Attitude of construction workers toward labour safety

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Abstract
The construction industry has one of the most dangerous working environments among various professions. Workers in construction investment projects account for a large component of the costs, and there are many risks to labor safety. Therefore, ensuring that workers are not injured and aiming for zero labor accidents is a significant imperative and challenge for project managers and construction workers. Ensuring safety during construction work contributes to the success of a project. This paper presents a study of worker attitudes toward labor safety. The research was conducted by using an expert interview approach and questionnaire survey in order to find out which factors influence construction worker attitudes about labor safety conditions. Factor analysis found five factors that affect the attitudes of workers toward labor safety: (1) organizational policy; (2) communication; (3) risk acceptance; (4) psychology; and (5) equipment monitoring and management.

Keywords: *construction workers; labor management*; *project management; safety management.*

1 Introduction

The construction industry is constantly evolving and growing due to the impact of technological progress, investment capital, and social needs. Construction projects are becoming increasingly complex and difficult to assess in term of success (Nguyen, Nguyen, Nguyen, & Huynh, 2016; Phong & Quyen, 2017). The success of a project is not only considered in terms of traditional factors such progress, cost and quality, but also in terms of other factors as suggested by researchers, such as performance, satisfaction and labor safety (Chan & Chan, 2004; Chan, Scott, & Chan, 2004; Ghomi & Barzinpour, 2018). Labor safety is a topic of particular concern due to the increased risk of occupational accidents facing the construction industry, which is striving to meet the need for infrastructure construction (Aksorn & Hadikusumo, 2008; Khandan, Vosoughi, Azrah, Poursadeghiyan, & Khammar, 2017).

Occupational Safety in Vietnam

According to the report of the Ministry of Labor, War Invalids, & Social Welfare of the year 2017, there were 8,956 occupational accidents causing 9,173 victims including those working without labor contracts and increasing 2.1% of occupational accidents compared to 2016. The construction sector accounted for 20.8% of the total number of fatal accidents and 19.7% of total deaths. In which Ho Chi Minh city is the locality with the most occupational accidents, with 1,492 occupational accidents, 1,508 victims, 101 deaths, and 303 serious injuries.

Table 1: Statistics on national occupational accidents from 2014-2017 (According to data from the Ministry of Labor, Invalids and Social Affairs, Vietnam)

Year	Total number of occupational accidents	Number of people with occupational accidents	Number of fatal occupational accidents	Construction sector accounts for (%) of occupational accidents	Construction sector accounts for (%) deaths
2014	6.709	6.941	592	33,1	33,9
2015	7.620	7.785	629	35,2	37,9
2016	7.588	7.806	655	23,8	24,5
2017	8.956	9.173	898	20,8	19,7

According to Table 1, the total number of labor accidents in Vietnam increased continuously in 2014-2017. Specifically, the number of occupational accidents increased by 2,247 in 2014. The construction industry is always at the top of the industry groups in terms of the number of occupational accidents, particularly in the construction industry in 2014, accounting for 33.1% of the total number of occupational accidents and accounting for 33.1% of the number of deaths. Efforts in the implementation of occupational safety of the construction industry have been successful. Specifically, the number of labor accidents in 2017 was 33.1%, 20.8% in 2014, down 12.3%. The death rate in 2017 compared with 2014 decreased by 33.9% to 19.7%, down 14.2%. Although there have been signs of reducing the number of labor accidents in the construction industry, in Hochiminh City where the construction market has developed, the number of occupational accidents has increased as shown in Table 2.

Table 2: Statistics on occupational accidents in Hochiminh city

Year	Total number of occupational accidents	Number of people with occupational accidents	Number of deaths	Number of people injured
2014	1.171	1.176	101	205
2015	1.525	1.547	105	420
2016	1.721	1.747	92	617
2017	1.492	1.508	101	303

Hochiminh city has a high rate of urbanization and attracts considerable investment capital for infrastructure construction. Along with the development and number of large construction projects, there is a risk to labor safety for construction workers. According to a report on labor accidents in 2017, there were 1,492 labor accidents in Hochiminh city with 1,508 victims and 102 deaths. Particularly, in the construction industry, there were 71 cases, resulting in 66 deaths and 04 injuries. The study was conducted to provide information about the causes of occupational accidents in the construction industry in Hochiminh City. It may be useful for project managers to contribute to the development of a program in reducing the rate of occupational accidents in this city.

