practice of enterprise safety management, man, machine and environment are the inducing factors of safety accidents, among which man is the main factor [1]. Enterprise safety culture affects man mainly from physical, institutional and spiritual dimensions [1]. Therefore, to improve safety management effectiveness of enterprises, we can start from safety culture and strengthen management on human behavior. Enterprises generally invest resources to increase safety training according to their own situation. They may arrange certain personnel to better manage on-site safety. Such investment is mainly to improve workers' safety awareness and their equipment operation so as to reduce accidents [3].

Given the differences in product attributes and safety management among enterprises in different industries, to effectively control the influence of industries on research results, the author selects Chinese engineering enterprises as the research data sources and discusses the influence of safety culture and training investment on safety

management effectiveness. The paper establishes influencing factor models and can provide decision-making reference for Chinese engineering enterprises to improve their safety management effectiveness.

## 2 Research Hypotheses and Model Construction

### 2.1 Enterprise Safety Culture and Safety Management Effectiveness

In the safety management of engineering enterprises, an important dimension is safety culture, which affects safety management effectiveness of enterprises from physical, institutional and spiritual dimensions [2]. In physical dimension, enterprises mark the dangerous goods and provide employees with safety equipment. These measures positively influence safety management effectiveness; in institutional dimension, enterprises implement clear safety rules and regulations and penalty systems to regulate workers' behavior and let them understand expectations of enterprises. By doing so, enterprises hope their employees behave better than expected, thus positively affecting safety management effectiveness; in spiritual dimension, safety culture helps employees have a strong safety awareness and a correct view of safety and act with safety philosophies, thus positively affecting safety management effectiveness. Based on this, the paper proposes the first hypothesis:

Hypothesis 1: Enterprise safety culture positively influence safety management effectiveness.

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## 2.2 Enterprise safety investment and safety management effectiveness

The construction site is complex and with increasing safety risks. Thus, enterprises need to invest more to ensure the safety of construction, production and the safety of workers on site [1]. Through safety investment, the redundancy of organizational study can be reduced; the study of workers will be more targeted and effective; the innovation ability will be improved [2] and enterprises will have more accurate prediction of employees' safety behavior [3]. Besides, employees will focus more on study and their stress can be relieved to some extent [4]. Enterprises send employees clear safety signals [5][6], which can help improve safety management effectiveness and reduce safety accidents. Based on this, the second hypothesis is proposed:

Hypothesis 2: Enterprise safety investment has a positive impact on safety management effectiveness.

### 2.2.1 The interaction between safety culture and investment and safety management effectiveness

Safety culture is a kind of enterprise culture, which has certain systematic and interactive features like enterprise factors. The interaction between safety culture and training investment can improve safety management effectiveness. Safety culture can promote enterprises to invest more in safety training and the investment can increase the positive influence of the physical, institutional and spiritual dimensions of safety culture on workers' safety behavior. In addition, the interaction can strengthen employees' self-conscious safety behavior [3], thus further improving the management effectiveness. Therefore, this paper proposes the third hypothesis:

Hypothesis 3: The interaction between enterprise safety culture and investment has a positive impact on safety management effectiveness.

The theoretical model is shown in Figure 1.

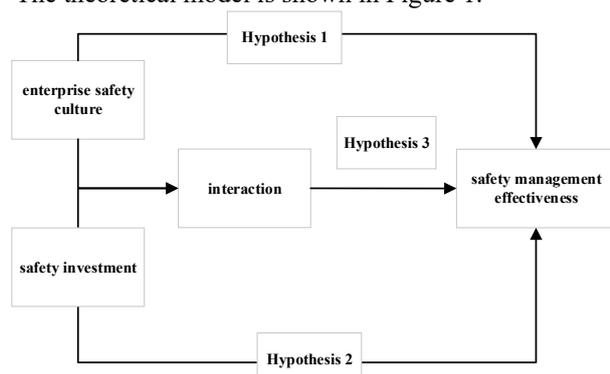


Fig 1. Theoretical Framework.

## 3 Research Method

### 3.1 Investigation objects

The paper takes the 100 independent project teams of 10 large engineering enterprises in China as investigation objects. The respondents to this questionnaire include

project managers and all the other working staff (excluding labor dispatching employees). Each project team includes at least one project manager and four working staff. Among the 500 distributed questionnaires, 460 were collected. Invalid questionnaires (like those with incomplete answers) were excluded. The number of valid ones is 420, meeting the research requirements. The details of enterprise are shown in Table 1.

Table 1. Sample details

Project	Type	Sample Size	Proportion (%)
Characteristics	State owned enterprise (SOE)	280	66.66
	Sole proprietorship	75	18.76
	Joint venture	65	15.48
Size	≤ 30	45	10.71
	30 ~ 60	60	14.29
	60 ~ 100	100	23.81
	100 ~ 200	80	19.05
	> 200	135	32.14
Age	1 ~ 3 (exclude 3)	25	5.95
	3 ~ 6 (exclude 6)	85	20.24
	6 ~ 10 (exclude 10)	115	27.38
	≥ 10	180	42.86

### 3.2 Research tools

The author determines measurement scales by reviewing literature about safety management. Many experts, project managers of work groups and other staff are invited to ensure the feasibility of scales. This questionnaire adopts the 7-point Likert scale.

