Significant factors affecting the effect of safety program implementation on construction projects in Ho Chi Minh City, Vietnam

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ABSTRACT

This research indicated 16 important factors that affect the result of labor safety program performance. The research was carried out by sending survey questionnaires to both foreigners and Vietnamese who are working for medium and large-scale construction projects. Most of them said that the most critical factor which influences the effect of labor safety program implementation on construction projects is "periodic evaluation of safety programs." In addition, MEAN is used to rank significant factors based on two groups of respondents: Safety Managers (SM) and Project Managers (PM).

1. Introduction

The construction industry is one of the most hazardous occupations that have been highly threatened with labor un-safeness because of the difficulties of working conditions and characteristics of construction projects (Luu & Do, 2002). In companies with developing of the construction industry, labor accidents on construction sites are also increasing, especially in developing countries (Bui, 2010), and Vietnam is no exception. To determine significant factors which directly influence the effect of labor safety program implementation play an important role in the prevention of labor accidents on construction sites. Labor accidents are not only affect the health, life, and happiness of workers but also directly affect the cost and process of production of organizations. In addition, labor accidents restrain the development of an economic society of countries.

The results in this paper are based on the research of labor safety program performance of Construction Companies in Vietnam. Identified factors were analyzed by using MEAN, Spearman's rho, and T-test.

2. Previous research and related literature in Vietnam and other countries

Based on fatal labor accident figures on construction sites in Ho Chi Minh City (Luu & Do, 2002), there are four main causes as follows: (1) lack of awareness of workers about the importance of labor safety; (2) workers without fully safety training and safety working equipping; (3) old and unsuitable equipment; (4) unsafe action of workers. Tran Hoang Tuan has studied a relationship between the past record trait of workers and the characteristic of managers and labor safety program implementation of workers on construction sites (Tran, 2008). The research also

showed that the time of labor accidents often happen at the beginning or end of working time in the morning or in the afternoon and often drop in on weekend days. Nguyen Trong Hai has estimated accident costs which are spent on labor accidents on construction sites in Ho Chi Minh City by main contractors or sub-contractors (Nguyen, 2010). The result showed that damages of accidents at work in the construction industry are great amounts of money and depend on the scale of projects, a level of seriousness of accidents. The losses are increasing when labor accidents are more serious.

Fang, Huang, and Wong (2001) have studied tasks of safety management in the construction industry in China. However, the scope of their research only focuses on technical factors, but there is a lack of managerial factors. Fang, Song, and Huang (1999) have evaluated generally the situation of labor safety in the construction industry in China, both the past and the present. Huang, Fang, and Li (2000) have been interested in the loss of construction accidents and showed that Chinese contractors hardly pay attention to labor safety because they have not recognized the loss which was paid by them and the importance of labor safety management on construction sites. Jannadi and Assaf (1998) have assessed a procedure of applying for a safety program in tasks on construction sites in Saudi Arabia. The standard checklist has been used to carry out a survey of under-construction projects.

3. Method of research

3.1. The process of research

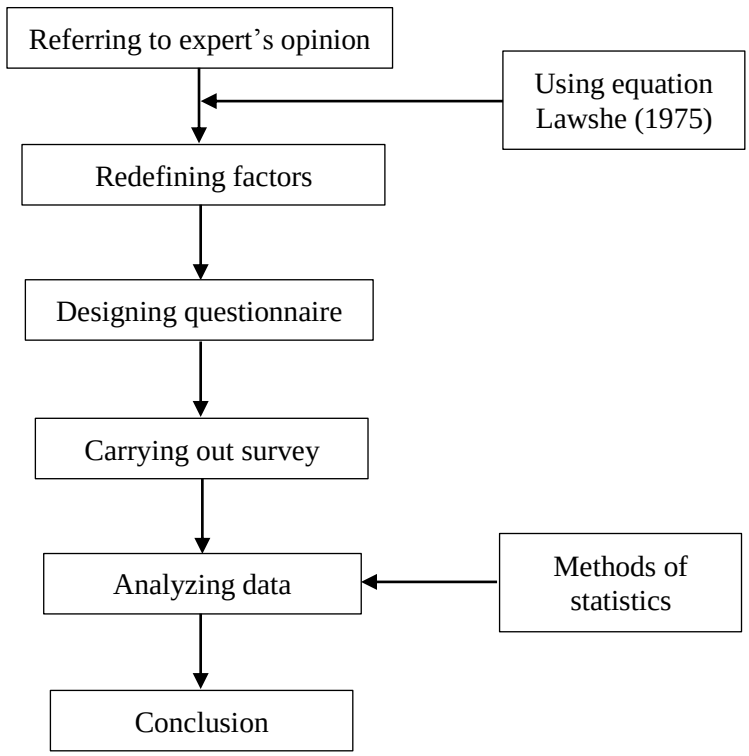

Figure 1. The process of research

3.2. Checking the validity and reliability of factors

Basing on the reference and assessment of a large number of material, sixteen critical factors were entered in a questionnaire. Previous to writing the questionnaire, these factors had been tested by using the Content Validity Ratio (CVR) formula, proposed by Lawshe (1975).

