

An Empirical Assessment of Factors Affecting Safety Performance of Subcontractors: The US Industry Perspective

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Abstract

Subcontractors perform most of the construction works which is apparent in different activities of construction. Therefore, subcontractors need more attention in order to minimize the fatalities and accidents in the industry. The aim of this paper is to identify, evaluate, and rank factors that influence safety performance according to their relative importance. The study was initiated with literature review in the area of safety management, however the study heavily relies on the primary data that is collected via questionnaire survey. The analysis of the responses concluded that reported accident rates will decrease among subcontractors and their workers if new workers are trained well, on the work site workers are informed about dangerous places, a workable safety plan is well preplanned. The results also showed that reported accident rates increased among subcontractors when old, unsafe equipment is used and due to difficulty of the construction sites. From the analysis of the responses, it is recommended that owners and General Contractors need to stipulate strict clauses for safety in the contract for improving safety record of subcontractors, construction workers must receive proper job related safety training and subcontractors and workers should attend continuing safety programs on regular basis as part of their prerequisite to work on construction sites.

Keywords

Subcontractors, safety management, safety plan, safety training

1. Introduction

In a market-driven society, it is common for construction stakeholders, especially those at the lower end of the supply chain, to concentrate exclusively on completing projects to the required quality standard with the minimum time and cost. Safety is, therefore, regarded as a secondary concern. The lack of motivation in fostering a safety culture at both organizational and project levels have resulted in a poor safety record in general, with construction being one of the most hazardous industries globally.

In view of the importance of Occupational Health and Safety (OHS), countries such as the United Kingdom (UK), Singapore and Hong Kong (HK) have adopted a self-regulatory approach to safety, whereby proprietors (including contractors) are required to develop, implement and maintain safety management systems. In addition to setting out safety objectives and targets in their safety management systems, construction firms need a rational framework for Safety Performance Evaluation (SPE) in order to objectively gauge their effectiveness in accident prevention over time. A systematic SPE framework

will also help companies to identify potential hazards at an early stage so as to help avoid unnecessary losses in life and cost.

The subject of safety attitudes and safety performance in the construction industry is a complex phenomenon, and with the increasing amount of jobs being subcontracted in the US it has become more difficult to ensure the safety and health of workers. Subcontractors are considered to be more significant role in construction safety compared to general contractors. It is they who perform the work on construction sites, which in turn have more responsibilities about the safety of the workers. By reviewing past studies, it has been found that most of safety performance of construction company depends on the subcontractors' safety performance. The U.S. Bureau of Labor Statistics reported that in 2010 fatal occupational injuries rate for roofers was 33.5 per 100,000 thousand of workers and for structural iron and steel workers this rate was 61.0 per 100,000 thousand of workers (U.S. Department of Labor, 2010). The above statistics signifies that analyzing the factors that affect the safety performance of subcontractors is very critical.

2. Literature Review

Construction relies heavily on subcontractors and their workers who are employed by prime contractors. Subcontractors are the wheels which carry the project to completion (Shimizu and Cardoso, 2002) and therefore, are the dynamic of the construction industry. In general, accidents at work occur either due to lack of knowledge or training, a lack of supervision, or a lack of means to carry out the task safely, or alternatively, due to an error of judgment, carelessness, apathy or downright reckless. In addition to these factors, the short term and transitory nature of the construction industry, the lack of a controlled working environment and the complexity and diversity of the size of organizations, all have an effect on safety performance within the industry.

The quality of subcontractors is significant as it has a direct bearing on how well tasks are performed for the general contractors. Sikes et al. (2000) stated that the selection of subcontractors is crucial to both the safety and success of a project. This selection-for-safety practice may eliminate subcontractors with the lowest bid, and who do not have satisfactory safety record. Subcontractors with a poor history of safety performance are eliminated and subcontractors who enforced safety program are selected (Bertagnoli, 2002). Table 1 summarizes the pertinent studies that outline the factors affecting the safety performance.

