CONSTRUCTION LOST-TIME INJURIES IN LAOS: AN EXPLORATORY STUDY

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Abstract

This paper presents a study on construction safety in the People Democratic Republic of Laos (PDRL). Fifty workers experienced certain injuries in their construction sites and 15 top managers were interviewed in twenty-six construction projects in Vientiane, the capital of PDRL. Research results show that stepping on and/or striking against objects (48%), struck by falling objects (24%), falling of persons (12%) are major types of construction injuries. The paper stresses that the ignorance of top managers about their crucial role in safety improvement, using safety incentive to raise safety performance, lack of thorough understanding about benefit from labor safety performance, and the willingness to cut off safety performance expenditures is considered as obstructions of safety improvement programs. The survey indicates that physical working conditions, relationship among workers, foremen behaviors and the monthly wage were influencing factors to worker's job satisfaction. The study also highlights afternoon as dominant time that led to a large number of injuries.

Keywords: Construction injuries, safety, safety management, Laos

Symbols

PDRL People Democratic Republic of Laos
PPE Personal Protective Equipment
CIL The Construction Industry in Laos

1. Introduction

Construction activities are characterized as hazardous work. This is due to the diverse and complex nature of work tasks, trades, and environments, as well as the temporary and transitory nature of construction workplaces and construction workforces [1]. Unfortunately, construction accident investigations stop at a premature level [2]. Zero-accident culture has been advocated in several projects and construction companies, yet numerous construction accidents have been reported all over the world. The risks of a

fatality and a major injury in the construction industry are five times and two and a haft times, respectively, more likely than a manufacturing based industry [3]. In the USA, construction accounted for only 4.8% of workforce but claimed a disproportionate 19.4% of all occupational fatalities and 12.3% of all disabling occupational injuries and illness [4, 5]. In Hong Kong, construction employees incurred approximately 46% of all annual occupational injuries [6]. The annual accident rate per 1000 workers in the Hong Kong construction industry has ranged from over 300 in the early 1990s and over 200 in 1999 [7]. A formal and recent investigation of the Vietnam's Ministry of Transportation in a tunnel construction project, the longest highway tunnel in Southeast Asia and one of the six national projects of Vietnam, revealed that 40% of the workers suffered from otorhinolaryngologic diseases in which occupational deafness made up 16% [8]. Therefore, comprehensive investigations into construction accidents and safety performance in both developed and developing countries are very challenging and extremely imperative.

This paper aims to conceptually investigate the major types of construction injuries, to assess top management attitudes towards safety performance in construction industry in PDRL. Results of this research are expected to contribute learning lessons and to improve the awareness of construction safety for construction participants in Laos and other developing countries

2. Previous study

Construction worker injuries have broad and adverse impacts, which include personal suffering of injured workers, construction delays and productivity losses incurred by contractors, higher assurance premiums that result from costly injuries and possible liability suits for all parties involved in the project [9]. The major causes of accidents are related to the unique nature of the industry, human behavior, difficult work-site conditions, and poor safety management [10]. There is no consensus in the literature what constitutes an accident. In fact, "accident" and "injury" are regularly confused [11]. Serious injuries were predefined by the Danish Working Environment Authority as lost-time-injury-incidents resulting in amputations, bone fractures, and/or injury to extensive parts of the body [1]

Preventing occupational injuries and illness should be a primary concern of all project parties [13]. Lingard [14] found that perceptions of worker before and after attending first-aid training about the likelihood of injury were different. In pre-training interviews, many participants expressed the unrealistically optimistic belief that "it will not happen to me" while most of them indicated that they had a medium or high probability of personal suffering from a work-related injury or illness after following first-aid training [14]. This affirms that there is a room for improvement of safety performance in construction trades when all employers and employees are aware of standard safety procedures and beyond.

Construction work accidents are the result of a sequence of events [15]. They arise from different causes that can generally be classified as physical incidents posing hazardous situations, and behavioral incidents caused by unsafe acts [16]. Thus, detailed information about the root causes of construction injuries and fatalities is necessary to perform accident prevention programs [17].

Identification of major type of construction accidents is obviously essential to mitigate accidents in future projects. As such, there are many accident causation models and human error theories proposed for all industries and particularly for the construction industry. Research in accident causation theory was pioneered by Heinrich in 1930 [2]. Recently, several models have been introduced in construction such as an accident root causes tracing model (ARCTM) [2] and constraint-response model [18]. To some extent, these models can reflect the unique characteristics of construction environments to readily determine the root causes of construction accidents.

