

# To Identify the Various Constraints for Delays in Construction Work and Suggesting Remedial Measures for the Same

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**Abstract:** A constraint is defined as anything that limits an organization or entity from moving toward or achieving its goal. Needs and constraints in a multi-party working situation bring complications in project management. The aim and scope of this project is to identify the constraints in construction project working environment. If constraints are better understood at the outset, it is believed that better performance can be assured. Recognizing and expelling constraints from bottleneck exercises help to lessen instabilities in development procedures and builds the straight forwardness of project management. This study was carried out based on literature review and a questionnaire survey. The data for this study will be gathering through a detailed questionnaire survey. The questionnaire form is forwarded to various construction industries through email and in personal. The objectives of the study are to successfully reduce the constraints which will help to decrease the unnecessary wastage and loss of both money and time because of inadequate planning. Postponement in development project would cause for additional cost and misfortune in budgetary return or different advantages from extend. In this way, delay is expensive for both proprietor and temporary worker. The overview discoveries showed that the main drivers of monetary related deferrals are a result poor cash flow management followed by late payment, insufficient financial resources and financial market instability. The methodology of this thesis work incorporates an itemized investigation of worldwide writing identified with development limitations causes in everywhere throughout the world and gathering of information to set up a survey. Utilizing this questionnaire, a review will be done among contractual workers, experts and designers. The outcome got from this questionnaire will give us extreme reasons for development delay, so we can discover the answer for limit them in future development projects. The aim of this dissertation is to identify the various constraints in construction industry & analyze them on the basis of

discussion carried out with experts in locality. The expand-focus principles & techniques will be applied for gathering the various causes from professional literature & also from local experts. This investigation will give a solution for delay in development project by limiting the constraints in development industry.

## 1. INTRODUCTION

Nowadays, companies struggle to survive in a global competition. Every company tries to find the best philosophy which is suitable with their strategy to gain any and every advantage among their rivals. Companies should be more focused on understanding their own structure in terms of processes whether they are in the production or service sector (Simsit, Gunay and Vayvay, 2014). Constraints become important factors which focus on the weakest rings in the chain. Constraints are defined as anything that limits a system from attaining higher performance towards its goal (Chua and Shen, 2003). Identifying and removing constraints from bottleneck activities help to reduce uncertainties in construction processes and increases the transparency of project management (Feng, Lei, Yang, Hong, Pang, Yao and Wang, 2011). Needs and constraints in a multi-party working situation bring complications in project management. Needs are diversified when the client is a large organization such as a public client or a corporate client. However, constraints in construction projects limit their achievement of high performance that we are unaware of the existence of the constraints, or, we tend to put more emphasis on the project goals. The construction working environment involves multi-party participation. Needs and constraints in a multi-party working situation bring complications in project management (Lau and Kong 2006). These can further develop into conflicts and disputes, which bring cost consequences, direct and indirect, to clients and contractors. The project team members have to meet client's needs on one hand and to

overcome constraints on the other hand. With the limited literature for the constraints in the construction working environment, it is important to identify the potential constraints in the construction project, which will help to decrease the unnecessary wastage and loss of both money and time because of inadequate planning (Jacob and McClelland, 2001). Controlling the constraints is thus a precondition for high performance of the project. Constraints is based on the idea that every system has at least one bottleneck which can be defined as any kind of situation that impedes the system to reach high performance level in terms of its purposes. A constraint is defined as anything that limits an organization or entity from moving toward or achieving its goal. Constraints logic forms major portions of the organization's philosophy of continuous improvement. It is applied to identify what factors limit an organization from achieving its goals, developing a solution to the problem, and getting the individuals in the process to invent the requisite changes for themselves. It has been realized that reducing and eliminating critical constraints through better means of look ahead planning are the keys to achieving reliable workflow and, consequently, increased productivity. Constraint modeling is an indispensable step in construction planning. Reliable planning depends on effective identification, formulation, and satisfaction of key constraints in production processes. Reducing uncertainties in the workflow requires new methodologies and tools that can deal with other types of constraints rather than only the process constraints. Construction projects are facing a greater number of uncertainties and more severe risks, which could cause much bigger losses than in the past. Construction projects are subject to numerous constraints of various types, including contractual due dates, resource limitations, and safety, financial, and managerial constraints (Mirzaei and Mabin, 2014). Construction projects are characterized by their complexity, uniqueness, and the fact that there are various types of constraints imposed by stakeholders. If constraints are better understood at the outset, it is believed that better performance can be assured.

