Causes, Effects and Minimization of Delays in Construction Projects

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Abstract: The construction industry is one of the main sectors that provide important ingredients for the development of an economy. The construction is the tool through which a society achieves its goals of urban and rural development. However it is becoming more complex because of the sophistication of the construction process itself and the large number of parties involved in the construction process, i.e., clients, users, designers, regulators, contractors, suppliers, subcontractors, and consultants.

Modern construction projects are characterized by new standards, advanced technologies, multiparty participation, and frequent owner-desired changes. Coupled with this state are inherent uncertainties and complexities in the physical, financial, and economic environment in which most projects are performed. Such conditions have made completing projects on schedule and on budget a difficult task to accomplish, often leading to claims on cost compensations and time extensions. This eventually leads to delay in the completion of the project.

Delay could be defined as the time over run either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project. It is slipping over its planned schedule and is considered as common problem in construction projects. Delay in construction project is considered one of the most common problems causing a multitude negative effect on the project and its participating parties. Therefore, it is essential to identify the actual causes of delay in order to minimize and avoid the delays and their corresponding expenses.

Delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. The party experiencing damages and the parties responsible for them in order to recover time and cost. However, in general delay situations are complex in nature. A delay in an activity may
not result in the same amount of project delay. A delay caused by a party may or may not affect the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date.

Delays caused by the client such as late submission of drawings and specifications, frequent change orders, and inadequate site information generates claims from both the main contractors and subcontractors which many times entail lengthy court proceedings with huge repercussions. Delays caused by contractors can generally be attributed to poor managerial skills. Lack of planning and a poor understanding of accounting and financial principles have led to many a contractor’s downfall.

Aim and Objectives

The research is aimed at identifying the major causes of delay, effect of delay, and methods of minimizing delays in construction projects. To achieve the aims, objectives have been identified as following:

a) To identify the main reasons of construction delay in construction project
b) To identify the effect of construction delay in construction project
c) To identify the means of minimizing construction delay in construction project

Scope of the Project

The scope of the project is mainly to focus on the literature review and a questionnaire survey. The questionnaire survey would be designed based on the causes of construction delays, effects of construction delays and the methods of rectification of the construction delays.

Causes of Delays in Construction

Construction delay is considered to be one of the most recurring problems in the construction industry and it has an adverse effect on project success in terms of cost, time, quality, and safety. There are several factors that cause delay in construction. Delay may be caused by clients, users, consultants, designers, owners, contractors and suppliers.

Ibrahim Mahamid, et al worked on finding out the causes of delay in road construction projects and their severity according to contractors and consultants through a questionnaire survey.

Cost, time, and quality have proven their importance as the prime measures for project success. According to Ahmed, et al delays on construction project is a universal phenomenon. They are usually accompanied by cost overruns. Delay has a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, and cash-flow problems. A project may be regarded as a successful endeavor until it satisfies the cost, time, and quality limitations applied to it. However, it is not uncommon to see a construction project failing to achieve its goal within the specified cost, time, and quality.

The causes of delays where categorized into eight related groups namely:

1) Project group
2) Owner group
3) Materials and equipment group
4) Laborers group
5) External group
6) Design group
7) Contractor group
8) Consultant group

The causes where ranked and recommendations to reduce time overrun in road construction where given to the government, owners, contractors, and consultants. Finally, the literature concluded with determining top five severe causes of delay as seen from the
combined view of contractors and consultants. They are as follows:

- Political situation
- Segmentation
- Award project to lowest bid price
- Progress payments delay by owner; and
- Shortage of equipments

Conversely, the bottom five causes of delay as seen from the combined view of contractors and consultants are:

- Poor ground conditions
- Insufficient inspectors
- Inappropriate design
- Monopoly; and
- Natural disaster

Murali Sambasivan, et al studied the delay factors and their impact on project completion in Malaysian construction industry. The study identified ten most important causes of delay from a list of 28 different causes. Ten most important causes of delay were:

1. Contractor’s improper planning
2. Contractor’s poor site management
3. Inadequate contractor experience
4. Inadequate client’s finance and payments for completed work
5. Problems with subcontractors
6. Shortage in material
7. Labor supply
8. Equipment availability and failure
9. Lack of communication between parties
10. Mistakes during the construction stage

