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FUTURE PREVENTION MEASURE FOR CONSTRUCTION ACCIDENT ON CONSTRUCTION SITE

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Abstract

General hypotheses are that risk on site has an effect on accident rates and the accident rates affects firm economic performance. On one hand, we obtain a significant positive linear relationship between site risk and accident rate. On the other hand, we find a significant quadratic relationship (inverted U shape) between accident rate and economic firm performance. Our empirical evidences suggest a complex relationship between those variables. Specifically, for a low range of accidents we can observe that company profitability increases while accident rate grows up, arriving to a tipping point from which more additional accidents will reduce the company profitability.

It is the responsibility of every worker to assist in maintaining a safe work environment. So this paper shows some main factor behind accident at sites and measure to prevent them.

Keywords

Construction, Accident and Prevention Measure

1. Introduction

In order to improve its poor performance in safety, the predominant strategy of the construction industry has been the multiplication of prevention norms and programs (for example: OSHA Law & Regulations in the U.S.; the Program of the Conditions and Environment in the Construction Industry (PCMAT) demanded by NR-18, organized by the Ministry of Work and Employment (MTE) in Brazil; and the actions to improve safety and health in construction promoted by the European Agency for Safety and Health at Work (EU-OSHA)). More recently, such safety practices in the construction industry have been enriched by proposals of design development aiming at safety at construction sites through the implementation of the concept of Construction Hazards Prevention through Design. [2]

Construction is one of the most dangerous ways to make a living. For the past few years, a number of fatal accidents took place while working at site. It attracts the public attention and expects the Government to do something to prevent the accident or improve the situation. This paper tries to analyse the causes of accidents, to propose preventive measures against these fatal accidents and finally making recommendations on how to control and monitor the safety issues for workers working at height. The writer is of the opinion that the major cause of the accident is the human factor and job factor. The only way to stop the occurrence of fatal accident of persons is to amend the law in such a way that every party involve has to bear the legal responsibility, both criminal and civil if negligence is found in his part. [5]

An "accident" is an unplanned, undesired event which may or may not result in injury or property damage that interferes with the completion of an assigned task. A "near miss" is a form of an accident that does not result in injury or property damage. The causes of accidents can be broken down into two basic components, unsafe conditions and unsafe acts. Unsafe conditions are hazardous conditions or circumstances that could lead directly to an accident. An unsafe act occurs when a worker ignores or is not aware of a standard operating procedure or safe work practice designed to protect the worker and prevent accidents. [3]

The principle of designing considering the worker's safety is starting to be disseminated in the construction industry, It is believed that the prevention capacity is reduced when the consideration for safety is absent in the phases prior to the construction But ''the production system, being the subject of the design, results from the integration of different types of knowledge and aims to perform one or several required functions'' [4]

[6] Reports cases that show how conditions not foreseen in phases prior to the construction may be related to accidents. One of the cases is of a crane operator who was assigned to remove a roof near an external wall. When the section of the roof was removed, the external wall, which had not been designed to be free from the roof, fell over the crane and smashed the worker. The analysis of this accident led to the development of safety recommendations during the execution of services in the following designs. Before the demolition and removal of any structure, there must be an engineering research accomplished by a competent person to determine the state of the structure, evaluate the possibility of unintended collapse and predict a plan of potential risks.

The construction site is one of the most dangerous places. All the activities can cause different accident happened and these often result in deaths or injuries. Therefore, accident prevention should be done to decrease the rate of the accidents. Accident prevention in construction is not just a matter of setting up a list of rules and making safety inspection, but is required to have a system for managing health and safety which meets and complies with the law. The safety measure that discussed in this paper are safety and health rules, regulation and policy, personal protective equipment, housekeeping, fire prevention and fire extinguishers, tool inspection, emergency procedures, safety bulletin board, construction safety meeting, first aid training and incident investigation. [7]

2. Human Errors

The human factors theory of accident causation attributes accidents to a chain of events ultimately caused by human error. It consists of the following three broad factors that lead to human error. The factors are overload, inappropriate response, and inappropriate activities. These factors are summarized in the Figure 1 below. [8]

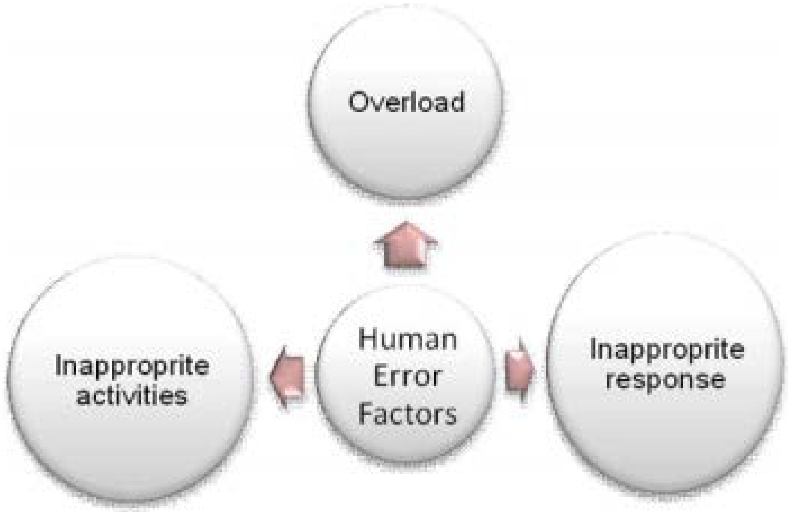

Figure 1: Factors that cause human errors.

