



COST OVERRUNS AND DELAYS IN CONSTRUCTION: A STUDY ON CAUSES AND CONTROL MECHANISMS

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Abstract- Triple constraints of a project i.e. cost, time and scope are considered as the key factors for defining the success of a project. At the same time, construction industry faced the challenges of time delays and cost overruns from the very beginning of its evolution till present. Multiple efforts are made by researchers in the past to identify the causes of such problems and proposed solution for them. This study focusses on the review of all the past studies conducted over the period of last decade. For this, number of relevant research papers are retrieved and filtered. After that frequency analysis was performed to find major factors throughout the world which significantly affect the project time and cost. Findings of this research show that lack of planning and design changes are the most important factors which affect the timely completion and total cost of a project. Further, emerging technologies like Building Information Modeling (BIM), Fuzzy techniques and Symbiotic Organism Search (SOS) can be used to control these problem in a project.

Keywords- cost overrun, fuzzy techniques, time and cost control, time delays

1 Introduction

Construction industry is considered as the main contributing factor to the development and economic growth of a country[1]. It accounts for approximately 10% of the global economy [2]. However, due to the uncertain and complex nature, it has been encountered by time delays and cost overruns over the years [3]. Researchers found that on average project time and cost changes 26% from its planned values [4, 5]. In order to reduce such kind of uncertainties from a project, critical factors needs to be identified which directly or indirectly affect cost and duration of a project. Multiple studies have been conducted over the decades to determine these factors which are causing time delays and cost overrun [28-31]. This study will focus on reviewing these factors which appear in different past studies over the last one decade and synthesize the results. Further, this research will also provide insight about the methods for controlling time delays and cost overruns by using modern tools.

2 Causes of Time Delays:

Since the time delays do not only affect the timely completion of project but also it affects the project cost as well. Indirect cost which includes overheads, profits, and expenses etc. increases with the time. In Table 1, causes of time delays are reported in details from past studies conducted in different developed as well as developing countries. Most of the reported studies here are from one last decade.

Table 1: Causes of Time Delays

Reference	Country	Causes of Time Delay
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[6]	Oman	Site conditions, poor contract management, delayed payments, lack of skilled labor, late supply of materials, poor supervision, poor communication, change in drawings, change of policies, weather conditions, price escalation and inflation.
[7]	Indonesia	Delay in land acquisition, delay in approvals, site location, unions strikes, design changes, rework, performance of specialty contractors
[8]	Dubai, UAE	Changes in design, wrong estimation of project durations, delay in getting approvals from law agencies,, change of scope
[9]	Saudi Arabia	Modification of design and scope changes
[10]	Pakistan	Cultural Risks: Language barriers, Poor communication b/w parties. Financial Risks: Price escalation, inflation, budget overrun. Management Risks: Incompetency of project team, Improper planning of project, Poor relations with Governmental agencies, Inadequate organizational structure. Legal Risks: Lack of enforcement of legal laws. Political Risks: Change in policies, involvement of political partner in project, corruption
[11]	Malaysia	Poor weather conditions, poor construction material, poor estimation of productivity of equipment, unavailability of skilled labor, poor planning, and design changes.
[12]	Turkey	Security issues, high number of contracts to one contractor, poor labor productivity, design Change, poor supervision, poor construction material, change of drawings, poor planning
[13]	Australia, Malaysia and Ghana	Poor planning and scheduling, poor supervision, delayed payments, inexperienced contractor, complexity of project
[14]	Rwanda	Delay in payments, late material procurement, poor supervision
[5]	Denmark	Lack of project funding, delay in obtaining governmental approvals, lack of planning, lack of identification needs
[4]	Jordan	Site condition, weather condition, variation order, un-availability of trained labor, mistakes in design, Price escalation, inflation, payment delays, political influence, poor construction materials, poor planning
[15]	Malaysia	Cash flow problem and storage on site

3 Causes of Cost Overruns:

Similarly, causes of cost overruns in construction projects are also retrieved from one last decade studies which were conducted in developed as well as developing countries. Table 2 summarizes the results from 18 different research papers.