3. Research Methodology

Construction injured workers were respondents of this research. An injured worker in survey was defined as a worker who had been experienced construction injuries requiring any first aid or medical examination or absence from work more than one day regardless of whether or not there were damages to property. A purposive sampling method was used to involve as many construction sites as possible in Vientiane, the capital of PDRL. Researchers had visited twenty six construction sites. The injured workers were identified based on the diaries of these construction sites and formal and/or informal communications with site authorized individuals. Finally, 50 injured workers were "face-to-face" interviewed on their construction sites. Collected data were statistically analyzed to find out research findings. Findings were compared with findings resulting from previous studies

Table 1. Summary of research tools

Research tools	Types of respondents	Reasons for selection
Interview	Injured workers	Construction workers had insufficient knowledge of understanding all questions in the questionnaire.
Interview	Top management	Top managers had no time to fill in any questionnaire; thus, interview is the best way to collect data from them.
Photograph and site investigation	Construction sites	Illustration for research findings and checking collected data.

Due to a large proportion of construction projects were gathered in Vientiane, the survey was conducted on twenty-six building projects in there. The selected projects might not be randomly because the survey had to be approved by competent persons. However, these selected projects were considered to be typical of small and medium size ones in Laos.

Table 2. Summary of research sample

Research sample features	Unit	Collected quantity
Construction Project	Project	26
Injured workers	Worker	50
Top management	Person	15