3. Lack of Commitment

In order to ensure the effectiveness of the safety policy, revealed that both management and employees have to be actively involved and committed. In the research it is found that companies with effective safety committees are more likely to take steps that improve safety performance than those without. Working with lack of concentration and commitment could cause distraction and result in an accident.

Besides that, the accidents happen in construction site also cause by working without authority, failure to warn others of danger, missing platform guardrails, inadequate fire warning systems, excessive noise, poor illumination, financial restrictions, lack of education, restricted training, poor quality control system, group attitudes, work overload, industry tradition, society attitude to risk-taking and commercial or financial pressure between contractors. [8]

4. Safety and Health Rules, Regulations, Policies

According to CSAO (1993), a health and safety policy is a written statement of principles and goals embodying the company's commitment to workplace health and safety. Safety policy demonstrates top management's commitment to ensure safe working environment and methods at every single construction sites. The Department of Occupational Safety and Health (DOSH) and other government agencies have regulations that set down the legal requirements to ensure the safety and health of all the workers at the place of work. [9]

5. Fire Prevention or Fire Extinguishers

According to Holt (2001), there are two methods of dealing with fire in construction work; preventing it happening and controlling the consequences if it should happen. [10] Both require equal attention during the planning process. The three ingredients of fire are fuel, oxygen and a source of ignition. By removing any one of them and there will be no fire. Much of fire prevention takes place at the planning stage, where simple rules apply:

• Use less flammable materials

• Minimum the quantity of flammables on site

• Store flammable solids, liquids and gases safely, separated from each other and from oxygen cylinders or oxidizing materials.

• Make sure that rubbish is removed regularly

• Ban smoking in appropriate areas

6. Emergency Procedures

Planning for emergencies begins with the purpose of minimizing their likelihood. The aim of publishing an emergency plan is to ensure that everyone on site can be alerted in an emergency, and knows the emergency signal and also the action should be taken. [10] All the emergency routes must be identified, signed, adequately lit and kept clear. When planning emergency procedures, routes and exits, the following should be taken into account:

• Size and characteristics of the site and the work being done

• Way to raise the alarm under those conditions

• Plant and equipment being used in site

• Quantity of people are likely to be present (size of the exits) Properties of substances likely to be present

• Location of the nearest emergency sew ices and their capabilities

• Access to the site for emergency services

7. Model of anticipation levels

The presentation and report of cases also make possible the conduction towards a path of analysis and construction of the model of anticipation levels. During field observations, the AI construction engineer reports that, in order to manage the construction process of a building and notice the problems, his main support tools are the designs, the budgets and the planning. He says: ‘‘the design is the starting point. It is based on the design that I can estimate the amount of material and work necessary, as well as the services to be implemented. So you get the given design and calculate the amount of work to be done’’ (AI construction engineer). [11]

Table 1:

Cases that generate problems for production, problem types and origin.

Cases	Types of problems	Origin of problems
AI-1	Delay; Rework	Incompatibility between projects
AI-3	Delay; Rework; Difficulty in execution	
AI-8	Delay	
AI-12	Delay	
AII-1	Rework	
AII-2	Rework	
AII-3	Rework	
AII-5	Delay; Rework	
AII-6	Delay; Rework	
AII-4	Rework	Incompatibility between design and use
BI-2	Delay; Rework	
AI-2	Delay; Rework; Difficulty in execution	Failure in project detailing
AI-4	Delay	
BI-1	Delay; Rework	Simultaneity between execution and project
AI-7	Delay; Rework	Deficiency in the management of service execution
AI-5	Delay	
BI-3	Difficulty in execution	
BI-4	Delay; Difficulty in execution	
AI-11	Delay; Difficulty in execution	
AII-8	Delay; Difficulty in execution	Difficulty in the interpretation and execution of what was designed
AII-9	Delay; Difficulty in execution	
AI-9	Delay; Rework; Difficulty in execution	Inherent unpredictability of the dimension of what was designed
AI-6	Delay	Deficiency in supply management
AI-10	Delay; Difficulty in execution	Unsuitable constructive technology

At the work management level, that is, after the anticipation levels.