Table 2: Causes of Cost Overruns

Reference	Country	Causes of Cost overruns
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[16]	Vietnam	<i>inflation, interest rate, costly equipment, incompetency of parties, poor communication</i>
[6]	Oman	<i>Change of scope, poor planning delay in payments, poor site conditions, inadequate trainings and experience, lack of skilled labor</i>
[7]	Indonesia	<i>Poor estimation of budget, price escalation, inflation, delays in payment, poor cash flow, weather conditions, rules and regulations</i>
[8]	Dubai, UAE	<i>Design changes, delays in approvals by client, wrong estimation of project costs, lack of capital availability of contractor, poor bidding method</i>
[9]	Saudi Arabia	<i>Poor cost and time estimation</i>
[17]	India	<i>Price escalation, inflation, poor bidding procedures, poor government policies, change of scope, wrong estimation of project cost, change of design, weak cash flow planning by contractor</i>
[18]	Pakistan	<i>Payment delays, delays in approvals by client, poor contract management, poor financial health of contractor, lack of planning, change of scope</i>
[10]	Pakistan	<i>Violation of contract, contractual terms not clear, less availability of information, delays in payment</i>
[19]	Qatar	<i>Change of scope, poor planning and scheduling, lack of skilled labor, inflation, poor cost estimation, poor construction materials, poor estimation of project duration, use of costly equipments</i>
[11]	Malaysia	<i>Weather conditions, poor construction material, poor cost estimation, lack of cost planning, lack of understanding to local rules and regulations</i>
[20]	Malaysia	<i>Weather conditions, poor construction material, poor estimation of productivity of equipment, unavailability of skilled labor, poor planning, design changes, poor supervision, change of scope, payment Delays, poor construction material, poor cost planning</i>
[12]	Turkey	<i>Lack of skilled labor, foreign contractor's dominance in industry, poor communication and cost control, scope changes, use of costly equipments, litigation, poor planning by contractor</i>
[21]	Malaysia	<i>Change of scope, poor communication among stakeholders, change in design, poor contract implementation, procurement problems, delay in payments, poor site conditions, misuse of material, inadequate use of equipment, Lack of skilled labor, Policies Change, poor implementation of rules and regulations</i>
[14]	Rwanda	<i>Design changes, lack of funds.</i>
[5]	Denmark	<i>Change of scope, design changes, inexperienced consultants, poor contract management</i>
[4]	Jordan	<i>Terrain condition, weather condition, variation order, un-availability of trained labor, mistakes in design, Price escalation, inflation, payment delays, political influence, poor construction materials, poor planning.</i>



[15]	Malaysia	Scope of work, tendering methods
[22]	Palestine	Political factor, escalation, unstable economy

So, it can be deduced from table 1 & 2 that these causes are related to each phase of project like planning, estimation, design, execution and supervision. Further, external factors such as political influence, change of policies, escalation and inflation also affect the projects in terms of time as well as cost. By controlling these factors, risks of time delays and cost overruns can be reduced.

4 Research Method:

A comprehensive literature review was conducted by retrieving around fifty (50) papers from multiple journals such as “Alexandria Engineering Journal”, “International Journal of Engineering & Technology”, “International Journal of Project Management”, “Journal of management in engineering”, “International Advanced Researches and Engineering Journal”, “International Journal of Construction Management” and others. Then these papers were scrutinized and filtered depending upon its relevancy with the research topic.

Initially, thirty four (34) factors, appearing in different journal and conference papers were identified which affect the project completion time. Considering the fact that factors appearing more frequently in different construction industries, will have significant effect on delays of project. So, these factors were shortlisted by using Equation-1, where frequency is considered the basic criteria for getting high score value. More the frequency of a factor means, more score value, more important that factor will be.

$$\text{Score} = \sum Fn / N \quad (\text{Equation-1})$$

Here:

Fn= Factor appearing in number of papers

N= Total number of papers

Similarly, twenty nine (29) factors for cost overruns were identified and shortlisted in the same ways as explained earlier for time delays.

