

Evaluation Major Accidents and Original Influence Factors on Safety Performance of Foreign Workers in Building Projects

Borvorn Israngura Na Ayudhya and Jing Geoqing

Abstract - The exploration and analysis of influencing factors to safety performance can lead to reduction and prevention of their occupational injuries due to accidents in construction project. Hence, this study was conducted with the aim to identify influenced factors related to occupational accidents and injuries on building construction sites in Bangkok and vicinity area. Data included the survey information of 400 respondents. Data analysis was carried out using Relative Important Index (RII). The results of survey indicated that common types of occupation injuries were puncture and penetrating wound, dislocation or displacement of bone, abrasion or laceration and bone fracture. Thai workers admitted that equipment, safety personnel, production pressure, safety rules and work overload has affected to their safety performance of their daily working time. While, foreign workers showed their attitudes on safety performance as safety culture, reward and penalty, management focus on safety job satisfaction and management concern/involvement were factors which influenced safety performance. Therefore, to mitigate and prevent the rate of such accidents, all these factors should be regarded in safety improvement programme.

Index Terms – Accident, Building, Foreigner, Safety performance, Worker.

INTRODUCTION

According to the Thailand Development Research Institute [1], the construction sector employs about 2.2 million workers (of whom 300,000 are registered foreign workers) but could accommodate up to 2.9 million due to ongoing growth in the property sector and public infrastructure projects. Despite of shortage of labour in construction industry, construction industry has still enormously contributed to national economy. The number of fatalities and non-fatalities are still the highest when is compared to other industries. The number of accidents in construction industry was 8,773 cases and 7,129 cases in 2012 and 2016 respectively [2]-[3]. The implementation of proper and effective health and safety policy on construction site appeared to be an essential for all labours and engineers. The hazards must be clearly understood by all the workers and engineers working on site especially those who unskilled and semi-labour in a construction project. All party involved in construction project should also put safety concerns as their main priority before and during

construction until the construction has been delivered. Therefore, the aim of this study is to identify the common cause of accidents to foreign workers and safety performance of foreign workers who are working in the Thailand's building projects.

LITERATURE REVIEWS

The number of accidents and fatalities reflected the level of attention in public health and safety policies. By ignoring safety procedures, it could eventually lead to loss of organs or death. It appeared that construction products, mostly fixed in location and the project participants differed from project to project. It caused difficulties in applying experiences and knowledge gained from one to another project. Addition, contractor influenced directly to subcontractors' approach to health and safety matters. Furthermore, the competition can also lead to the lowest cost solution which tried to minimise health and safety procedures. In contrast, contractors should deploy monitoring risk management plan on a daily basis with specific guidelines. It helped to minimise cost overruns and change orders. In order to minimise the risks, bidder qualification should also be introduced. Other researchers also studied and analysed the safety characteristics of the accident. Chi *et al.*, [4] analysed the accident patterns and prevention strategies of falling accidents in the construction industry. Xia *et al.*, [5] investigated injury among migrant workers in Changning district area China, they found that the first four injuries were incised and penetrating, falling, traffic injury and burning. Ceric [6] and Zerjav and Ceric [7] had mentioned poor communication as one of the safety-related problems with foreign employees. Previous studies mainly identified different culture, background, and language of foreign workers, but little attention had been paid to safety perception. Addition, difficulty in changing behaviour from normal practice to safety practice of workers could still be found. Therefore, safety perception between foreign and Thai workers at building construction sites in Thailand was compared. In order to provide a better safety to foreign workers, a questionnaire survey was conducted at building construction projects. This helps to conclude the best education method for better safety procedure.

METHODOLOGY

This study was based on qualitative and quantitative approaches. Qualitatively, 13 most commonly causes of accidents and injuries to foreign workers were found. These causes had been identified based on both knowledge obtained from literature review and discussion among practitioners (owner, main contractor, subcontractor, consultant and foreign workers). Several data collection techniques (archival records, interviews, direct observation and participant observation) were used. The parties involved in safety performance were interviewed (owners, main contractors, subcontractors, consultants and foreign workers). However, the level of workforce was divided into three levels. The first level was managerial staff (i.e., project directors, project managers, contract managers, safety managers, and site agents). The second level was supervisory/technical staff (i.e., engineers, safety officers, safety supervisors, project coordinators, and supervisors). The third level was onsite workers (i.e., construction workers and plant operators). Addition, an interview technique was employed for open-ended discussion. The probing questions were also adopted. This would enable to insight interviewees' opinions on accidents and safety issues. Quantitatively, 250 questionnaires were distributed randomly to parties involved in safety performance. This would help to get their opinion about the influence of the identified factors.