## 2. IDENTIFICATION OF CONSTRAINTS

### 2.1. Introduction

Collection of information through literature review and preliminary study of the factors are causing constraints in delay of construction work. The collected data will be the base for the further progress of the study. In our study, we firstly

classified the constraints into five categories based on literature review they are as follows

#### 2.1.1 Economic Constraints

The economic constraints mainly happened with budget limit and allocation of the money. Due to the budget limit, the adopted construction system may not be the best option for achieving the project goal and quality. It will affect the proceeding of the project. As for the allocation of money to be used in the project, if the money is not effectively allocated, it will affect the progress of the project. The effect on the project is the product quality and performance of the project (Muhwezi, Acai and Otim, 2014).

#### 2.1.2 Legal Constraints

The legal constraints exist because there are many regulations that are ruling the construction project. The legal constraints are mainly related to work law, safety regulations, and supervision plan. For example, as prohibited by law, certain types of construction work could not be carried out during Sunday and public holidays. As for the impact of the legal constraints, from one side, it may affect the schedule and lead to project delay (Lau and Kong, 2006).

#### 2.1.3 Environmental Constraints

The public concern and regulations require the environment to be protected such as air protection, tree preservation, traffic limit, noise control and so on. In the planning and design stage of the project, the responsible people need to go to the "Environmental Department" to apply for the approval justification for the project. This takes time and will affect the project progress. If the approval is not obtained on time, the whole project will be delayed, or could not be carried out. There are also other technical constraints arising from air protection, tree preservation, traffic limit, limit due to excavation permit for works, etc (Lau and Kong, 2006).

#### 2.1.4 Technical Constraints

There are quite a few technical constraints arising from restrictive site area and congested surroundings which are particularly applied to the site environment in India. On one hand, building projects in India are usually constrained with restrictive site area where storage space, transportation and temporary works require input of careful planning by design engineers, while the design and construction of the building works itself can be fairly certain at the outset. On the other hand, coordination of services works also poses technical constraints in construction. While having electrical wiring, ventilation duct work, fire services and plumber works with further complication of broadband

alignment, telephoning system and security system give rise to technical constraints that demand coordination and collaboration of multiparties in terms of design and construction. Technical constraints are more readily recognized at the outset and at the stage of design, but this does not mean that all constraints can be overcome (Lorterapong and Ussavadiokrit, 2013).

### 2.1.5 Social Constraints

No construction work could proceed in rural area without people's involvement. The social factors constitute constraints in the construction working environment. It is not surprised to learn that undesirable effects come from a relative small number of key persons and the constraints are human constraints (Wang, Shou and Wang, 2015). These social constraints may appear minor and insignificant, but is very complicated to deal with. Sometimes it may arouse big problems for the project and will at the same time affect the progress of the project. Constraints related to people can appear in three different forms:

- a) Human resistance
- b) Emotional constraints
- c) Ownership of the problem

In implementing changes, there will be human resistance. So constraints have to be thought of during the planning stage before actual implementation so as to minimize the effect of human resistance. As for the emotional constraints, there is tendency for people to take defensive action rather than 'toleration' even the rational minds tell them not to. In this stance, people are emotional disturbed. In situations when constraints are concerning job security, the impact of the emotional constraints can be even greater and can cause devastating effects. As for the ownership of the problem, people may at times facing problems caused by others or by Act of God. It is easy to say that they do not cause the problem and thus are not responsible for it. Someone have to be held responsible for whatever causes there are. Moreover, providing an answer to a problem even if you are aware of it sometimes may not bring the expected results.