The risk of unsafe labor may come from attitudes towards the implementation of measures to ensure labor safety. Attitudes of workers will affect their behavior in terms of safety and may result in labor accidents.

To better understand the effects of the environment on workers' behavior for labor safety, this paper presents factors influencing the attitudes of construction workers toward labor safety measures when working in construction works.

2 Literature Review

2.1 Employee attitude towards labor safety in construction

Attitudes are valuable statements or evaluations of things, people or objects. The attitude reflects how people feel about something (McShane & Von Glinow, 2013). Organizational behavior, attitude components include:

(i) The cognitive component includes opinions or beliefs about attitudes; (ii) The influence component is the feeling or emotion of the attitude; and (iii) Behavior is intentional to behave in a certain way with a person or something.

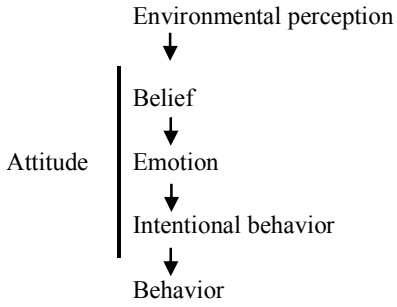

Figure 1: Models of attitudes and behaviors (McShane & Von Glinow, 2013)

The composition of attitudes, including beliefs, emotions, and intentional behaviors, will be influenced by environmental perception, which in turn leads to their behavior as shown in figure 1. In terms of employees in construction, the factors of environment and safety management will be "Environmental Perception" that directly affects employees, which can lead to good or worse safety behaviors. The bad attitude towards safety in construction will lead to improper safety practices and a direct cause of construction work accidents. Therefore, the research topic of construction workers' attitudes aims to improve their attitude to the safety program. It helps managers understand the impact factors to improve the safety performance program in the organization in the best way, minimizing unnecessary accidents.

2.2 Attitude's factors of workers toward labor safety

Workers' behaviors affect their productivity and safety when working on the job site. Studies show that the risks of labor accidents originate from or are related to unsafe behaviors of workers. Du Pont, a company well known for their effectiveness in promoting safe work, says that 96% of the causes of work-related accidents are unsafe behavior, and Heinrich claims that about 90% of industrial accidents are related to unsafe behaviors (Heinrich, Petersen, Roos, & Hazlett, 1980). The rate of unsafe labor practices from construction workers may come from objective reasons because they are direct workers in the process of creating construction products, while subjective reasons are their perceptions of the risk of jeopardizing their own safety. According to Choudhry and Fang (2008), construction workers believe that they are more vulnerable than other staff. The causes of unsafe behaviors have also been identified, including lack of safety awareness, demonstrated skills, colleagues' attitudes, and other economic factors.

Labor safety management

The support and involvement of management and its commitment to safety is an extremely important factor for improving safety (Jaselskis, Anderson, & Russell, 1996; Mohamed, 2002; Sawacha, Naoum, & Fong, 1999). Safety management is ensured through planning, organization, and provision of safe workplace policies and procedures.

Safety procedures

Safety procedures should be disseminated to and understood by management engineers and field workers. Mohamed (2002) points out that rules are critical elements of safety management systems.

Psychological characteristics

Supervisors must advise, remind and pay attention to unsafe labor behavior and the psychological behaviors of workers. Langford, Rowlinson, and Sawacha (2000) points out that the more supervisors interact with workers, the safer they will be.

Economic characteristics

Incentive pay can have a huge impact on worker's productivity and even on their risk levels. Workers may accept increased productivity goals and put these goals ahead of the safety measures they need to take. In this way, incentive pay can adversely affect their perceptions of and attitudes toward labor safety. In a study by Choudhry and Fang (2008), a worker said that "If you pay us more for productivity, we have to produce more and then why we must pay attention to safety." That proves that workers may tend not to commit to safe

behavior because they have been rewarded for doing so. Reward measures for productivity should be in line with labor safety policy.

Self-esteem

Workers tend to practice very standard safety measures in training about labor safety. Such practices might be opposite to the way actual work is done. Research shows that skilled workers will risk and violate safety measures to demonstrate their ability and create credibility in a group of workers. Workers' support and perceptions of safety risks are a challenge to safety measures (Choudhry & Fang, 2008).