(a) Level 1 (design) – it corresponds to the time at the construction phase when the construction engineer analyses the designs (executive and complementary), before the beginning of the construction.

(b) Level 2 (service planning/scheduling) – it corresponds to the time at the construction phase when the construction engineer and his construction and/or suppliers and/or service providers management team analyze the designs and plan/ schedule the services, before moving on to the implementation level.

(c) Level 3 (implementation) – it corresponds to the time at the construction phase when the construction and/or suppliers and/or service providers management team and the execution actors (from the construction firm or subcontractors).

Results

Tables 2 and 3 report the information we have collected using our CONSRAT (SRI), SABI database (ROA, number of workers) and Labour Authority records (number of accidents, Official and sample Incidence Rate).

Table 2 reports the number of firms for which we have complete information in all variables included in each model and for each year. For example, for year 2004 and model 1 (first row in Table 2) we have complete information of 91 firms out of our sample of 272 firms; similarly, for 2004 and model 2 (second row in Table 3) we have full information of 199 firms out the 272 firms in our sample. Last column in Table 1shows the total number of year data observations, i.e. how many observed cases we have in our panel for each model. Data in Table 1tells that our panel is unbalanced, which means that some time periods are missing for some firms. This is quite usual for this kind of data because the normal evolution of the economic activity makes some firms disappearing over time, while some other new firms enter, or because some firms do not answer the questionnaires in subsequent years, or simply, because they do not share their economic data to database builders. Other empirical studies on H&S issues have used unbalanced panel data as for example. We have worked with an unbalanced panel for several reasons. On one hand, for the model 1, the random sampling did not allow us to have data for work sites of the same firm in all years. On the other hand, for models 2 and 3, we could not build a balanced panel because SABI does not contain all financial information for all years and all firms. Since our sample selection is entirely random, there is no reason to believe there is a specific process for firm to drop out of the panel. Therefore, we assume there is no systematic relationship between the rule of dropping out cases in our panel and the response variables. For estimating linear models, the results with unbalanced panels are valid because all needed assumptions hold. Moreover, standard and modern software packages work well with unbalanced panels in case of linear models

In Table 3 we report the sample incidence rate which is obtained dividing the number of accidents with the number of workers for each year of sample firms. We also have included the Official Incidence Rate which is the official data published by Labour Authority for Balearic Islands.

Table2:

Number of data observations per year from our panel data of 272 firms.

	2004	2005	2006	2007	2008	2009	Total number of year data observations
Number of firms in model 1	91	68	62	77	44	13	355
Number of firms in model 2 and 3	199	214	228	214	193	191	1239

Table 3:

Information of the accidents per year in our sample of 272 firms and official incident rate.

	2004	2005	2006	2007	2008	2009	Total
Number of accidents	925	977	1047	972	699	385	5005
Number of workers	5088	5363	6044	6364	5929	4958	33,746
Sample Incidence Rate[a]	18180.03	18217.42	17322.96	15273.41	11789.51	7765.23	-
Official Incidence Rate[b]	16829.03	17315.00	17156.00	16653.00	14128.10	10865.50	-

One of the most relevant differences of our study with traditional literature explain the accident rate using a leading indicator with our variable SRI. This is because, SRI contains relevant safety barriers on site, and assessing them we can provide better leading indicators. All the literature recognizes that accidents cause disturbs at work, interfere in the normal development of tasks and finally entail direct and indirect cost. However, it does not seem to be a broad knowledge about the mechanisms that regulates the mutual relationship between the cost of accidents, on one side, and the costs of prevention and protection measures, on the other side. At least in theory, it has been proposed that a trade-off exists between the cost of accidents and the cost of prevention. But the problem in the practical application is that, although a high level of safety will always implies huge prevention costs, a low level of safety will not always be paired with high cost of accidents when they do not occur.

Conclusion

There seems to be no other choice but impose a tighter control over the quality of work. Unprofessional practice and unqualified subcontractor & workers should be reframed from engaging in this kind of high risk work. Various approaches have been discussed above. Finally it is of the opinion that with the support from the Government in this direction, the main contractor, reputable developers & the interest parties as a team, the objective of preventing fatal accident in this respect can be achieved.

The results allow the establishment of relations between the anticipation levels in the construction phase and the improvement of production and safety performance. Likewise, they are consistent with the importance of the experiences of the actors involved in the construction's production process. The key issue of the proposed model is to promote exchange, return and sharing of experiences (collaborative effort) among the anticipation levels in the construction phase, organized in such a way that they feed one another.

Safety measure is the method used to improve the safety performance at any workplace. Effective safety measure can result in decreasing of rate of the accidents happen. It's found that the frequencies of the accidents that present at most of the selected project are less than 5 cases.

In conclusion, the safety measure used in the site will directly affect the safety performance in every single construction project.

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