Table 1: Factors affecting Safety Performance in International Literature (Adopted from Abdul-Rashid, Bassioni, & Bawazeer, 2007)

Authors	Factors affecting Safety Performance
Jaselskis, <i>et al.</i> (1996)	<ul style="list-style-type: none"> • Upper management support. • Time devoted to safety issues for the company safety coordinator. • Number of informal safety inspections made by the company safety coordinator. • Meetings with the field safety representatives and craft workers. • Length and detail of the company safety program. • Safety training for new foremen and safety coordinators. • Specialty contractor safety management. • Company safety expenditures. • Increased project manager experience level. • More supportive upper management attitude towards safety. • Reduced project team turnover (team stability). • Increased time devoted to safety for the project safety representative. • More formal meetings with supervisors and specialty contractors. • More informal safety meetings with supervisors.

	<ul style="list-style-type: none"> • A greater number of informal site safety inspections. • Increased budget allocation to safety awards.
Sawacha, <i>et al.</i> (1999)	<ul style="list-style-type: none"> • Management talks on safety. • Provision of safety booklets. • Provision of safety equipment. • Providing safety environment. • Appointing a trained safety representative on site.
Hinze and Gambatese (2003)	<ul style="list-style-type: none"> • Minimizing worker turnover. • Implementing employee drug testing with various factors initiating the testing. • Training with the assistance of contractor associations. • Growth in company size.
Fang, <i>et al.</i> (2004a)	<ul style="list-style-type: none"> • Frequency of a crew's receiving safety inspection. • Frequency of a foreman's presence in safety meeting. • Frequency of a foreman's reporting safety related matters to manager. • Frequency of a foreman's announcing safety related matters to workers. • Frequency of a foreman's correcting workers' unsafe actions. • Frequency of a worker's smoking on the site. • Frequency of a worker's breaking safety regulations. • Hours of safety education per year a worker receives. • Frequency of a worker's partners reminding him of personal safety. • Frequency of a crew's receiving notices of hazard removal. • Frequency of a crew's breaking safety regulations. • Frequency of a crew's suffering safety penalty. • Frequency of a project manager's presence in safety meeting. • Frequency of a project manager's hearing safety reports. • Frequency of a project manager's discussing safety matters with subcontractors. • Days of safety education per year a safety officer receives. • Hours of safety education per year a foreman receives. • Frequency of a foreman's reminding new workers of safety regulations. • Ratio of workers whose occupational experience is less than 1 year to total workers on site.
Fang, <i>et al.</i> (2004b)	<ul style="list-style-type: none"> • Quantity of safety supervisors. • Involvement of contractor top management. • Authority of safety supervisor. • Authority of foremen. • Size of the crew. • Safety investment. • Worker compensation insurance. • Safety investment on personal protective equipment. • Factors related to the relationship between management and labor on site.
Tam, <i>et al.</i> (2004)	<ul style="list-style-type: none"> • Poor safety awareness of top management. • Lack of training. • Poor safety awareness of project managers. • Reluctance to input resources to safety. • Reckless operations.
Ng, <i>et al.</i> (2005)	<ul style="list-style-type: none"> • Implementation of safety management system in accordance with legislation. • Compliance with occupational safety and health legislation, codes and standards. • Definition of safety responsibility.

3. Methodology

The study commenced with the literature in the area of safety management in order to skim out factors that affect safety performance. Subsequently, an initial list of the subcontractor safety performance factors was obtained via pilot interviews with subcontractors in various trades. Thirdly, a survey was carried out from the subcontractors operating in the US construction industry to determine most important factors that affect the safety performance in construction and also to benchmark as to how many companies were familiar with OSHA Standards and used it on their construction sites. Also, focus was given on their views about Safety practices and training if they had implemented it. Some companies had correspondence through calls and e-mails with the author where discussion about safety and its implementation and usefulness to them was carried out. A sample size of 50 companies was selected to whom questionnaires were sent via e-mail and faxes. The analysis was carried out on a response rate of 46%.

