

FACTORS AFFECTING DELAY AND SAFETY ON CONSTRUCTION PROJECTS IN BANGLADESH

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ABSTRACT

Construction is the process of constructing or executing a building according to plan. In modern building construction, different professionals participate to construct a construction project. A complete construction according to plan is important as it involves money, the value of assets and it impacts stockholders. The important objectives of construction projects are time, cost, quality, and safety. The most common causes of delays on large-scale construction projects are adverse weather, changes of orders, inappropriate scheduling, inaccurate design, lack of experience, unskilled labor, financial issues, and so on. This paper presents the main factor that affects the construction project's delay in completion and safety on the construction site. After a combination of literature review, and open discussion, a questionnaire was prepared with important factors that affect delay on construction projects. 200 questionnaires were sent to professionals where 75 reports returned back and responses were measured five-point rating system. Construction professionals such as Architectural/Engineering firms (A/E), owners, contractors, workers participated in this questionnaire survey from Dhaka and Khulna Regions. The questionnaire survey also includes the awareness of health and safety on personal protective equipment (PPE) where a four-point rating system to measure how they concern about health and safety on PPE. The results are divided into two subcategories: A/E, owner, and Contractor-workers. The results showed that accident (94%), manpower (86%), environment (84%), equipment (82%) are the main reasons for the delay. Nine out of ten sub factors for delay are indicated above-average rating on satisfaction. However, A/E's and owners consider that environment, scheduling causes more delays in construction whereas contractors and workers consider these subfactors less severe. In the case of materials, it is vice-versa. The reasons for the different opinions of two subcategories might be described as A/E's and owner's works on technical, decision making, and financing, whereas contractors and workers work on the construction site. A Pareto Chart is drawn from the data and it was found that accident, manpower, environment, equipment, materials, government policy are cause more delay, according to the Pareto principle. The results on the importance of health and safety on PPE showed that 87 percent professional believes that PPE is important for safety on construction site. However, safety measurements are not properly followed in the construction industry in Bangladesh. It was also found that workers have less awareness than other categories of professionals as they lack proper training and equipment. Proper managerial measurements including training, modern techniques, scheduling, financing, safety should be taken in order to minimize factors that affect construction projects.

Keywords: *Construction safety, Delay, Construction project, Government policy, Accident.*

1. INTRODUCTION

Safety is a complex phenomenon and the subject of safety attitudes and performance in construction projects is even more so. 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 (Sawacha, Naoum, & Fong, 1999). Various factors significantly influence construction costs from the estimating stage to project completion. Some factors are intrinsically related to construction organizations that are solely responsible for managing them, whereas others are closely related to the socio-cultural, economic, technological and political environments within which such organizations operate. The latter is usually called global risk factors. In the construction industry the risk of a fatality is five times more likely than in a manufacturing-based industry, whilst the risk of a major injury is two and a half times higher (Davis & Tomasin, 1990). All the material-factor contains shortage, changes, delivery, damage, manufacturing sub-factors. Moreover, Manpower contains labor shortage, skill, nationality, language. The equipment has shortage, delivery, productivity subfactors (Assaf, Al-Khalil, & Al-Hazmi, 1995). Financing is the contractor main factor. Environment factor contains climate, earthquake, rain, soil, Scheduling, Controlling Techniques, and monitoring are important factors which has management, leadership, quality subfactors. Government policy contains political conflict, change, state evolution of subfactors. Previously questionnaire surveys done with various delay factors with each questions was measured different systems such as five-point rating system (Guha & Biswas, 2013). Researchers from the UAE revealed that 50% of the construction projects in UAE encounter delays and are not completed on time. Approval of drawings, inadequate early planning and the slowness of the owner's decision-making process is the top cause of delay in the UAE construction industry (Faridi & El-Sayegh, 2006). This paper discusses the core factors causes delay for a project affecting safety. Factors were identified through an extensive literature review by a questionnaire survey in different under-construction projects. The findings of the questionnaire will form the basis for structured interviews using the report grid techniques to elicit relevant knowledge to develop a knowledge-based decision support system (Baloi & Price, 2003). The most major factors for delay in a construction project are materials, manpower, equipment, financing, environment, scheduling, control techniques, and monitoring, government and political issues, accidents. Accidents occur at work either due to lack of knowledge or training, a lack of supervision or a lack of means to carry out the task safely or due to an error of judgment and carelessness. Personal protective equipment has a pivotal role in construction safety. This paper also provides a catalogue of essentiality of these factors to everyone.