- The method of Mei Qiang<sup>[1]</sup> et al. (2017) is adopted to measure the enterprise safety culture. The scale includes 14 measurement items in 3 dimensions. The results of confirmatory factor analysis (CFA) indicate that the safety culture model has a good construct validity (NNFI=0.936, NFI=0.945, CFI=0.960, RMSEA=0.075). Cronbach's Alpha coefficient of this scale is 0.904. <sup>[7][8]</sup>
- The calculation method of enterprise safety investment in this paper is as follows: the natural logarithm of safety investment each year is taken as the variable.
- The safety management effectiveness questionnaire in this paper is revised according to employee management effectiveness. The results of exploratory factor analysis show that this measurement has a good construct validity (NNFI=0.906, NFI=0.925, CFI=0.934, RMSEA=0.045). The Cronbach's Alpha coefficient of this scale is 0.916. <sup>[7][8]</sup>
- When designing the questionnaire, the following demographic variables are controlled: educational background, work seniority and gender (the values of male and female are 1 and 0, respectively).

Controlled enterprise variables include enterprise type (the values of SOE, sole proprietorship and joint venture are 3, 2, 1, respectively), enterprise size (the natural logarithm of the size is the variable) and age of enterprises.

SC, SO	75.731	0.945	0.965	0.041	0.046
SC+SO	95.613	0.910	0.862	0.089	0.102

where SC represents safety culture; SO denotes safety management effectiveness; “+” means that two factors are combined into one variable; \*\* represents  $p < 0.01$ .

## 4 Results analysis

### 4.1 Discriminant validity of CFA

The analysis results can be seen in Table 2. Enterprise safety culture and safety management effectiveness are two independent variables.

TABLE 2 CFA RESULTS

Model	AIC	NNFI	CFI	RMR	RMSEA
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Table 3 Variable mean, standard deviation and correlation analysis

Variable	Mean	Standard deviation	1	2	3	4	5	6
X1	3.79	0.85	1					
X2	13.12	8.38	0.36**	1				
Y	3.85	1.03	0.45**	0.31**	1			
SIZE	4.03	11.49	0.13**	0.29**	0.16	1		
AGE	7.5	15.26	0.20**	0.26**	0.17*	0.15*	1	
C1	2.51	13.44	0.15*	0.24*	0.18*	0.27	0.32*	1

where X1 represents enterprise safety culture; X2 is safety investment; Y denotes safety management effectiveness; SIZE represents the scale of enterprise; C1 denotes enterprise type. Here and elsewhere in this paper, \*\*\* means  $p < 0.001$ ; \*\* represents  $p < 0.05$ ; \* means  $p < 0.1$ .

### 4.3 Hypothesis testing

The maximum VIF of all regression models is 2.78, less than 10, indicating that multicollinearity between variables can be ruled out. [11][20]

In Model 1, all control variables are introduced, thus it is the benchmark model of hierarchical multiple regression. Model 2 introduces safety culture as the independent variable on the basis of control variables and the regression coefficient is 0.362 and  $p < 0.05$ . Thus Hypothesis 1 is verified, namely, enterprise safety culture has a positive influence on safety management effectiveness. In Model 3, safety investment is introduced as a new independent variable and its regression coefficient is 0.181 and  $p < 0.05$ . Thus, Hypothesis 2 is verified, namely, safety investment positively influences safety management effectiveness. The interaction between safety culture and safety investment is introduced in model 4 to investigate its influence on safety management effectiveness. And the regression coefficient is 0.115 and  $p < 0.05$ , so Hypothesis 3 is verified, namely, the interaction positively influences safety management effectiveness [13][14][15]. Now all the hypotheses in this paper have been verified, indicating that enterprise safety culture, training investment and the interaction between the two positively affect safety management effectiveness.

Table 4 Testing of interaction effect analysis

Variable	Y			
	Model 1	Model 2	Model 3	Model 4
SIZE	0.073	0.070	0.068	0.065
AGE	0.161*	0.145*	0.138*	0.115*
C1	0.089	0.081	0.078	0.070
X1		0.362**	0.315**	0.295**
X2			0.181**	0.175**
X1*X2				0.115**
F VALUE	7.502	24.560**	26.654**	28.621***

### 4.2 Descriptive and Correlation Analysis

In this paper, IBM SPSS 26 is adopted to calculate the correlation between variables, the mean and standard deviation. The results of descriptive and correlation analysis are shown in Table 3.

The results show that the correlation between variables is moderate. Therefore, the hypotheses can be tested. [9]

R2	0.097	0.245	0.270	0.291
△R2	0.096	0.148	0.173	0.194

\*\*\* means  $p < 0.001$ ; \*\* represents  $p < 0.05$ ; \* means  $p < 0.1$ .

## 5 Conclusion

The results of this paper show that enterprise safety culture and training investment positively influence safety management effectiveness. The paper also explains how the safety culture and safety training investment influence safety management effectiveness. The paper can encourage enterprises to invest more in safety training, thus improving safety management effectiveness.

1) This paper selects Chinese engineering enterprises as research samples and more researches can be done in the subindustries to make the conclusions more convincing.

2) Many intertwined factors influence the effectiveness of enterprise safety management. So how other factors affect safety management effectiveness can be discussed.

3) Affected by some subjective factors of scorers, the ratings of enterprise safety culture and safety management effectiveness in this paper may show certain subjectivity. Therefore, in the future, subjective and objective data and dynamic data (combining cross sectional data and longitudinal data) can be used to explore the influencing factors, thus providing more effective decision-making reference for enterprises to improve safety management effectiveness.

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