A research framework is depicted in figure 1

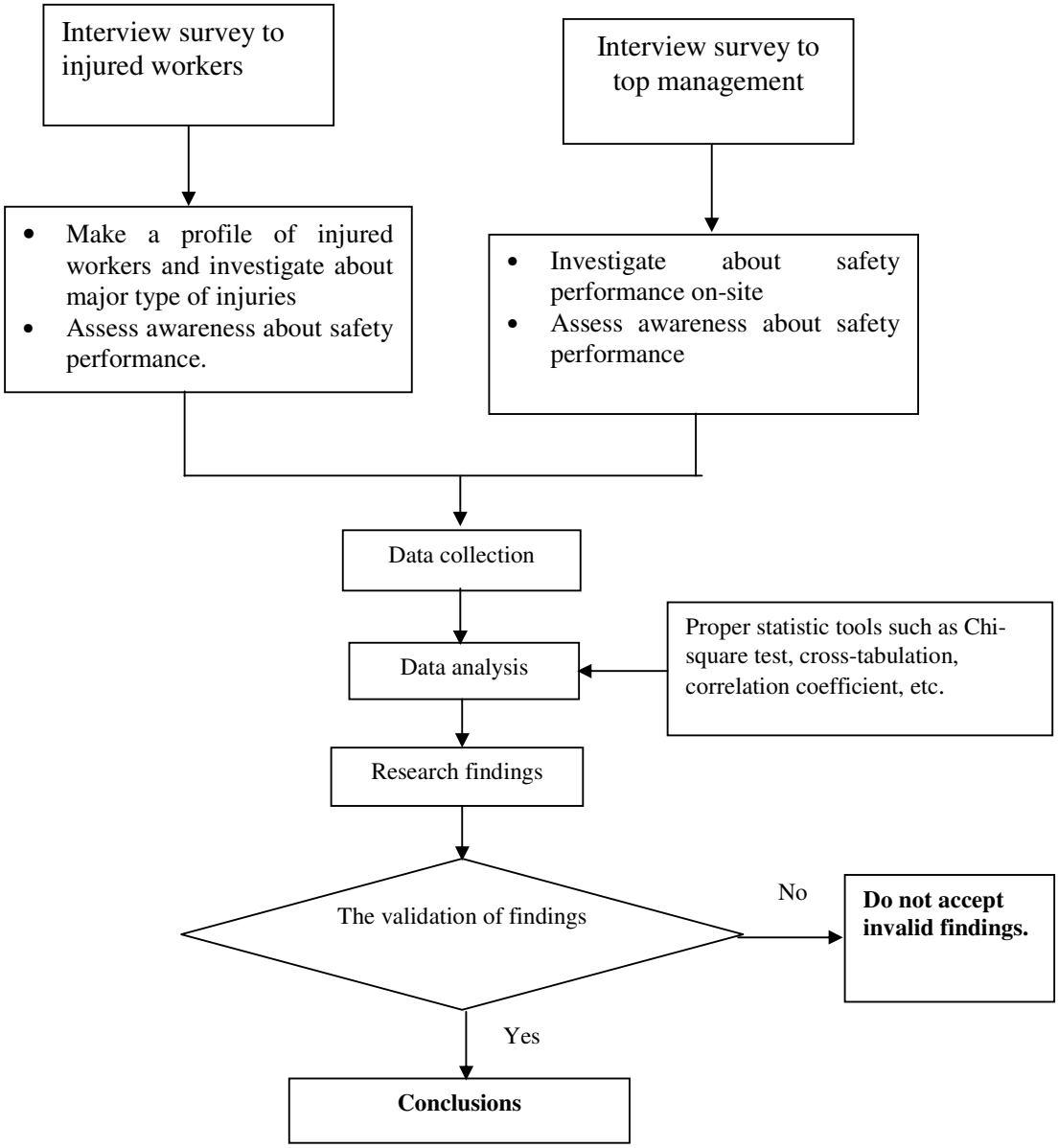

Figure 1. Research framework of the study

Data was collected in Vientiane over eight weeks from September to November of 2005 and on 26 construction sites involving 15 different construction firms. The size of the selected projects ranged between 300 million Kip and 2.5 billion Kip (Kip is Laos' currency unit; 1 Kip = 0.000103581 USD; 1 USD = 9,654.25 Kips) and was completed from 10% to 85%. Based on the agreement of on-site managers, 50 injured workers were interviewed on 26 sites. Top managers from 15 construction firms were also interviewed to find out more other factors affecting safety performance.

4. Discussions of Findings

4.1. Characteristics of injured workers

Fifty injured workers were interviewed from twenty-six investigated projects, which included 20 buildings (office, school,) and 6 industrial and warehouse facilities. Most of injured workers were apprentices (32%), carpenter (26%) and steel-fixing worker (12%). Although the data could not represent safety performance of the industry, the apprentices in Laos obviously have higher likelihood of suffering from injuries since they are not sufficiently trained in standard safety procedures before starting their jobs. A proportion of 68% injured workers did not receive any safety training. Thus, the construction injuries can be reduced if safety awareness of the workers is enhanced. Moreover, 80% of injured workers had the age between 20 and 39. There was evidently no relationship between accident rates and age. A study [6] on Hong Kong and Vietnam [12] construction workers also confirms this issue. A possible explanation is that most of Lao's construction workers are twenties and thirties, and the proportions of these workers and accident rates are positively related.

A rate of 40% of injured workers who have more than 6-years experience reflect that lack of formal training about safety is an actual problem in Laos Construction Industry. The injuries occurred not only to experienced workers without safety training, but also to workers who had formal safety training and less experience. It is possible that current safety training programs are not well to build up self-awareness about safety to construction workers.

For praising to workers, 18% of injured workers who said "No" and 50% said "rarely" received praising from management for good work done (Table 3). After a workday, workers feel satisfaction from seeing the results of their work, so timing praises can increase their satisfaction. As a result, they enjoy their construction works.

Table 3. Injured workers vs. praising to workers for the good work done

Do you often receive praises from management for your good work done?					Total
Never	Rarely	Sometimes	Often	Always	
9 18%	25 50%	5 10%	10 20%	1 2%	50 100%

Injured workers were asked to describe their feeling about safety rules, regulation, Code, etc. More of injured workers (52%) thought that "dislike it but they must conform", 28% of them thought "their work is obstructed". This results reflected that injured workers get wrong awareness about safety rule, regulation, Code, etc., at sites. Therefore, it is necessary to train properly construction workers in safety performance to improve their safety awareness. In addition, the enforcement of safety rule, regulation, Code, etc., is necessary because it is very difficult for them to conform by themselves.

4.2. Types of Construction Injuries

Stepping on/and striking against objects, struck by falling objects, falling of persons were main injury types. Result shows that 48% of the injuries were caused by stepping on and striking against objects, 24% were struck by falling objects falls, 12% were falling of persons (Table 4).

Table 4. Types of construction injuries

Injury types	Percent
Stepping on/striking against objects	48%
Struck by falling objects	24%
Falling of persons	12%
Electric shock	8%
Traumas of eyes, spinal cord, etc.	6%
Caught in between objects	2%

Falls of persons are identified as the highest occurrence in many countries, such as in USA [18, 19], in UK [20], Vietnam [12] and India [21]. Nevertheless, the degrees of occurrence of stepping on and striking against objects is identified as high occurrence in Laos. A possible explanation is that most of buildings in Laos are not high-rise building. Therefore, it is widely accepted that preventing in stepping on and striking against objects is necessary to prevent non-fatal injuries. However, the degrees of occurrence of other injury types are rather different from the study in other countries. In Vietnam, electric shock was the second highest cause of construction injuries whilst it was responsible for only 5% of fatal accidents in construction in UK [20].