2. METHODOLOGY

In this study, a combination of literature review, open discussions, surveys, and interviews were conducted with an aim to get the necessary information about the public and private construction projects in Khulna and Dhaka. The investigation was undertaken in two phases. The first phase included a literature search and interviews. Various related international journals, conference papers, and reports are analyzed to mark the factor regarded with delay in construction projects. A questionnaire was prepared with a view to evaluating the frequency of occurrence and the impacts of selected causes. After carefully consideration, 10 subcategories are selected for analyzing delays in construction projects. The questionnaire was personally handed over to the respondents such as Architect/Engineers (A/E), owners, contractors, workers. The questionnaire was asked and convinced in Bangla to the labor in order to have the answers more accurately. The response to each attitudinal question was measured on a five-point rating under the categories of 'strongly agree', 'agree', 'neither agree nor disagree', 'disagree', 'strongly disagree', where each subfactors numerical values are represented as 5,4,3,2,1 respectively. Another questionnaire surveying was runned*s about awareness of personal protective equipment items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses, which protects the worker against health or safety risks at work. In this questionnaire, the attitude of the questions is measured as 'Very Important=4', 'Important=3', 'Less Important=2', 'Not Important=1'. In total, 200 questionnaires were sent to individuals of which 75 returned, after evaluating 66 reports found valid for use. The operatives who

completed the questionnaire varied in their trade and they were selected randomly under construction site in Khulna and Dhaka.

3. DATA ANALYSIS AND RESULTS

The result of questionnaire survey of delay analysis summarised in Table 1, where results are divided into two categories: first groups are A/E's and owners of construction projects who are responsible for technical, supervision, and financial matters; the second groups are contractors and workers, who execute projects on the construction site. After analyzing data from Table 1 and Figure 1, two groups have a slightly different opinion on delay in construction. While two groups have a more or less similar opinion on manpower, accident, government policy, financing, their opinion varies on materials, environment, scheduling (more than 0.5). A/E's and owners consider that environment, scheduling causes more delays in construction whereas contractors and workers consider these sub-factors less severe. In the case of materials contractors and workers claims that materials cause delay on-site as it is impossible to work without materials. Numbers on the ranking section in Table 1, illustrates chronological order in which sub factors cause more delay.

Table 1: Summary of sub-factors that causes delay on construction

Type of incident	A/E's and Owners	Contractors and Workers	Average Rate	Average Percentile	Ranking
Materials	3.6	4.2	3.9	78	5
Manpower	4.2	4.4	4.3	86	2
Equipment	3.9	4.3	4.1	82	4
Financing	3.4	3.5	3.4	68	8
Environment	4.7	3.7	4.2	84	3
Scheduling	3.9	3.1	3.5	70	7
Control Technique	3.0	2.6	2.8	56	10
Monitoring	3.2	2.8	3.0	60	9
Government Policy	3.7	3.9	3.8	76	6
Accident	4.6	4.8	4.7	94	1