The formula of Lawshe is written as:

$$CVR_i = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \quad (1)$$

Where CVR_i is the content validity ratio of the i^{th} factor; n_e is the number of an expert who proposes that the i^{th} factor is necessary; N is the number of experts.

Questionnaire of 3-point Likert scale (1 = strictly necessary, 2 = useful but unnecessary, 3 = unnecessary) had been sent to 25 experts. The result of CVR analysis has found that the minimum value is 0.37 and is accepted. Therefore, factors that are under 0.37 have not been used in the final questionnaire (Aksorn & Hadikusumo, 2008).

3.3. Verifying the reliability of the 3-point Likert scale

The reliability is the level of uniformity of each time of independent scale. In order to evaluate the stability of scale, the reliable coefficient - Cronbach's Alpha (α) has been used. The formula calculates Cronbach's Alpha factor as follows:

$$\alpha = \frac{n}{(n-1)}\left(1 - \frac{\sum_{i=1}^{n}\sigma_i^2}{\sigma_t^2}\right) \quad (2)$$

Where n is the number of the i^{th} scale, σ_i is the variance of the i^{th} scale, σ_t is the variance of a total of scales.

The more considerable the Cronbach's alpha value is, the more reliable it is. In most cases of study, the acceptance of Cronbach's Alpha value is more than or equal to 0.6 (Hoang & Chu, 2008).

4. The results of research and discussion

4.1. The scale of surveyed projects and the experience of surveyed experts

96.4% of surveyed projects are more than or equal to class 01, and 75.1% of surveyed experts have 10 years of work or more than; this proves that the experts of the survey have a wealth of practical experience in labor safety tasks on construction sites. They also clearly know all aspects that could impact and cause accidents to occur on sites. This ratio also shows that surveyed experts have an overall and practical view of the importance of factors that influence labor safety implementation issues on construction sites. These ensure the confidence level of information and research.

There is 02 following group of surveyed experts: Project Managers (PM) who works for the Project Management Unit and Safety Manager (SM) who works as contractors.

4.2. The result of a ranking of significant factors

The ranking of factors based on MEAN. Besides, factors were ranked following the group: project manager and safety manager. The result of the ranking is showed in Table 1.

Relying on the ranking table of factors, the factor of "Periodic evaluation of safety program" (mean = 4.395) is the most influential in labor safety program implementation. This corresponds with the opinion of experts who work for PMU. According to them, the safety program's effect has to be evaluated periodically to determine its success or failure in the meetings and to define the following goals. The evaluation of the safety program is a great advantage to identify shortcomings or mistakes and to improve the way of performance that is more appropriate to the target. The next one is "safety training and coaching" (mean = 4.345). The success of the safety program could not be achieved if all staff are not trained and coached frequently in order to enhance knowledge and skills of labor safety at work. The factor "strictly safety supervision" (mean = 4.339) is also considered as a remarkable influence. A successful safety program is

required enough safety supervisors on-site to monitor and warn workers of acts and hazards which cause serious labor accidents.

Three factors that the influential level is over average are "clear and practical target" (mean = 3.46), "personal motivation" (mean = 3.345) and "communication" (mean = 3.1). To get desired results, the safety targets have to be set up clearly and practically. Clear safety targets will help managers to focus their guidance on daily activities in order to reach the best results, and the way to lead the success is easier. Although workers have knowledge and skills to complete their work safely, working like this does not ensure to achieve the level of necessary safety unless they have a positive attitude to their safety themselves. In addition, it needs the policy to commend and reward workers on sites timely to motivate them. When the connection between managers and workers is best, workers can report unsafety and dangerous activities as well as environmental matters to their managers. Vice versa, managers can also transmit their guidance, interests, and preferences of safety to reach the compliance of their staff or workers.

The results of the overall ranking show that the factor "safety training and coaching" (mean = 4.345) is highly evaluated by both two groups of experts. Even if the working position is different, these two groups of experts play an important role in safety programs on construction sites. The evaluations of all experts are the same as factors in which the level of influence is over average.

Table 1

The ranking of influential factors to safety program implementation

Factors	Position in the Project								
	Project Manager (PM) (A)			Safety Managers (SM) (B)			Total (C)		
	MEAN	N	Rank (1)	MEAN	N	Rank (2)	MEAN	N	Rank (1) & (2)
Periodic Evaluation of Safety Program	4.470	36	1	4.320	47	5	4.395	83	1
Safety Training and Coaching	4.310	36	3	4.380	47	2	4.345	83	2
Strictly Safety Supervision	4.249	36	6	4.430	47	1	4.339	83	3
Cultural Foundation	4.312	36	2	4.362	47	3	4.337	83	4
Safety Manpower	4.251	36	5	4.360	47	4	4.305	83	5
Teamwork	4.140	36	8	4.310	47	6	4.225	83	6
Maintaining and safety of old Equipment	4.252	36	4	4.171	47	9	4.211	83	7
Implementing Efficiently Safety Program	4.190	36	7	4.190	47	7	4.190	83	8
To be Supported by High-ranking Leaders	4.080	36	9	4.170	47	8	4.125	83	9
Personal Attitude	3.890	36	10	4.040	47	10	3.965	83	10