5 Results and Discussion:

Based on the frequency analysis of past studies, it was synthesized that design changes and lack of planning are most influential factors that causes time delays as well as cost overruns as shown in Table 3. Similar results were also found in other studies that lack of planning and change of design are major factors of cost overrun and delay in time of a project [23-25]. The reason is that projects get delayed in the absence of detailed planning, because there are no well-established baselines with which progress of project will be compared. In the absence of baseline schedule, it is very difficult to know either your project progress is up to the mark or not till date. Similarly, design changes ultimately cause the change of scope, where contractors have to perform rework sometimes, if that design change was suggested after construction of some elements. Therefore, this additional task demands extra time as well as extra money. So both of these factors discussed above significantly affect the time and cost of projects.

Further, lack of skilled labor and weather conditions are found as the other major causes of time delays and cost overruns. Since unskilled labor compromises the quality of work frequently and client rejects the work on the basis of poor quality. In that case, rework has to be performed. Further, weather conditions also affect the timely completion of project due to wastage of time in rainy season and then wait for site conditions to be dried. So time delays ultimately causes cost overrun as well because contractor has to bear project overheads (indirect cost). However, poor supervision, delayed payments, incompetent team and poor quality of materials are found as the influential factors only for time delays. On contrary, change of scope, inflation, poor estimation of cost and procurement issues such as awarding contract to lowest bidder are the factors which only affect the project cost significantly.



Table 3: Ranking of most important factors affecting project time and cost

Ranking	Factors affecting Project Time	Score	Factors affecting Project Cost	Score
1	Design Changes	61.5%	Design Changes	44.4%
2	Lack of planning	46.2%	Lack of planning	44.4%
3	Poor supervision	38.5%	Change of Scope	38.9%
4	Delayed Payments	38.5%	Lack of Skilled Labor	33.3%
5	Incompetent Project Team	30.8%	Weather Conditions	27.8%
6	Weather Conditions	30.8%	Inflation	27.8%
7	Lack of Skilled Labor	30.8%	Poor estimation of schedule	27.8%
8	Poor Quality of Construction Material	30.8%	Procurement issues	27.8%

The major implication of this study is to provide the root causes of core issues of contraction industry since its inception i.e. time delays and cost overruns in the light of research conducted worldwide. The major issues found in this study are poor planning and design changes along with other factors as given in Table 3. So in order to overcome these issues detailed planning and right design should be ensured with help of BIM, Fuzzy techniques and SOS etc. at early stage of project life cycle.

6 Conclusion and Recommendations:

It is concluded that design changes and lack of planning are the factors which significantly affect the performance of a project in terms of time and cost. Further, other factors such as lack of skilled labor and poor weather conditions also found as major causes of time delays and cost overruns. By controlling these factors through latest management tools, project performance in terms of time and cost can be improved.

It is recommended to overcome major causes such as lack of planning and design changes, change of scope, poor estimation and quality of construction materials, latest tools can be used. Amandin and Kule [14] studied that Gantt Bar Chart, Critical Path Networks/Method (CPM), Program Evaluation and Review Technique (PERT), Elemental Trend Analysis/Line of Balance (LOB), Precedence Network Diagram (PND), and Simulation are very much effective for controlling time delays and problem of poor planning. Further, design changes, scope changes, accurate estimation, clash detection and issues of quality control can be controlled through Building information modelling (BIM) [20]. Moreover, Fuzzy Analytical Network Processing, Fuzzy Artificial Neural Network, Fuzzy Monte-Carlo Simulation, and Fuzzy Bayesian Belief Network are used to understand the uncertainties in a project in terms of time delays and cost overruns [26]. After that Symbiotic Organism Search(SOS) algorithm can be used to find out multiple feasible solutions for project manager[27].Lastly, issues of procurement and lack of skilled labor can countered by adopting Quality Based Evaluation of firms and rigorous trainings of workers respectively.

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