## 3. RESEARCH STRATEGY

Data collection is a vital part of research. In this project, data was collected from Maharashtra, Kolhapur and Sangli region through direct interview based on standard questions formulated. A questionnaire was designed to collect information from Engineers, Contractors, Architects, and Builders.

The questionnaire contains a set of simple and straight forward questions whose purpose is to

collect particular data and information. This provides the basis to identify the constraints in delay of construction work. The collected data will be the base for the further progress of the study.

The processes plays vital role in completing the construction task in desired way. Financer's expectation, requirements and participation will be direct influencing factor for causing constraints in delay of construction work. The Financers will feel the value of the capital that he has spent on if only his desires and expectation are delayed due constraints in the completion of project. So in order to get a better understanding regarding Financers views and desires on the timely completion, a direct interview has conducted and the data has been tabulated.

### 3.1 Primary Data

The primary data was obtained using the survey method. These include the distribution of questionnaires and collection of data from key respondents and professionals pertaining to the construction industry. In order to achieve the aim and objectives of the study, well-designed questionnaire were formulated to gather information from appropriate respondents. Data obtained was analyzed to get meaningful conclusions and recommendations.

The design of questionnaire was done based on the analysis made in various literature reviews. Various data's have been collected for designing the questionnaire. Total 26 questions related to different factors were designed but those questions having more impact on delay have selected. Questionnaire was generally designed in the rating of factors on five point scale was given in the questionnaire.

#### 3.1.1 General

After identifying the problem and setting the objectives of the research, the research methodology has carefully designed to achieve these objectives. The questionnaire is designed and distributed to the Engineers, Contractors, Architects, Builders. In this chapter the research objectives are restated and the general approach for achieving these objectives is illustrated. This chapter discusses the design and the development of the questionnaire which is more applicable to the study.

#### 3.1.2 Activities Conducted

- 1) A comprehensive review of the literature related to the topic of this study is performed.
- 2) To achieve the study objectives, several research techniques have been reviewed and the questionnaire technique has been selected due to the applicability to this research.

3) The questionnaire is developed based on the literature findings and preliminary discussions with some parties involved in public projects.

4) To ensure maximum participations, the questionnaires were sent to major projects, clients and their contractors and consultants.

5) The data collected were presented, tabulated and analyzed using suitable statistical techniques.

6) A discussion of the results is linked with the findings of the literature and delay causes were identified and ranked based on their severity.

### 3.1.3 Weightage for Effect of Delay

It is important to identify the degree to how much the respondents agree or disagree on the severity of these causes based on their own experience and knowledge. To achieve this, a rating scale was designed which consists of 5 point scale. Table 3.1 shows the guidelines for causes regarding to their severity weightage.

**Table 3.1: Weightage for Effect of Delay**

Sr. No.	Category	Explanation	Weightage
1	Not significant (N.S.)	0% delay contributing factors. Work progress is not affected by these factors at all.	1
2	Slightly significant (S.S.)	<35% delay contributing factors. Work progress is affected but without having effect in total construction time.	2
3	Moderately significant (M.S.)	35-60% delay contributing factors. Work acceleration may be necessary. However, delay could be adjusted within total construction time.	3
4	Very significant (V.S.)	60-75% delay contributing factors. Total construction time is affected. Work acceleration may be necessary; even then overall construction time exceeds and may also affect total project cost.	4
5	Extremely significant (E.S.)	>75% delay contributing factors. These factors certainly increases project completion time as well as may exceed project cost.	5

$$\text{Relative Importance Index (RII)} = \frac{\sum W}{A \times N}$$

Where,

W is the weighting given to each factor by the respondents (ranging from 1 to 5),

A is the highest weight (i.e. 5 in this case), and

N is the total number of respondents (Gunduz, Nielsen and Ozdemir, 2013).