I. Relative Importance Index (RII)

A five point Likert scale was used to sort the ranking output of the different factors that influence safety performance of foreign workers, the Relative Importance Index (RII) was applied. This method transformed the five-point Likert scale to determine the ranking of each factor. The value of RII was ranged from 0 to 1 by using the following equation..

$$RII = \frac{\sum_{i=1}^5 a_i x_i}{5 \times N} \quad (1)$$

Where

a_i = A constant expressing the weight of the i th response

x_i = Frequency of the i th response of the total responses for each cause,

i = The response category index ($i = 1, 2, 3, 4$ and 5 respectively)

N = The total number of respondents.

FINDINGS AND DISCUSSIONS

Table I
QUESTIONNAIRES DETAILS

Organisation	Number of questionnaires	Number of
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Table II
COMPARISON OF OCCUPATIONAL INJURIES BY INJURED ORGANS

Factors	Thai workers			Foreign workers			Factors	Thai workers			Foreign workers		
	RII	Rank	Overall	RII	Rank	Overall		RII	Rank	Overall	RII	Rank	Overall
Motivation	73.8	7		37.1	9		Work pressure	78.5	2		75.5	2	
Job motivators	56.0	6	54	23.0	6	39	Production pressure	68.7	1	3	83.6	4	26
wage	67.7	5	52	26.6	4	27	Work overload	75.0	2	5	81.5	2	18
job satisfaction	91.3	3	36	61.7	2	4	Fatigue and burnout	74.2	5	28	65.9	3	20

	Sent	Return	questionnaires	
			Percentage return	Foreign workers
Owner/Developer	40	27	67.5	-
Contractors	60	32	53.3	49
Subcontractors	60	38	63.3	201
Consultants	40	24	60	-
Sub-total	200	150	75	250
Total			400	

In Table I showed questionnaires details and a comparative between two nationalities on motivation aspect was showed in Table II. The Thai workers exhibited a greater positive attitude on motivation category than foreign workers. Thai and foreign workers gave their high relative importance index as 73.8 percent and 37.1 percent respectively. It appeared foreign workers did not feeling motivation category influenced a safety performance. Similar result was found by other authors [8]. In motivation category, it was also found that Thai workers weighted a reward and penalty factor as the highest relative importance factor which influenced safety performance to their workers. Regarding to rules and regulations category, it was found that Thai workers paid their most of attention to safety rule factor which similarly to foreign workers. The relative importance weight of rules and regulation category which provided by Thai and foreign workers, were 79.0 and 73.5 respectively. It was also found from interview that contractors and subcontractors' attitude toward safety were ranged from ignorance, minimal compliance to total commitment. While, investment and costs category, it was found that both Thai and foreign workers had similar agreement on safety budget which had influenced on safety performance. It reflected to safety equipment and facilities costs. Interviewees admitted that safety equipment and facilities were provided to protect workers from potential hazards on construction sites. It ranged from personal protective equipment, safety fences and other facilities that facilitated the workers to carry out their work safely. Huang and Snell [9] found that worker with poor attitude often showed hubris and dereliction of duty. In motivation category, it was also found that Thai workers weighted a reward and penalty factor as the highest relative importance factor which influenced safety performance to their workers. As far as resource and equipment category was concerned, it was found that both Thai and foreign workers gave their priority concern to resource and equipment category. It was ranked as fifth and first place in overall comparative nine categories by Thai and foreign workers respectively. Interviewees admitted that employees were more accident prone than others who have a preventive awareness toward risk of accident in construction site. Similar behavior was found by other authors [10].