Experience

Experience will affect safety awareness. New workers are more likely to have accidents than skilled workers, which can be explained through the experience they are accumulating (Choudhry & Fang, 2008). However, it is a continuous learning phase, and a person's perception can be changed by subsequent experiences. Wilson (1989) points out that the combination of knowledge and experience will help to provide more choices in fixing problems. There are also many signs that experience does not necessarily affect safety. Increased experience tends to reduce cautiousness and increase confidence in one's ability to cope with an incident (Gherardi & Nicolini, 2002).

Pressure on project performance

The efficiency of a project will greatly affect the attitudes of workers in the implementation of labor safety (Flin, Mearns, O'Connor, & Bryden, 2000; Rabbani, Farrokhi-Asl, & Manavizadeh, 2017). The value of safety over work pressure should be conveyed by site managers, including engineers and site supervisors.

Risk perception

Wilson (1989) points out that workers may be exposed to unsafe risks due to ignorance or non-compliance with safety procedures. Project managers are often unaware of all of the factors that affect their risk problem. Choudhry and Fang (2008) indicates that each person will have different perceptions of risk and these may change over time. If workers do not know or their experience is limited, then they will be at higher risk.

Work environment

Sawacha et al. (1999) points out that a well-organized site would bring high security to workers. The use of machines and mechanical equipment is also considered a source of accidents. Managers should warn or prohibit entry into such high-risk areas.

Organization of periodic training on labor safety

Wilson (1989) describes that workers learn by doing the work directly based on peer observation or by trial and error. One of the problems with traditional training is that it does not represent the real work environment. When workers work at the construction site, they face completely different situations, such as weather, temperature, temperature, humidity, or limited workspace, etc. Mohamed (2002) provided training to help skilled workers carry out specific tasks safely. Nevertheless, training is focused on changing worker attitudes toward the implementation of safety measures.

3 Research Methodology

The research model is based on factors adopted from previous research related topics. Those factors will be the basis for the research questionnaire design. The study aims to identify the factors affecting the attitude of employees in the implementation of labor safety during construction at the civil construction site in Ho Chi Minh City: Organizational policy; Equipment supervision and management; Employee psychology; Risk acceptance; Behavior management.

Table 3: List of factors affecting the attitude of employees in the implementation of labor safety

Variable	Description of factors	Source
CS1	Employees only use machines and equipment when they have enough knowledge about it	(Langford et al., 2000)
CS2	Corporate and manager's attention to individual safety.	(Langford et al., 2000)
CS3	Periodically organize training courses on occupational safety	(Langford et al., 2000)
CS4	Provide full equipment, personal protective clothing	(Langford et al., 2000)
CS5	Clean, neat, equipment, materials are arranged orderly	(Langford et al., 2000)
CS6	Develop an effective management organization in finding, communicating risk factors and taking timely remedies	(Langford et al., 2000)
GS1	Supervise the process of using mechanical and electrical equipment and inspecting the condition of machines	(Langford et al., 2000)
GS2	Provide proper equipment for proper personal protective equipment and work in accordance with regulations	(Langford et al., 2000)

GS3	Take responsibilities for safe scaffolding	(Langford et al., 2000)
TL1	Pressure on layoffs when working unsafe	(Choudhry & Fang, 2008)
TL2	Recognizing the importance of labor safety that affects the productivity, family of workers, and workers themselves	(Jitwasinkul & Hadikusumo, 2011)
TL3	Effectively affect the colleagues' performance	(Choudhry & Fang, 2008; Wilson, 1989)
TL4	Worker's self-esteem.	(Choudhry & Fang, 2008; Wilson, 1989)
RR1	Hard working conditions: weather, temperature, workspace, etc.	(Choudhry & Fang, 2008; Wilson, 1989)
RR2	Regulations on safety bonuses, performance bonuses	(Langford et al., 2000)
RR3	Work experience of workers	(Jitwasinkul & Hadikusumo, 2011; Langford et al., 2000)
HV1	Supervisors are active and attentive in reminding the workers	(Jitwasinkul & Hadikusumo, 2011; Langford et al., 2000)
HV2	Communication and cooperation between safety management and workers	(Choudhry & Fang, 2008; Langford et al., 2000)
HV3	Communication and cooperation between groups of workers	(Choudhry & Fang, 2008)
HV4	Encourage, receive comments from workers in improving labor safety	(Yip, Rowlinson, Kvan, & Lingard, 2005)
HV5	Committed from management to creating a safety culture in the organization.	(Heinrich et al., 1980)

A list of 21 factors was grouped into five groups that are included in the survey after conducting the pilot study. The questionnaire is designed on a five-level scale and was distributed in a convenient way to engineers and employees working on projects in Ho Chi Minh City.