Assaf, et al identified 56 main causes of delay in Saudi large building construction projects and their relative importance. A survey of contractors, owners, and architects/engineers was conducted on the causes of delay factors in large building projects in Saudi Arabia. The survey showed that all three groups generally agree on the ranking of individual delay factors. The factors were categorized into nine major groups and were ranked. The nine groups were material, manpower, equipment, financing, changes, government relations, scheduling and controlling, environment, and contractual relationships. Based on the contractors surveyed, the most important delay factors were:

1. Preparation and approval of shop drawings
2. Delays in contractor’s progress
3. Payment by owners and
4. Design changes

From the view of architects and engineers, the cash problems during construction, the relationship between subcontractors and the slow decision making progress of the owner were the main causes of delay. However, the owners agreed that the design errors, labor shortages and inadequate labor skills were important delay factors.

Sadi A. Assaf, et al conducted a survey on time performance of different types of construction projects in Saudi Arabia to determine the causes of delay and their importance according to each of the project participants, i.e., the owner, consultant and the contractor. The field survey conducted included 23 contractors, 19 consultants, and 15 owners. Seventy-three causes of delay were identified during the research.

Both owners and consultants specify labor and contractor related causes as the severe and important sources of delay while, contractors indicate that the important sources of delay in construction projects are owners and consultant.

**Effects Of Delays**

Murali Sambasivam, et al studied the effects of construction delays on project construction industry. The six effects of delay identified were:
Fig 1. Effect of Construction Delays

B.P.Sunjka, et al stated that poor quality completed projects and bad public relations are also the effects caused due to delay in construction projects in addition to the above six effects.

2.4 Minimisation Of Construction Delays

When a construction delay occurs, there is no question that the Owner suffers financially, but the extent to which an Owner can recover its loss of income from the Contractor, and more importantly minimize the risk that such delays will occur, depends largely on how the construction contract was drawn up. Based on several studies of project success factors and rectification of delays in construction project, a total of 15 methods have been identified as follows:

Sadi A. Assaf, et al recommended following points in order to minimize and control delays in construction projects.

Owners should give special attention to the following factors:

- Pay progress payment to the contractor on time because it impairs the contractors ability to finance the work.
- Minimize change orders during construction to avoid delays.
- Avoid delay in reviewing and approving of design documents than the anticipated.
- Check for resources and capabilities, before awarding the contract to the lowest bidder.

Contractors should consider the following factors:

- Enough number of labors should be assigned and be motivated to improve productivity.
- Contractor should manage his financial resources and plan cash flow by utilizing progress payment.

- Administrative and technical staff should be assigned as soon as project is awarded to make arrangements to achieve completion within specified time with the required quality, and estimated cost.

Consultants should look to the following points:

- Reviewing and approving design documents
- Consultants should be flexible in evaluating contractor’s works.

Finally architects/design engineers should focus on the following points:

- Producing design documents on time
- Mistakes and discrepancies in design documents have to be taken care off.

Research methodology

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<tr>
<th>LITERATURE REVIEW</th>
<th>QUESTIONNAIRE PREPARATION</th>
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<tr>
<td>COMPANY IDENTIFICATION</td>
<td>QUESTIONNAIRE SURVEY</td>
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<tr>
<td>DATA COLLECTION</td>
<td>DATA ANALYSIS (RII)</td>
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<td>SUGGESTIONS &amp; CONCLUSIONS</td>
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Questionnaire design

The questionnaire is divided into four sections. Section A is related to general information for both the company and respondent. Both the contractors and consultants were further
requested to answers pertaining to their experience in the construction industry and their opinions about the average time overrun in construction projects that they have experienced. Section B is related to the causes of construction delays. It is classified into owner, contractor, consultant, materials, equipment, labour and external factors. Section C consists of effects of construction delays. Section D consists of means to minimise construction delays. They are categorised into five-point scale.

Data Analysis

The data analysis is determined to establish the relative importance of various factors that contribute to causes, effects, and minimization if construction delays. Analysis of data consists of the following:

1) Calculating the Relative Importance Index(RII)
2) Ranking of factors in each category based on the Relative Importance Index(RII)

\[
RII = \frac{\sum W}{A \times N}\tag{1}
\]

Where,
RII is the Relative Importance Index,
W = weighting given to each factor by the respondents (ranging from 1 to 5),
A = highest weight (i.e. 5),
N = total number of respondents.