## 4. FINANCIAL RELATED DELAYS

Delay in payment resulted in the slow progress on site, as many sub-contractors and suppliers are subjected to financial difficulties; hence no material is delivered to the site. Table 4.1 shows the list of 19 possible causes of financial related problems.

**Table 4.1: A List of 19 Possible Causes of Financial Related Problems**

Category	Sub-categories
<b>Late payment</b>	<ul style="list-style-type: none"> <li>Client's poor financial and business management</li> <li>Withhold of payment by client</li> <li>Contractor's invalid claim</li> <li>Delay in valuation and certification of interim payment by consultant</li> <li>Inaccuracy of valuation for work done</li> <li>Insufficient documentation and information for valuation</li> <li>Involvement of too many parties in the process of honoring certificates</li> <li>Heavy work load of consultant to do evaluation for variation order</li> </ul>
<b>Poor cash flow management</b>	<ul style="list-style-type: none"> <li>Contractor handles too many projects at the same time</li> <li>Contractor's unstable financial background</li> <li>Unqualified contractor underbidding the project cost</li> <li>Lack of regularly cash flow forecasting</li> <li>Poor credit arrangement with creditors and debtors</li> <li>Capital lock-up</li> </ul>
<b>Insufficient</b>	<ul style="list-style-type: none"> <li>Difficulties in getting loan</li> </ul>



<b>financial resources</b>	from financiers <ul style="list-style-type: none"> <li>• Allocation of government budget not in place</li> </ul>
<b>Financial market instability</b>	<ul style="list-style-type: none"> <li>• Increment of interest rate in repayment of loan</li> <li>• Inflation (material prices, labour wages, transportation costs)</li> <li>• Increment of foreign exchange rate (imported materials and plants)</li> </ul>

significantly give impact to project's cash flow and hence affect the timely performance of the project. Figure 3.2 shows the financial related delays and their categories.

## 5. RECOMMENDATIONS TO REDUCE DELAY PROBLEMS

Delays can be avoided or minimized when their causes are clearly identified. According to the preceding findings, the following recommendations can be made as ways to minimize and control delays in construction projects:

### 4.1 Late Payment

Late payment is defined as failure of a paymaster to pay within the period of honoring of certificates as provided in the contract. The parties involved in the process of payment claim such as client, contractor, superintending officer, architect, quantity surveyor, banker and other construction players may cause a payment to be delayed. A delayed payment by a party who is involved in the process of payment claim may have an influence on the supply chain of payment in whole (Rahman, Takim and Min 2009).

### 4.2 Poor Cash Flow Management

Cash flow management is defined as a process of monitoring, analyzing and adjusting projects cash flow. The most important aspect of cash flow management is to avoid extended cash shortages that are caused by having too great a gap between cash inflows and outflows. A well-managed cash flow is important to enable the delivery of a successful project by performing a cash flow analysis on a regular basis to identify cash flow problems. In analyzing the cash flow of a project, cash flow forecasting is an essential method to head off cash flow problems. It is then important to develop and employ strategies that will maintain an adequate cash flow for the project. Therefore, a well-managed cash flow will improve the project's cash flow and subsequently improve the timely performance of a project. Conversely, a poorly managed cash flow represents the opposite.

### 4.3 Insufficient Financial Resources

One of the most important factors causing delays in high rise projects is the shortage of resources. Main causes of delays are the insufficient resources of an organization. Lack of funds may affect the project's cash flow and lead to delay in site possession, which consequently causes delays in the project as whole.