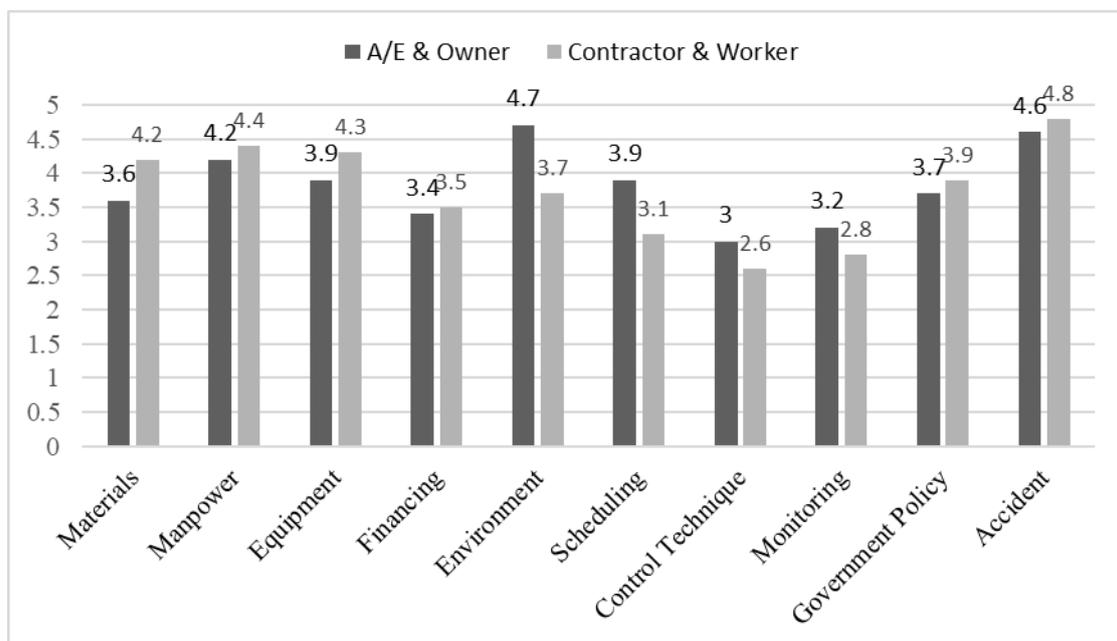


Figure 1: Comparative representation of effecting delay factors through Bar Diagram

Figure 2 represents the Pareto Chart, where the average rate of sub factories is shown in descending order with a cumulative percentile on a secondary axis as a percentile of the total. According to ‘Pareto Principle’, accident, manpower, environment, environment, materials, government policy considered ‘Vital Few’ as they stand above 80 percentile, where authority should focus more and target immediately in order to minimize delay on construction while scheduling, financing, monitoring, control technique known as ‘Trivial Many’, which could be given less importance. The unusual pattern of ‘Pareto Line’ is because of the uniformity of values of the average rate.

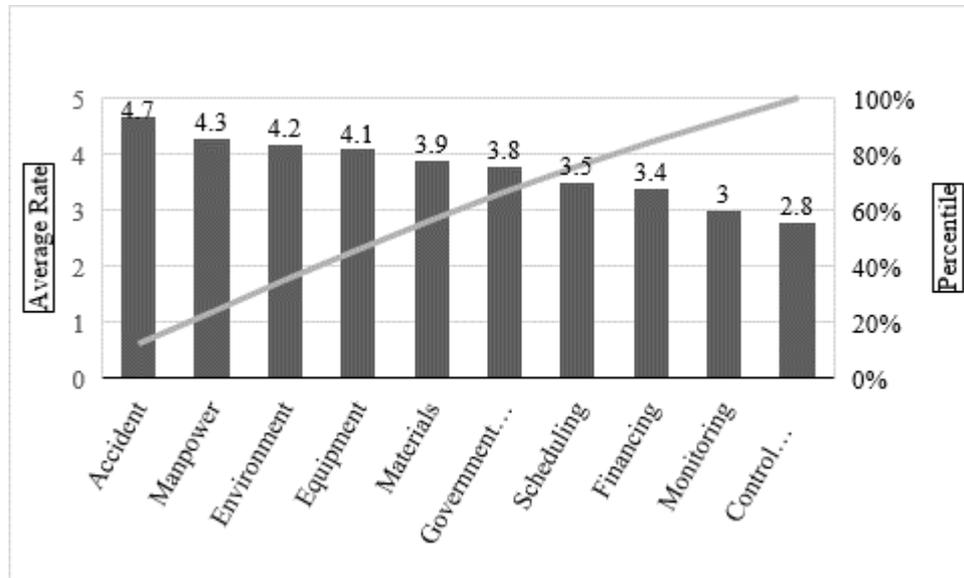


Figure 2: Analysis of delay factors with Pareto Chart

Table 2 represents the summary of uses of personal protective equipment, where 87 percentile believes that personal protective equipment is important for health and safety on the construction site. Figure 3 (a) and Figure 3 (b) is the graphical representation of uses rate of using personal protective equipment. However, personal protective equipment is not used in Bangladesh. In some cases, proper training is not provided to the worker about the significance of Personal protective equipment and sometimes, for lack of knowledge, the workers do not take it seriously. After analyzing data, Dhaka city’s construction professionals and workers practice higher rate personal protective equipment than in Khulna city. Sometimes, the health and safety of workers fail because of no inspection from local government authorities like RAJUK, KDA, etc.