Respondents will respond to the questionnaire in three parts, including the first part about their company's safety information. The second part is 21 questions about the factors affecting the safety attitude of construction workers with a scale of 5 levels. And the last part is the information of the respondent. The questionnaires were surveyed in two ways:

(i) Direct: 60 survey questionnaires were carried out at construction works in Ho Chi Minh City, 53 questionnaires were collected. The questionnaire rate obtained accounted for 88.3% of the number of questionnaires distributed.

(ii) Indirect: 120 survey questionnaires were sent to colleagues working in the construction field in Ho Chi Minh City. The number of questionnaires collected 38 questionnaires accounted for 32.5% of the total number of questionnaires distributed. The total number of questionnaires collected is 91 questionnaires.

A total of 91/180 surveyed samples were collected, processed and analyzed, of which more than 84% comprised safety engineers and construction engineers. Regarding years of experience, 70.3% have 5 to 10 years, and 29.7% have less than 5 years. Respondents from private-sector enterprises accounted for 96.7%. Cronbach's Alpha coefficients of 05 sub-groups in the survey were analyzed. From 21 original variables, 18 variables are retained. The results are summarized in Table 4.

Table 4: Summary of the Cronbach's Alpha coefficient analysis

Group of factors		Variables excluded	Cronbach's Alpha
Organizational policy	1	Corporate and manager's attention to individual safety.	.849
Equipment supervision and management	0		.827
Psychological characteristics of the workers	1	Worker's self-esteem.	.882
Risk acceptance	0		.871
Communication	1	Committed from management to creating safety culture in the organization.	.805

An EFA analysis was conducted to identify the groups of factors that influence workers' attitudes toward labor safety. SPSS 22.0 and Microsoft Excel were the main software applications used to process and analyze the data in this study.

4 Results and Findings

The results summarized 18 factors affecting attitudes toward labor safety practices of workers working in construction projects in HCM city. EFA analysis was performed to reduce to the 18 variables. KMO and Bartlett's Test of Sphericity tests were performed to test the suitability of the data before performing EFA analysis (Du & Yan, 2008). The KMO test was relatively stable (0.655), $0.5 \leq KMO \leq 1$ and Bartlett's test has Sig <0.05, which is also statistically significant, so the variables are generally correlated and the factor analysis is appropriate.

Table 5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.655
Bartlett's Test of Sphericity	Approx. Chi-Square	919.611
	df	153
	Sig.	.000

EFA analysis was performed with 18 observational variables to be shortened by PCA and Varimax. The results of EFA factor analysis were accepted with a total categorical deviation of the study of 74.040 > 50% for which it can be said that these factors account for 74.040% of the variance in the data. No observed value variable was excluded when performing EFA factor analysis. The results of the analysis are presented in Table 7 and Table 8.

Table 6: Communalities

	Initial	Extraction
CS1	1.000	.736
CS3	1.000	.601
CS4	1.000	.638
CS5	1.000	.576
CS6	1.000	.800
GS1	1.000	.772
GS2	1.000	.775
GS3	1.000	.801
TL1	1.000	.763
TL2	1.000	.811
TL3	1.000	.891
RR1	1.000	.870
RR2	1.000	.805
RR3	1.000	.770
HV1	1.000	.687
HV2	1.000	.650
HV3	1.000	.741
HV4	1.000	.643
Extraction Method: Principal Component Analysis.		

Table 7: Summary of the percentage of variance explained by components

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.127	22.929	22.929	4.127	22.929	22.929	3.320	18.445	18.445
2	3.106	17.258	40.187	3.106	17.258	40.187	2.581	14.337	32.782
3	2.254	12.522	52.709	2.254	12.522	52.709	2.543	14.128	46.910
4	2.129	11.830	64.538	2.129	11.830	64.538	2.508	13.935	60.846
5	**1.710**	**9.501**	**74.040**	**1.710**	**9.501**	**74.040**	**2.375**	**13.194**	**74.040**
6	.762	4.232	78.272						
7	.657	3.648	81.920						
8	.567	3.150	85.070						
9	.496	2.758	87.828						
10	.425	2.362	90.190						
11	.363	2.014	92.205						
12	.352	1.953	94.158						
13	.295	1.642	95.799						
14	.208	1.157	96.957						
15	.189	1.052	98.009						
16	.134	.744	98.753						
17	.117	.650	99.403						
18	.107	.597	100.000						
Extraction Method: Principal Component Analysis.									