4. Analysis

The analysis of the received responses is presented in succeeding sub-sections:

4.1 Safety Performance & Practices

From analysis of the responses it can be concluded that almost all of the organization give their utmost attention to acquire commitment from their sub-contractors to abide by the safety regulations set for them. Furthermore they invest heavily in terms of human resources to achieve adequate level of performance for themselves and their sub-contractors. This finding leads to the belief that within the context of U.S. construction industry there is a positive inclination towards integrating the efforts of all drivers of the project to achieve optimum safety performance on their projects.

4.2 Workspace Safety Non-Performance

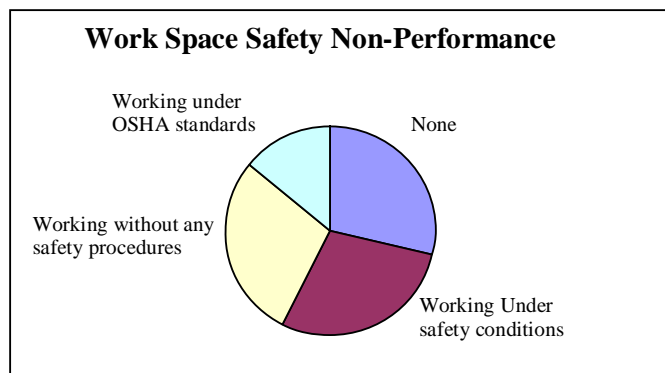


Figure 1: Work Space Non-Performance

As depicted in Figure 1, working under OSHA standards causes relatively minimal work space troubles, indicating that organizations that participated in the survey firmly believe that such standardization leads to a positive and productive work place. Whereas there was a section of respondents, that were not that too much satisfied with the fact that, “only having standards will lead to less work place safety non-performance” hinting that in order to achieve enhanced safety performance, a number of factors including cultural and behavioral aspects must be over hauled to achieve desired results.

4.3 OSHA standards Implementation

The analysis of the responses concludes that all of the participating organizations have implemented OSHA standards at both organizational and project level. This is an encouraging finding because it leads to a belief of standardization in the safety context. Hence, it can be assumed that the clients get the same value from majority of the construction service providers in the local construction sector.

4.4 Practicing Safety Improves Overall Effectiveness

The analysis of the responses propagates that through their practice, the respondents believe that safety has overhauled the overall operations and has improved the effectiveness of their operations. This is extremely helpful in advocating that safety has a grand impact on the macro-level operations of the project and it is not only limited to minimizing accidents only.

4.5 Safety Affordability

From the analysis of the responses it can be extracted that Safety Practices, training and equipment will take some time before companies of all sizes start making use due to the capital cost. The cost not only with respect to buying the personal protective equipment but also training the personnel and the money that will used/lost in the initial stages of implementation.

4.6 Safety Practice Recommendation

The analysis of the responses suggests that, all participating organizations were well aware of the benefits of safe practices so much so that even if they did not practice it, they were recommending others to follow the safe practices on their projects. From this understanding it can be believed that the local construction industry is demonstrating signs of maturity with reference to safety management systems, mechanisms and practices.

4.7 Investment in Safety Training

From the analysis of the responses it can be deduced that all the companies felt that it is worth to invest in training employees in various safety disciplines. These companies believe that by investing in training they will be receiving much more than they are training. Investing in training employees in safety helps the company in every project they do be safe and thus reduce insurance premiums and improve contractor rating.

4.8 Causes of Poor Safety Performance

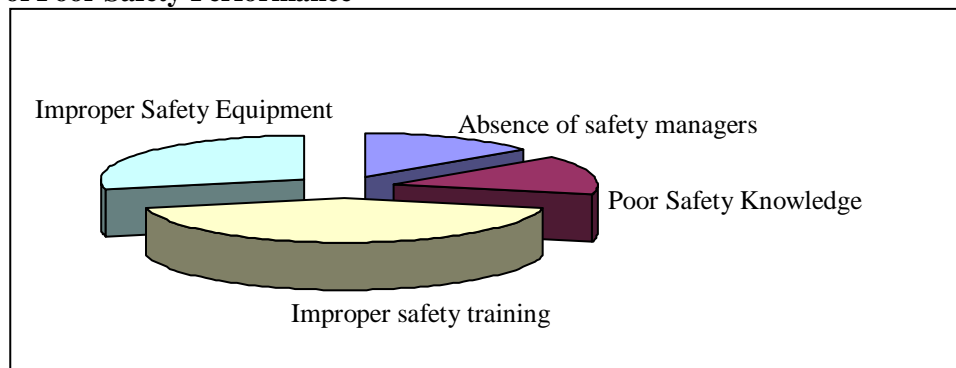


Figure 2: Causes of Poor Safety

As per Figure 2, the analysis of the responses shows that, “Improper safety training” has been the leading case cause of poor safety performance followed by improper safety equipment, absence of safety managers and finally poor knowledge of safety. This finding leads to an understanding that, in order to bring about a meaningful improvement in the safety scenario of the local construction sector, the monetary and organizational commitment must target the above mentioned causes in the same order of occurrence.

5. Conclusions & Recommendations

Following are the observations of this survey:

- Many companies have implemented Building Safety in their projects. Approximately 71% of the companies have implemented safety training systems and mechanisms but companies lacking trained personnel cannot take the full advantage even after investing.
- Safety Practices, training and equipment will take some time before companies of all sizes start making use due to the capital cost. The cost not only with respect to buying the equipment but also training the personnel and the money that will used/lost in the initial stages of implementation.
- However the horizon is bright for Safety. As analysis of responses suggests the companies that had implemented safety standards together with practicing safety on their projects and were happy with the results.
- Another positive fact is that all the companies that responded, claimed that even if they did or did not implement safety training themselves they would recommend other companies to implement safety training. This may be because the companies that did not implement were not ready to implement due to lack of money or resources. But they did find the safety training to be resourceful and promising for every company.
- Also all the companies felt that it is worth to invest in training employees in various safety disciplines. These companies believe that by investing in training they will be receiving much more than they are training. Investing in training employees in safety helps the company in every project they do be safe.
- A workable preplanned site safety plan is required to reduce accident rates. The injury rate increases when subcontractors use old, unsafe equipment, and also when the job has complex and difficult features.

The construction industry plays a vital role in the U.S national economy. Subcontractors provide economic flexibility and technical expertise to the construction industry and the safety performances of these subcontractors are investigated in this study. This study indicated that the injury rate decreases among subcontractors and their workers if new workers are trained well in job tasks and are informed about job risks and associated hazards. Furthermore, a workable preplanned site safety plan is required to reduce accident rates. The injury rate increases when subcontractors use old, unsafe equipment, and also when the job has complex and difficult features. It is interesting to note that although incentives may play an important role in altering workers actions and help in reducing injuries, there is no guarantee that they will lead to a good overall safety record. Financial constraints and hard economic circumstances have a critical effect on safety performance because it may lead workers and subcontractors to accepting work under unsafe conditions.

Modern construction industry requirements are that subcontractors and their workers must change their attitudes towards safety behavior and site conditions. All construction industry stakeholders have a responsibility for improving or upraising safety performance on site. Results indicate that training, contract items, safety plans, motivation, safety rules and regulations, hiring of safety officers, avoiding worker turnover and worker replacement are the important elements for improving site safety. Owners

and general contractors have to stipulate in their contracts with subcontractors an amount that must be set aside for safety training, personal protective equipment and other preventive measures.

Construction workers must receive proper job-related safety and health training with a safety logbook. Workers must be required to fill in the safety logbook to reflect their contribution towards site safety, as well as for using the record to improve their safety performance. The study recommends that hiring a safety officer is critical if safety performance is to be improved; however, employing a safety officer either part-time or full-time must depend upon the work volume. General contractors have to keep full details of the safety records of specialist contractors as this should have impact on their suitability for future subcontracted works. It is recommended that subcontractors and their workers should attend safety programs regularly on site as part of their obligation to work on that site. Finally, subcontractors should be required to modernize equipment, machines and do regular maintenance if they are to help keep site operations safe.

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