Table 2: Summary of uses of personal protective equipment

Importance of safety and health	Rating	Response (%)
Very Important	1	46.3
Important	2	40.7
Fairly Important	3	9.1
Not Important	4	3.1
Total		100

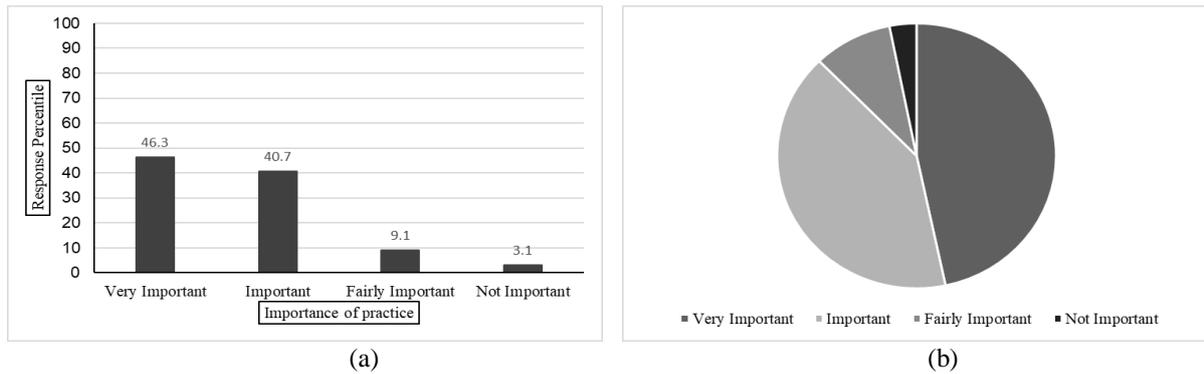


Figure 3: Representation importance of personal protective equipment through (a) bar diagram; (b) Pie

4. CONCLUSIONS

This study represents the factors affecting construction projects especially in the delay of works on site and the importance of safety and health in construction on Bangladesh, mainly on Dhaka and Khulna. A literature review was conducted and most vital factors were noted and questioned about causes delay on construction site. A field questionnaire was done involving A/E's, owners, contractors, and workers, who are professionals in this sector. The result was presented in two categories; first, the A/E's and owners and second, contractors and workers. The result showed that nine out of ten sub-factors of delay on-site are above the average rate. Accident (94%), manpower (86%), environment (84%), equipment (82%) are the main reasons for the delay, hence, these affect the construction site physically and financially. In two categories of professionals, opinion varies widely between two sub-factors that affect delay. Another survey result showed that more than 85 percent of professional believes PPE is important for safety. However, contractors and workers are less concern about personal protective equipment as they have minimal training, awareness, equipment, and budgets on health and safety.

RECOMMENDATIONS

To ensure safety, governmental intervention is a crucial need where the bureaucratic auditors have an enormous role to play for arranging seminars and training on health and security in an ongoing construction project. These campaigns are supposed to focus on scaffolding, electrician's sensibilities, along with head and fall protection to prevent the accidents. New techniques such as Building Information Modeling (BIM) should be implemented for proper scheduling and finance. Before starting a construction project, proper managerial measurement should be taken in order to prevent any hazardous situation that could happen on the construction site.

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APPENDIX

The following pictures are the sample of questionnaires that were asked.

Factors Affecting Safety on construction Projects #26

Company/Site Name	Tari Construction Limited
Address	Officer, Dhaka
Name of Responder	Engr. Razvee
Designation	Engineer

Data Set 1

Factors that affect Delay on Construction	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
Materials			✓		
Manpower		✓			
Equipment	✓				
Financing		✓			
Environment	✓				
Scheduling		✓			
Control Technique			✓		
Monitoring			✓		
Government Policy/Accident	✓				
Accident	✓				

Data Set 2

Importance of Health and safety	Very Important	Important	Fairly Important	Not Important
Personal Protective Equipment	✓			

Factors Affecting Safety on construction Projects #61

Company/Site Name	১২২ ফার্স-১১১১১১১১ (New Building)
Address	১১১১১১ (Rohgata, Khulna)
Name of Responder	১১১১ (Zabbar)
Designation	১১১১ (Head Mason)

Data Set 1

Factors that affect Delay on Construction	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
Materials		✓			
Manpower			✓		
Equipment	✓				
Financing		✓			
Environment	✓			✓	
Scheduling		✓			
Control Technique			✓		
Monitoring		✓			
Government Policy/Accident	✓				
Accident	✓				

Data Set 2

Importance of Health and safety	Very Important	Important	Fairly Important	Not Important
Personal Protective Equipment			✓	