### 4.4 Financial Market Instability

The external factors of poor economic conditions such as currency and inflation rate would

1. Contractors should not be rewarded jobs for which they lack sufficient expertise. They should gain necessary experience before the bidding stage. Inadequate experience of contractors is the most important factor in causing delays. Contractors with inadequate experience cannot plan and manage projects properly, and this may result in deleterious consequences.
2. Contractors should pay more attention to preparing effective planning and scheduling. During construction, planning and scheduling may be revised if necessary conditions occur. Only a project that is well planned and scheduled can be well executed.
3. All working drawings must be clearly drawn indicating all the dimensions and labels to scale so as to avoid confusion during construction.
4. Site management and supervision should be done correctly. Administrative staff should be assigned to make necessary arrangements to complete projects within the specified time while meeting quality and cost requirements.
5. Owners may demand design changes during construction, but only to the extent that no adverse effects occur with respect to mission critical activities.
6. Delivery of construction materials to a site should not be late so that work may be executed in the planned order.
7. Generally, large projects may entail having many subcontractors working under main contractors. If a subcontractor is capable and reliable, the project can be completed on time as planned. If the subcontractor underperforms because of inadequate experience or capability, the project may face delays. The use of many subcontractors may lead to a high risk of delays.
8. Inspection and testing by consultants is an important activity during construction since poor quality inspection may result in lower quality of work.

9. The quality and experience of the labour force can have a major impact on projects. Unqualified workers may lead to inefficient work and cause accidents during construction.
10. Clients should ensure that proper planning and costing of the works are made during the pre-contract period so as to avoid intermittent stoppage of works as a result of funding constraints since this not only increases the construction period but also impacts on the contractors overhead costs and costs associated with mobilization and demobilization during the period within which the works were suspended.
11. Delays in deliveries to construction sites, approval of design documents, and progress payments are delay factors caused by owners. Sites should receive deliveries as soon as possible. Design documents should be approved promptly; otherwise, work progress could be delayed. Progress payments should be made on time to contractors to finance the work.
12. Owners should make decisions as quickly as possible so as to avoid delay.
13. Since many parties are involved in a project (client, consultant, contractor, and subcontractors), communication and coordination with other parties is a crucial factor in the timely completion of the project. Effective communication avoid most delays. Proper communication and coordination channels between the various parties should be established during each phase of construction. Problems with communication may result in misunderstandings and, therefore, delays in the execution of the project.

## 6. CONCLUSION

To have a good understanding of the identified constraints at the planning stages, we suggest the management to have the constraints documented and to consider these constraints in the relevant project planning agenda and schedule as well as the designing of the organizational structure. At the implementation stage, the management should keep track of the progress and be aware of the constraints they encounter. The management should ensure that enough resources, which include money, facilities, staffing and effort, are allocated to decrease the limitations from the constraints encountered. In view of the nature of the different types of constraints, we suggest that the middle managers are empowered to take up adaptive management in response to the prevailing conditions.

Delay is a serious issue in construction industry as it impacts the time and cost of projects.

Delay in construction projects would cause for extra cost and loss in financial return or other benefits from project. Thus, delay is costly for both owner and contractor. The extent of delays should be reduced by identifying the root causes of financial related problems and find out the solutions that are able to reduce the extent of delays in construction project. The survey findings indicated that the root causes of financial related delays are because of poor cash flow management followed by late payment, insufficient financial resources and financial market instability. Contractor's instable financial background, client's poor financial and business management, difficulties in obtaining loan from financiers and inflation were identified as the most significant underlying causes. All parties involved in the construction project agreed on the fact that clients should bear the greatest responsibility and play the most important role in lessening the impact of financial problems and delays.

The identification of the constraints helps project managers not only understand the characteristics of the constraints, but also predict the time and stage that the constraints may be encountered. The economic constraints, legal constraints and the environmental constraints are mainly appeared in the planning and definition stage. It affects the proposal and design of the project. The technical constraints and social constraints are expected to be encountered during the project implementation and maintenance period. A good prediction of the constraints helps make good project planning and resources allocation. Project managers can judge whether the constraint is maintained through the whole progress of the project.

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