

# Identification of Constraints in Construction Projects to Improve Performance

Tanaya Shinde<sup>1</sup> Divyanshu Sachidanand<sup>2</sup> Nikhil Sachdev<sup>3</sup>  
<sup>1,2,3</sup>MITCOM(M.B.A-P.C.M) MIT-ADT University, Pune, India

**Abstract**— Requirements and constraints in a Joint Venture situation bring complications in project management. Requirements are broadened and varied when the client is a large organization such as a public client or a corporate client. However, in construction project constraints, limit the achievement of high performance. The goal of this paper is to identify the constraints in construction project working environment and apply the theory of constraints (TOC), which provide guidance for taking decisions where constraints exit. With the aim of achieving high performance it is necessary to better understand the constraints of the project. In current scenario, client requirements are discussed well but constraints are not much understood yet. Here we have categorised constraints into five viz:

- 1) Economical
- 2) Legal
- 3) Environmental
- 4) Technical
- 5) Social

Here we suggest that, for achieving high level performance in a project, we suggest to develop awareness in managing and controlling the working environment of the construction project in the context of constraints.

**Keywords:** (TOC) Theory of Constraints, Constraints, Construction

## I. INTRODUCTION

Every project or in working environment have existence of constraints, however the situation be that we are unaware of their existence, or we are more focused on the goals and objectives of project. Though the constraints are discussed on theoretical terms, there isn't much application of them in working environment. Construction projects usually involves joint ventures and multiple stakeholders, this increases the complexity in project management. Multiple number of participants includes chances of conflicts and disputes which affect the project in terms of cost or to the contractor or to the client, directly or indirectly

The project team has to multi task between managing the client and the constraints of the project. To minimise the loss of time, cost, quality wastage, it is important to identify the potential constraints in a project. (Whelton, Penneanen and Ballard 2004; Tam, 2006), Relation between Processes and Objects is described as constraints. Constraints create hurdles or limitations which are undesirable for the organizational achievements.

The solution is in the Environment and System Limitations as suggested by Stein in 1997. For efficiency of the project these constraints should be eliminated or reduced to minimize their effect and generation of wastage.

Planning and Controlling are two major functions of project that Constraints management contributes to. Planning functions focuses on developing optimal schedules using simple or complicated algorithms with the objective of fulfilling project goals such as duration, cost, and quality.

Control functions emphasizes on both plan and implementation such as work assignment and and supply chain management such as material delivery and inventory control, resource allocation etc.

To Increase and maintain the transparency of the project management and to reduce the uncertainties in construction processes, Identifying and removing constraints from bottleneck activities is the key.

Yates in 2002 suggested, precautions and control measures can be taken if the cause of disputes and conflicts are understood, for this a framework was proposed for identification of conflict and disputes in construction industry. In 1998 McMullen classified constraints in two:

- 1) Constraints with lesser impact.
- 2) Constraints with greater impact

According to McMullen, from the range of identified constraints many are of relatively low impact and single or fewer are of higher impact. The constraints that possess higher impact are called as root cause or core problems. Time is an important or prime constraint and so its important to use it effectively on identifying and maintaining the focus higher impact constraints.

Goldratt categorises constraints in two basic types as:

- 1) Physical constraints.
- 2) Non-physical constraints

A physical constraint is something like the materials, machines, people, demand level, physical capacity of a machine, in other words, it is something that is rigid.

A non-physical constraint might be something like demand for a product, a corporate procedure, or an individual's paradigm for looking at the world.

Capacity and demand are two variables of constraints. A comparison of the two functions at the system level acts as a measure to track the progress of project towards its goal. The constraints can be classified into two types:

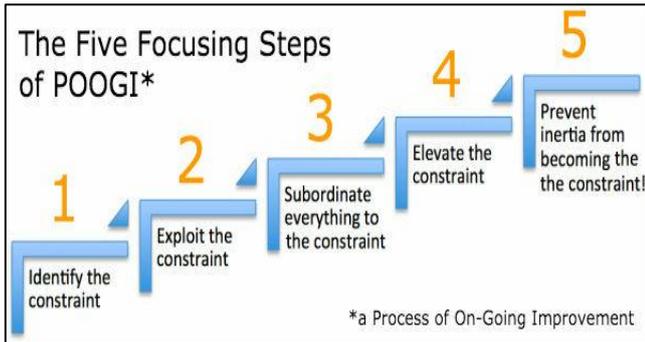
- 1) Internal constraint
- 2) External constraints.

Internal constraints are the ones within the system and usually more under control. When top managers assign middle managers with tasks, they frequently face the situations where they have to manage internal constraints to complete the task, the hurdle here is that they may have to engage more time and resource than planned. There may arise situations or there are possibilities where they have to go beyond their capabilities in order to accomplish the task.

External constraints are the one outside the system and control over them is on lower level. Hence the systems actions taken over tem can merely minimize them. It should be noted that constraints cannot be permanently eliminated.

They shift from one medium to other and every time theory of constraints is to be applied. The main aim of developing TOC is to identify and eliminate the constraints for smooth processing and achieving organizational goals. For continuous improvement of the organizational process application of TOC plays a major part, it helps identify the

hurdles, identify solution, and deploying individuals in process to invent changes for themselves. The five steps applied for TOC by Goldratt are as shown below:



A. The Five Focusing Steps (POOGI)

- 1) Identify The System's Constraint.
- 2) Exploit The Constraint.
- 3) Subordinate Everything Else To The Constraint.
- 4) Elevate The Constraint.
- 5) Prevent Inertia From Becoming The Constraint

II. RESEARCH METHOD

The reason for unpleasant effects or undesirable problems are the core problems or core constraints. So to eliminate the hurdles identification and evaluation of constraints is key. We that first step to TOC in project management is identification of constraints which shall help project managers make appropriate decisions and achieve higher performance index. In our study we categorised constraints in 5 based on literature review (Manning 1995, Peter and Rod 2003, Lambropoulos 2006; Schultmann and Rentz 2002) as:

- 1) Economic constraints.
- 2) Legal constraints.
- 3) Environmental constraints.
- 4) Technical constraints.
- 5) Social constraints.

III. STUDY AND RESULTS

A. Economic Constraints

Constraints are physically classified under internal and external, economical comes under External Constraints. The economy of the country closely connected with the success of construction industry. Economy of country on better terms better will be performance of construction industry. The reason being, well economy, more disposal income, more buying of goods by individuals, thus more business by the industry. To fulfil these requirements, demand of more banks, building societies and finance companies and also for the shops providing the goods which people need, all of which provides additional work for the construction industry.

Therefore the economic constraints mainly deal with budget and allocation. Due to limitation in budget, construction industry may not be best option to earn the goals and quality project is aiming for, this will also affect the project proceeding. To summarise unmanaged economic constraints lead to affected quality, performance, functions, product of the project.

B. Legal Constraints

Work law, supervision plan, safety regulations are points that are related to legal constraints, legal constraints appear due to the rules and regulations that are ruling construction industry. There are also situations where publication of new rules, the project has to update the whole schedule accordingly to comply with the new rules and regulations. Talking about impact, legal constraint impacts the timeline and lead to delay.

Examples are: Approvals, permits, types of construction work could not be carried out on Sunday and public holidays etc.

C. Environmental Constraints

The project should run hand in hand with environment and human, that means it should cause no harm to the environment. In every stage of the project specially during planning and design stage, Environmental department should grant approvals and permit on a responsible note. This process takes time and affects the schedule, delay in approvals leads to delay in project. There are also other technical constraints arising from air protection, tree preservation, traffic limit, limit due to excavation permit for works, etc.

D. Technical Constraints

Activities or processes involved in completion of project, generally refer to technical constraints, these often deal with the practicality of the building standards and methods. Example: space required for builders work, site access routes, available storage or handling areas, co-ordination of services, construction tolerances, and so on.

E. Social Constraints

Stakeholders and consultation interests play major part of social constraints. Social Constraints include factors that are arised due to external interest or opposition to the project from external factors. Factors like media pressure, public concern, give tougher role as social constraints to a project, these can cause delay in schedule costing and so the whole link of project is disturbed. Social constraints have such high influence on project that they even may result in alterations and changes in the original project. Government projects or the ones funded by public money are more prone to social constraints.

1) Result

Average rating based on the study is depicted in the table below.

Constraints	Level of Impact on the construction project
1. Legal constraint	7.20
2. Economic constraint	7.00
3. Environmental constraint	7.00
4. Technical constraint	4.75
5. Social constraint	5.40

Table 1: Level Impact of the Constraints on the Construction Project

IV. CONCLUSION

Documentation of constraints that are identified at planning stage helps in good understanding and these should be

considered for better planning and designing of organizational structure. During execution stage management should keep track of progress and keep a note of constraints that they encounter. Resources viz, money, manpower, machinery, overheads, and efforts should be deployed efficiently to decrease the hurdles caused from the constraints encountered during the project.

As per our study and in context of nature of different types of constraints, Middle managers play important role in dealing with constraints. Although we are still in the process of collecting data, we regard the results sufficiently indicative of how constraints in construction would be like. We consider further study in other areas of TOC necessary to understand the complex nature of construction.

#### REFERENCES

- [1] Chua, D. K. H., Shen, L. J. and Bok, S. H. 2003. Constraint-based planning with integrated production schedule over internet. *Journal of Construction Engineering and Management*. 129(3). pp. 293-301.
- [2] Cunningham, J. B. 1979. The management system: its functions and process. *Management Science*. 25(7). pp. 657-670.
- [3] Goldratt, E. M. 1990. *Theory of constraints*. Croton-On-Hudson, NY: North River Press. Goldratt, E. M. 1993. 2nd edition. *The goal: a process of ongoing improvement* / by Eliyahu M. Goldratt and Jeff Cox. Aldershot, Hampshire: Gower. Goldratt, E. M. 2000. *Necessary but not sufficient: a theory of constraints business novel*. Eliyahu M. Goldratt with Eli Schragenheim and Carol A. Ptak. Great Barrington, MA : North River Press.