Table 8: Results of key factor analysis with varimax rotation method

	Factor name	Factor loading	Eigenvalues	% of Variance	Cumulative %
	Organizational policy		**4.127**	**18.445**	**18.445**
CS6	Develop an effective management organization in finding, communicating risk factors and taking timely remedies	.892			
CS1	Employees only use machines and equipment when they have enough knowledge about it	.854			
CS3	Periodically organize training courses on occupational safety	.764			
CS4	Provide full equipment, personal protective clothing	.763			
CS5	Clean, neat, equipment, materials are arranged orderly	.694			
	Communication		**3.106**	**14.337**	**32.782**
HV3	Communication and cooperation between groups of workers	.825			

HV2	Communication and cooperation between safety management and workers	.786			
HV1	Supervisors are active and attentive in reminding the workers	.773			
HV4	Encourage, receive comments from workers in improving labor safety	.754			
	Risk acceptance		**2.254**	**14.128**	**46.910**
RR1	Hard working conditions: weather, temperature, workspace, etc.	.920			
RR2	Regulations on safety bonuses, performance bonuses	.882			
RR3	Work experience of workers	.875			
	Psychology		**2.129**	**13.935**	**60.846**
TL3	Effectively affect the colleagues' performance	.926			
TL2	Recognizing the importance of labor safety that affects the productivity, family of workers, and workers themselves	.878			
TL1	Pressure on layoffs when working unsafely	.853			
	Equipment supervision and management		**1.710**	**13.194**	**74.040**
GS3	Take responsibilities for safe scaffolding	.865			
GS2	Provide proper equipment for proper personal protective equipment and work in accordance with regulations	.823			
GS1	Supervise the process of using mechanical and electrical equipment and inspecting the condition of machines	.822			

The first factor, *"Organizational Policy,"* had four components and held the first position, with the strongest impact. This shows that the employer has an appropriate policy that directly affects the company's labor safety practices. The variable "Develop an effective management organization in finding, communicating risk factors and taking timely remedies" is the most powerful impact on workers' safety practices. This is also true of working conditions because most workers are wage earners, day laborers with less knowledge and awareness than engineers and supervisors. Developing a management organization that supervises and reminds workers to work safely is essential to improving worker safety.

The second factor is *"communication"* with four observation variables, in which the observation variable "Communication and cooperation between groups of workers" is the most important. This shows that co-operation among workers is an important factor for improving worker safety. Communication and exchange specifies the work process and limits the shortcomings in tasks that can increase work performance and work safety.

The third factor is *"Risk acceptance"* with three observation variables. Workers' experience, performance bonus, and difficult work environment will greatly affect their attitudes towards work safety. Incentive to increase performance should consider the safety of workers in order to increase worker safety concerns as they increase productivity.

The fourth factor is *"Psychology"* with three observation variables, in which the variable "Impact of employee occupational safety practices" is the most important. If a co-worker is doing well, the worker is also influenced and follows his colleagues' safe practices. In addition to psychological factors from the working environment, two factors of family perceptions and likelihood of job loss also affect the implementation of labor safety.

The fifth factor is *"Equipment supervision and management"* with three observation variables. The process of using construction equipment, protection tools, and especially scaffolding should be considered.

The units that manage the provision of equipment and monitor the workflow will affect the safety of workers that are performing the assigned work.

5 Conclusion

Work-related accidents are a major problem that affects not only the progress and cost of a project, but also results in physical and mental injury, and even the loss of human life. Identifying the causes of labor accidents to reduce occupational accidents is an urgent matter that investors and contractors are concerned about to improve progress, cost, and assurance of safety in the construction process. The author summarizes past research and the theoretical background related to the topic and conducted a survey by using expert interviews to complete a questionnaire with 21 variables that affect workers' attitudes toward labor safety and 91 observations were included in the analysis. The research results show that there are five factors with 18 variables of observation and these are considered as directly affecting workers' attitudes toward labor safety during the construction process. These variables include (1) organizational policy; (2) communication; (3) risk acceptance; (4) psychology; and (5) equipment monitoring and management.

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