Factors	Position in the Project								
	Project Manager (PM) (A)			Safety Managers (SM) (B)			Total (C)		
	MEAN	N	Rank (1)	MEAN	N	Rank (2)	MEAN	N	Rank (1) & (2)
Authority and Responsibility	3.810	36	11	3.680	47	13	3.745	83	11
Role and Attendance of Workers in Safety Program	3.690	36	12	3.740	47	11	3.715	83	12
Personal Ability	3.670	36	13	3.710	47	12	3.690	83	13
Clear and practical Target	3.280	36	15	3.640	47	14	3.460	83	14
Personal Motivation	3.310	36	14	3.380	47	15	3.345	83	15
Communication	3.030	36	16	3.170	47	16	3.100	83	16

Source: Data analysis result of the research

4.3. Checking the correlativeness of two groups of experts - Project managers and safety managers

To verify the similarity in the ranking table between two groups of experts, a correlation coefficient - Spearman's rho (ρ), is used to prove whether there is considerable correlation or not (Aksorn & Hadikusumo, 2008). The result indicates that the correlation of ranking between two groups of experts is $\rho = 0.911$ with statistical significance 1% (Table 2). Therefore, it could be stated that the correlation of the ranking table between the two groups is very strong. In spite of differing positions at work but the evaluation of the importance of factors is the same; this means the interrelationship between factors is linear (to increase or decrease together).

Table 2

Spearman's rho between PM and SM

			Means_PM	Means_SM
Spearman's rho	Means_PM (PMU)	Corelation Coefficient	1.000	0.911**
		Sig. (2-tailed)	.	0.000
		N	16	16
	Means_SP (Safety supervisor)	Correlation Coefficient	0.911**	1.000
		Sig. (2-tailed)	0.000	.
		N	16	16

Source: Data analysis result of the research

4.4. Evaluating the level influence of factors by T-test

Nine factors which are ranked from first to ninth (Table 1) are $mean \geq 4.0$, all of them have P-value < 5% (level of statistical significance), so all of these factors impact strongly on the success of labor safety implementation programs on construction sites.

5. Conclusions

In order to prevent and reduce to a minimum of accidents on construction sites, the managers need to carry out the best labor safety programs. It is essential to identify clearly what factors are a strong influence on the success of safety programs and implement the best. This research defined 16 important factors by means of using the Lawshe equation to verify the content validity and to rank them based on the level of influence of factors on the efficiency of labor safety program implementation on construction sites in Ho Chi Minh City, Vietnam. The result is that the factor "Periodic Evaluation of Safety Program" (mean = 4.395) is the most influential degree on the efficiency of labor safety program performance on construction sites.

References

Aksorn, T., & Hadikusumo, B. H. W. (2008). Critical success factors influencing safety program performance in Thai construction projects. *Safety Science, 46*(4), 709-727.

Bui, T. T. (2010). *Analyzing factors that affecting the labor safety performance of construction workers and proposing solutions to improve safety situation on sites* (Master's thesis). Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam.

Fang, D. P., Huang, X. Y., & Wong, J. C. W. (2001). Review of the researches of construction safety management. *Journal of Safety and Environment 2001, 1*(2), 25-32.

Fang, D. P., Song, H. B., & Huang, X. Y. (1999). *Construction safety in China past, present and future*. Paper presented at the 02nd International Conference on Implementation of Safety and Health on Construction Sites, Honolulu, Hawaii.

Hoang, T., & Chu, N. N. M. (2008). *Analyzing research data by SPSS*. Ho Chi Minh City, Vietnam: Hong Duc Publisher.

Huang, X. Y., Fang, D. P., & Li, X. D. (2000). *Construction accident losses: How much an accident costs*. Paper presented at the International Symposium on Safety Science and Technology, Beijing, China.

Jannadi, M. O., & Assaf, S. (1998). Safety assessment in the built environment of Saudi Arabia. *Safety Science, 29*, 15-24.

Lawshe, C. H. (1975). A quantitative approach to content validity. *Personal Psychology*, *28*(4), 563-575.

Luu, V. T., & Do, L. T. X. (2002). *The matters of safety on construction sites in Ho Chi Minh City.* Paper presented at the 08th Science and Technology Conference, Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam.

Nguyen, H. T. (2010). *Estimating the cost of contractors because of labor accidents in construction in Ho Chi Minh City* (Master's thesisHo Chi Minh City Open University, Ho Chi Minh City, Vietnam.

Tran, T. H. (2008). *Analyzing factors that influencing the labor safety implementation of site workers and putting forward ideas to ameliorate safety situation on sites* (Master's thesis). Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam.