

**AN EMPIRICAL ASSESSMENT OF SUBCONTRACTORS' PERCEPTION OF
SAFETY AND FACTORS AFFECTING SAFETY PERFORMANCE OF
SUBCONTRACTORS IN THE US CONSTRUCTION INDUSTRY**

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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 in Florida region of the US construction industry. Data analysis revealed that accidents have a high potential to decrease among subcontractors and their workers if; 1) newly inducted workers are trained well; 2) Workers are appropriately informed about unsafe places on the site; 3) A well-prepared safety plan is enacted upon. Results also indicated that reported accident rates have increased among subcontractors, primarily owing to the following reasons: 1) When using old, unsafe equipment; and 2) Due to the difficulty of the construction sites. It is recommended that 1) Owners and General Contractors need to stipulate strict clauses for safety in the contract for improving safety record of subcontractors; 2) Construction workers must receive proper job related safety training; and 3) 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 AND BACKGROUND

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.

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 recklessness. 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. In construction, it is suggested that 'unsafe behavior' is the most significant factor in the cause of site accidents and therefore provides evidence of a poor safety culture.

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 US Department 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. The above statistics signifies that analyzing the factors that affect the safety performance of subcontractors is very critical.

Literature suggests that the safety performance of a subcontractor is impacted by historical, economical, psychological, technical, procedural, organizational and environmental factors. The historical factor can be assessed by the background and characteristics of the individual, such as

age and experience. The economic factor can be determined by the monetary values which are associated with safety such as, hazard pay. The psychological factor can be assessed by the safety behavior of fellow workers on site including supervisors. The technical and procedural factors can be assessed by the provision of training and handling of safety equipment on site. The organizational and environmental factors can be assessed by the type of policy that the management adapts to site safety.

2. SCOPE AND OBJECTIVE

The objective of this study is to identify the factors which influence safety performance of subcontractors. The scope is limited to collecting and analyzing data from subcontractors in the South Florida region only.

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 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 43 companies was selected to whom questionnaires were sent via e-mail and faxes. The analysis was carried out on a response rate of 46.5% (20 companies).

4. RESULTS

4.1. Factors Affecting Subcontractor Safety Performance

As per the survey results, the primary factors which affect the safety performance of subcontractors can be classified as follows:

4.1.1. Historical and Environmental Factors

Historical issues and economical issues are two of the prominent factors influencing the safety of subcontractors. The historical factors are based on operative's age and operative's job experience. Subcontractors usually hire young workers with little or no job experience. The average of construction workers is fairly young and connected with it is a study conducted in 2003 about Nevada contractors suggesting that higher turnover rates are associated with higher injury rates, which has also been advocated by Hinze and Gambatese (2003).The

workforce hired by subcontractors is usually for a short period of time because they often experience high turnover rates. New hires have been noted as the workers who are most susceptible to being injured (as also suggested by Hinze (1997)).

4.1.2. Economical Factors

In the US, subcontracting is often organized in the form of small businesses. These small businesses regularly face fierce competition from other small businesses in the construction industry. The environment can be very hostile and usually requires a subcontractor to be very aggressive to be able to survive and make a profit. Subcontractors, in general, are reticent to spend in safety because of fear that will incur losses by doing so. But the facts reveal totally the opposite. Every year, workplace injuries, illnesses and fatalities cost businesses in America more than \$170 billion. In today's highly competitive global economy, when employers are looking for ways to reduce costs, any savings is important. The number for fatal occupational injuries for the South Florida region was found to be 03 in 2010. This means that workplace deaths exist, and need to be addressed by promoting safety practices.

4.1.3. Organizational Factors

The safety performance of subcontractor is primarily dependent upon safety policy of the company, relationship with workers, and existence of safety representatives, controls on subcontractor safety behavior and talk of safety which are considered to be the organizational factors. They are briefly discussed in following sub sections.

4.1.3.1 Worker-Management Relationship

The worker-Management relationship depends on the interaction between the co-workers about the safety policy implemented by the company. Frequent interaction between foremen, safety managers, and site employees is necessary to ensure maximized productivity and quality of work. The general contractors have a moderate level of interaction with the subcontractors. GC usually monitors the work performed by the subcontractor to ensure compliance with the contract conditions. The level of worker-management relationship can be maximized by having safety meetings every week and by seeking feedback from workers.

4.1.3.2 Controls On Subcontractor Safety Behavior

It is the subcontractor who is going to perform the work on field and hence has the highest level of control must be placed over its safety behavior. Usually, the general contractors have medium level of control over safety behavior. The frequent interaction of GC with the workers is considered to be an important factor in conflicting directions and impedes safety implementation. It is to be enforced that GC should have the authority to direct a subcontractor superintendent to remove specific workers from the site due to unsafe work or behavior.

4.1.3.3 Site Safety Representative

The subcontractor has the responsibility to provide a qualified onsite health and safety representative full time. The subcontractor's designated safety representative must make frequent and regular inspection of the construction worksite to identify and correct any instances of non-compliance with the project safety requirement. The number of safety representative onsite depends on number of workers and contract conditions. As a thumb rule, for 20 workers performing formwork (or any form work stripping), one safety manager is allotted for the job.

4.1.3.4 Safety Committee Policy

The safety committee policy includes the compliance of employee of the company and all standards established by OSHA. It is the subcontractor's responsibility to provide safe and maintain possible work conditions for all workers by promoting the integration of safety management into all construction process. Project managers, construction managers, superintendents, safety representatives, and foremen are responsible for implementing and maintaining an effective safety program. The subcontractor implements the procedure of noncompliance to all subcontractor work on the designated construction site. This type of policy is established to promote safety and eliminate offenders and repeat offenders, and may lead up to contract termination.

4.1.3.5 Talk By Management On Safety

Talk by Management on safety involves the orientation/ education, safety meetings, training, and reporting. The subcontractor has the sole responsibility to assure that new co-workers to be properly trained and provided with the copy of safety manual and any other safety program information. Also, weekly jobsite safety meetings are to be provided to evaluate effectiveness and suggestions for improvement.

4.1.4. Environmental Factors

Environmental factors such as tidy site condition, planned and organized site also plays a vital factor in affecting the safety performance. Working under improper site conditions dramatically increases the chances that an accident will occur. For example, poor housekeeping, broken ladder, or a structurally deficient work platform could result in unexpected severe accidents on construction sites. To prevent the hazards task should be allocated on appropriate conditions. Secondly, actual condition of the site should be observed while performing the work and regular inspection by safety representative will avoid risks.

4.1.5. Procedural Factors

The procedural factors include protective clothing and personal protective equipment. They are briefly discussed in the succeeding sub-sections.

4.1.5.1 Protective Clothing

Protective clothing includes uniforms, overalls, boiler suits, laboratory coats, weatherproof clothing, aprons, gloves and similar items. It is considered to be the responsibility of each department to assess requirements and to provide such items of protective clothing to employees and students as are necessary. Costs incurred should be debited to the departmental account and are not normally recoverable from the general safety account. In special circumstances (e.g. unusual non-routine activities) financial support may be made available from the general safety account on submission of supporting documentation.

4.1.5.2 Personal Protective Equipment (PPE)

PPE includes head, eye, ear, foot and respiratory protective equipment (RPE) together with certain items of PPE required for radiological protection purposes (e.g. lead aprons). It is the responsibility of each department to carefully examine work activities, to identify hazards and assess the risks associated with these and to establish safe systems of work. So far as is reasonably practicable, control measures should be taken to eliminate or minimize hazards and risks to health and safety. The use of PPE should only be considered as a method of control after all other reasonably practicable control measures have been taken.

4.2 Benchmarking Current Safety Status of Subcontractors

The results of the analysis are discussed in the succeeding sub-sections below:

4.2.1 Safety Performance & Practices

As per Figure 1, it is affirming that the sub-contractors operating in the U.S. construction industry are fully aware of the advantages of the safety performance and practices and majority of the respondents suggested they such practices are advantages for their projects in particular and business in general.

4.2.2 Causes of Poor Safety

As shown in Figure 2, many companies have implemented safety in their projects. From the analysis of the responses, approximately 71% of the companies have implemented safety training. These respondents claimed that lack of trained personnel have hampered them to take full advantage even after investing which has proven to be the biggest barrier in implementation of safety management.

4.3 Safety Affordability

As shown in Figure 3, Safety management is affordable by majority of the companies of the survey, however the very small extent that opted "No" may be due to the investment in the initial capital cost. But it is obvious that they after some time such companies will eventually start making progress in this arena realizing its long term cost efficiency. The cost associated not only with the buying of equipment but also training of the personnel and the money that will be expedited in the initial stages of implementation.

4.4 Safety Practice Recommendation

All the companies that responded claimed that even if they did or did not implement Safety training, 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.

4.5 Safety Practices Usefulness

All the companies that had implemented Safety were enjoying the benefits of implementing safety on their projects and were convinced with the results.

4.6 Safety Training Investment

All the respondent organizations believed that it is worth to invest in training employees in various safety disciplines. These companies also believed that by investing in training they will be receiving much more as return on investment. Investing in training employees in safety helps the company in every project they do be safe.

5. CONCLUSIONS AND RECOMMENDATIONS

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 factors affecting safety performance of these subcontractors were 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.

6. REFERENCES

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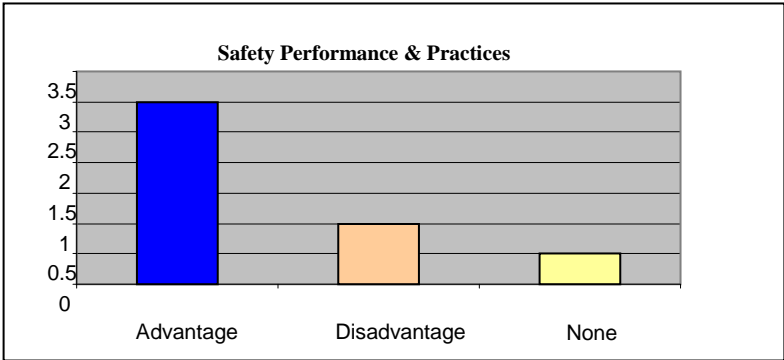


Figure 1: Safety Performance & Practices

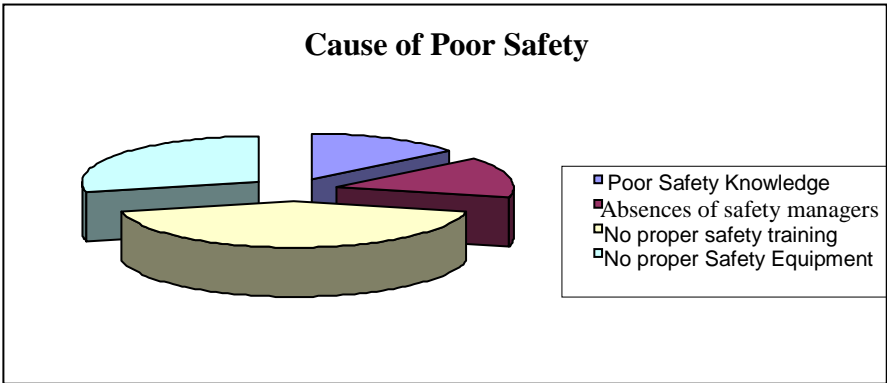


Figure 2: Causes of Poor Safety

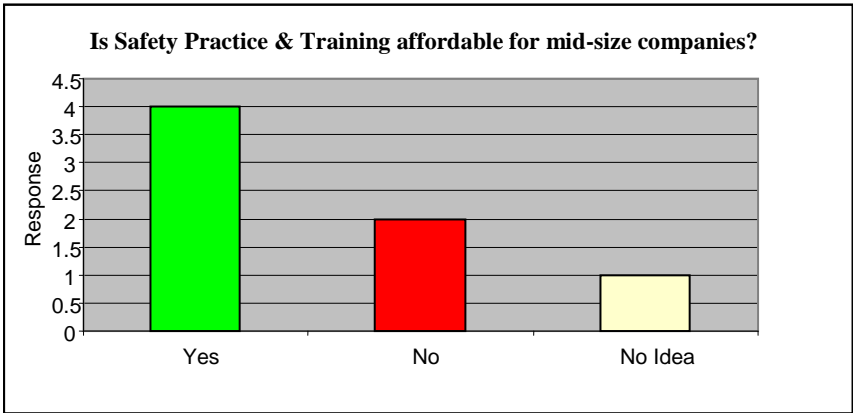


Figure 3: Safety Affordability