reward and penalty	91.7	1	14	74.0	1	2	Working pace	15.8	4	21	69.3	7	54
Incentive programs	86.8	2	15	73.0	3	6	Working time	63.2	6	34	63.8	5	34
Co-worker's influence	65.0	4	38	57.7	5	32	Overtime work	77.3	3	6	78.9	1	13
Means	76.4			52.7			Schedule delay	24.0	7	50	31.3	6	49
Rules and regulations	73.5	3		79.0	5		Means	56.9			67.8		
safety rules	81.8	1	4	76.2	1	16	Culture and climate	60.5	7		59.5	8	
Rules compliance	76.2	3	11	74.3	2	19	Safety culture	65.2	2	31	91.8	1	1
Paperwork of regulations	78.6	2	7	59.5	3	37	Safety climate	71.5	1	18	77.3	2	13
Means	78.9			70.0			Supervisory environment	51.3	5	45	54.2	5	41
Safety investment and costs	81.8	6		64.9	3		Supportive environment	63.9	3	33	73.8	3	21
Safety budget	69.3	1	19	70.4	1	25	Leadership	55.4	4	41	72.0	4	23
Costs of accidents	66.0	2	43	54.7	2	30	Means	61.5			73.8		
Return of investment on safety	15.8	3	46	49.9	3	54	Safety programs and management systems	70.8	4		78.8	6	
Means	50.4			58.3			Limited management time	52.8	44	44	21.0	16	52
Resource and equipment	86.0	1		68.3	3		Management commitment	67.4	26	26	73.5	6	22
Safety personnel	76.8	2	2	84.1	2	14	Self-example	47.4	48	48	24.2	13	48
Resource constraints	53.0	3	12	75.8	3	42	Management work pressure	26.9	51	51	82.0	4	9
Equipment	85.5	1	1	88.8	1	7	Pre-hire screening of employees	62.3	35	35	49.3	10	43
Means	71.8			82.9			Management focus on safety	56.1	39	39	91.5	1	3
Organization	41.0	8		34.8	9		Management concern/involvement	65.9	28	27	89.7	2	5
Company's revenue	67.9	4	25	60.0	6	36	Communication and information	71.8	17	17	81.5	5	10
Company reputation	49.6	6	47	80.2	1	11	Safety instructions	77.0	9	9	82.7	3	8
Company's costs	72.0	2	16	77.5	2	12	Safety control mechanisms	68.1	24	24	64.5	9	33
Company size	25.9	8	53	76.0	3	17	Safety programs	58.7	37	37	65.7	8	31
Client's control	34.8	7	49	61.7	5	35	Safety management systems	70.1	20	20	33.7	11	45
Involvement of subcontractors	55.0	5	42	46.5	7	44	Risk assessment implementation	64.3	32	32	23.2	15	51
Number of subcontractors	75.4	1	13	67.8	4	27	Safety policies and procedures	55.7	38	40	66.8	7	29
Number of employees/crew size	68.3	3	23	23.2	8	51	Safety committees/meetings	66.1	27	34	25.0	14	47
Means	56.1			61.6			Safety management practices and skills	68.7	22	22	25.5	12	46
Work condition	82.6	1		80.3	4		Means	61.2			56.2		
Work environment	65.4	3	30	70.0	1	24							
Exposure to hazard/unsafe work situation	78.1	1	8	58.2	2	38							
Project hazard level	76.3	2	10	55.8	3	40							
Means	73.3			61.3									

Safety investments comprised accident prevention programme which lied on contractor and subcontractor's responsibilities. Interviewees mentioned that most of their safety investment and costs went to staffing costs, mandatory training costs and in-house safety training cost. These were main expenditure of safety. In resource and equipment category, it was ranked as fifth and first place in overall comparative nine categories by Thai and foreign

workers respectively. The relative importance weight of equipment factor was given as the highest among three factors in its category. The right usage of machinery and tools must be done by all workers. Interviewees admitted that some of their employees were more accident prone than others while some other employees have a preventive awareness toward risk of accident in construction site. Similar behaviour was found by other authors [11]. For

work pressure category, Thai workers gave most of their relative importance weight to production pressure factor while foreign workers gave their weight to overtime work factor as the most influenced factor to safety performance. The work pressure was negatively related to safety behaviour. The perception of work pressure reduced workers' tendency for engaging in safety behaviour was similar found by Means *et al.*, [12]. In-experienced workers often had difficulties in comprehending the safety rules and procedures given to them. It was found that most of foreign workers were engaged in more risky tasks than local workers. Similar results were found by Roelofs *et al.*, [13]. The risk perception might be shaped by the norm and practices in their home countries. The safety standards and requirements of these home countries were relatively lower than those where Thai workers. Interviewees admitted that there might be more than one occasion which compromised or ignored safety rules to get the work done. Addition, there seldom took risks when wearing personal protective equipment.

CONCLUSIONS

- The common types of occupational injuries in building construction projects were penetrating wound, dislocation of bone and abrasion and bone fracture.
- From results of study showed that Thai workers paid their attentions to equipment, safety personnel, production pressure, safety rules and work overload factor which influenced safety performance of their daily working time. While, foreign workers showed their attitudes on safety performance as safety culture, reward and penalty, management focus on safety job satisfaction and management concern/involvement were factors which influenced safety performance.
- It was found that two nationalities had mutual correlation on self-example, schedule delay, working time, safety instructions and involvement of subcontractors factor which influenced on safety performance.
- The safety cost was inevitably effect to the investment of all practitioners' organization. It can impact to productivities and quality.
- The safety procedures can be compromised when project delivery is constrained.

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