<table>
<thead>
<tr>
<th>Category</th>
<th>Causes of Delays</th>
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</thead>
<tbody>
<tr>
<td>Contractor related</td>
<td>1 Rework due to errors during construction</td>
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<tr>
<td></td>
<td>2 Poor communication and coordination</td>
</tr>
<tr>
<td></td>
<td>3 Ineffective planning and scheduling of project</td>
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<tr>
<td></td>
<td>4 Poor qualification of contractor’s technical staff</td>
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<td></td>
<td>5 Delay in sub-contractor’s work</td>
</tr>
<tr>
<td>Consultant-related</td>
<td>1 Inadequate experience of consultant</td>
</tr>
<tr>
<td></td>
<td>2 Poor communication and coordination</td>
</tr>
<tr>
<td></td>
<td>3 Mistakes and discrepancies in design documents</td>
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<td></td>
<td>4 Unclear and inadequate details in drawings</td>
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<td></td>
<td>5 Un-use of advanced engineering design software</td>
</tr>
<tr>
<td>Materials-related</td>
<td>1 Shortage of construction materials</td>
</tr>
<tr>
<td></td>
<td>2 Delay in materials delivery</td>
</tr>
<tr>
<td></td>
<td>3 Changes in material types during construction</td>
</tr>
<tr>
<td></td>
<td>4 Late procurement of materials</td>
</tr>
<tr>
<td>Equipment-related</td>
<td>1 Equipment breakdowns</td>
</tr>
<tr>
<td></td>
<td>2 Shortage of equipment</td>
</tr>
<tr>
<td></td>
<td>3 Low level of equipment operator’s skill</td>
</tr>
<tr>
<td></td>
<td>4 Low productivity and efficiency of equipment</td>
</tr>
<tr>
<td>Labor-related</td>
<td>1 Shortage of labors</td>
</tr>
<tr>
<td></td>
<td>2 Low skill of labors</td>
</tr>
<tr>
<td></td>
<td>3 Personal conflicts among labors</td>
</tr>
<tr>
<td>External factors</td>
<td>1 Delay in obtaining permits from municipality</td>
</tr>
<tr>
<td></td>
<td>2 Weather effect on construction activities</td>
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<table>
<thead>
<tr>
<th>Category</th>
<th>Causes of Delays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner-related</td>
<td>1 Delay in progress payments</td>
</tr>
<tr>
<td></td>
<td>2 Delay in delivering the site to the contractor</td>
</tr>
<tr>
<td></td>
<td>3 Poor communication and coordination</td>
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<tr>
<td></td>
<td>4 Change orders by owner during construction</td>
</tr>
<tr>
<td></td>
<td>5 Late in revising and approving design documents</td>
</tr>
</tbody>
</table>
Accidents during construction
Rise in prices of materials
Delay in providing services from utilities (Such as water, electricity, etc.)

Effect of delays

1. Time overrun
2. Cost overrun
3. Dispute
4. Arbitration
5. Total abandonment
6. Litigation

Minimisation of construction delays

1. Frequent progress meeting
2. Use up-to-date technology utilization
3. Use proper and modern construction equipment
4. Use appropriate construction methods
5. Effective strategic planning
6. Proper material procurement
7. Accurate initial cost estimates
8. Clear information and communication channels
9. Frequent coordination between the parties involved
10. Proper emphasis on past experience
11. Proper project planning and scheduling
12. Complete and proper design at the right time
13. Site management and supervision
14. Collaborative working in construction
15. Compressing construction durations

Research findings and results

Questionnaire were distributed to 20 respondents and were collected

Ranking of delays

The causes, effects and minimisation of construction delays were ranked by using relative important index.

The top affecting causes of delays category wise are late in revising and approving design documents by owner, ineffective planning and scheduling by contractor, mistakes and discrepancies in design documents by consultant, changes in material types and late procurement of materials, equipment breakdowns, personal conflict among labors, and rise in prices of materials.

When the causes were ranked overall, the main causes for delay are ineffective planning and scheduling by contractor, rise in prices of materials, late in revising and approving design documents by owner.

The top effects of delay are time overrun and cost overrun.

The top means of minimisation of construction delays are effective strategic planning, frequent progress meeting, accurate initial cost estimates, proper project planning and scheduling, site management and supervision.
REFERENCES