4.3. Top Manager Interview Analysis

The interviewed data reflects **poor top management** practices towards labor safety performance as well as safety improvement. Nearly 90% of top managers got much experience, along working time for current companies (60% of top mangers have more than six years working for the current firms) and had high education (100% of them obtained bachelor degree of civil engineering). **Work experience is found as prevailing source (60%) to raise labor safety awareness of top managers.**

20% of top management who strongly disagreed on "Labor safety improvement will bring out lower construction costs**"** indicates an indicator of management's unawareness about labor safety, which causes some obstacles to labor safety improvement programs. Due to high competitiveness in the construction market, some top managers have concerned the priority of their existence more than labor safety. Therefore, they don't aware of cost saving aspects in labor safety improvement.

When asking top management about the existence of control system for safety performance at sites, only 43.8% of them said "Existent and effective" but 37.5% of them said "Existent and but not effective" and 18.8% of them said "Nonexistent" (Table 5). This shows a somber picture of control system for safety performance at construction sites. It is possible that lack of knowledge about safety management in transition period is the main reason of

this bad situation. So, it is expected that the improvement of safety management knowledge should be provided to top managers to raise safety performance in Construction Industry in Laos (CIL).

For safety performance of CIL during the last five years, 13.3% of the top managers thought "no change" during this period, 20% of them thought "fallen slowly". Only 18.8% of them thought safety performance at the firm level had rapidly risen during the last five years. These above rates revealed that some of top managements did not care about safety performance in their firm. It should be considered as obstructions, which can not create positive attitudes towards safety performance improvement and accident prevention programs. In addition, 53% of top management thought that sufficient providing PPE to workers led to good safety but low productivity. This resulted in poor top management practices towards labor safety performance and safety improvement at the firm level

Table 5. Frequency distribution of opinions towards "the existence of control system for safety performance at sites"

The top management opinions	Frequency distribution of opinions towards the statement			Total
	Nonexistence	Existent but not effective	Existent and effective	
Frequency Percent	3 18.8%	6 37.5%	7 43.8%	16 100%

5. Recommendation for further studies

The first limitation regard to the size of the survey sample, in which only 50 injured workers were interviewed. The limited number of injured workers may not reflect the actual construction safety issues as a larger scope. Moreover, the data used in this survey were collected from construction companies located mainly in Vientiane, thus may not represent a common situation on construction safety for the entire country. Further studies should conduct a larger-scale survey on safety with construction companies throughout the country. This will provide a greater number of accident cases in the survey sample, and obviously yielding more convincing results. Finally, the period of data collection should be extended as the survey is a work in progress and it should be steadily updated to incorporate new possibilities of accident occurrences. Developing a complete injury prevention program for construction firms is also need to raise accident prevention in Construction Industry in PDRL.

6. Conclusion

In conclusion, this research may help construction project parties in PDRL to recognize the real causes of construction injuries and the properly problems of their safety management. Stepping on/and striking against objects, struck by falling objects are typical construction injuries. The result also reveals that both construction working environments and safety attitudes are knotty.

The results also showed that most of injured workers were apprentices and had no high education, so it revealed shortcomings of construction workforce. The majority of them had

no formal safety training. Injured workers satisfaction is negative with many adverse factors such as low wage, insufficient providing of PPE, and overtime working. In the psychological aspects, most of injured workers were not satisfied with foremen behaviors but reserved a friendly relationship to other members of their crew. Besides, they seldom received praise for their well done tasks. Also, this research showed that injured construction workers are not sufficiently trained in standard safety procedures.

In addition, the results indicated that top managers gained much experience, along working time at current companies and had high education. However, most of them were lack of formal safety training. A careful analysis of tabular data shows that top managers really were aware of the importance of labor safety improvement in CIL by their work experiences. The results also provide a basis for problems, which results in poor top management practices towards labor safety performance, safety improvement.

The study proposes contractor/subcontractor safety performance should be a crucial criterion of any bidding evaluation process. A sound construction-safety program should be compulsory before a contractor receive an approval of project commencement. During the construction project, safety procedures should be properly planned, monitored, controlled and re-planned to continuously enhance a good safety image and to motivate employees to carry out the work in an accident-free manner. Safety performance improvement has both tangible and intangible benefits. Finally, excellent safety performance is obviously one of competitive advantages in today's construction business environment.

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