

EMPIRICAL STUDY ON THEORY OF CONSTRAINTS IN A CONSTRUCTION PROJECT MANAGEMENT

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Abstract: Constraints acquire complexities managing a project. Needs are differentiated when the customer is a vast association, for example, a public sector customer or a corporate customer. Be that as it may, constraints in construction business limit their accomplishment of high efficiency. The point and extent of this paper is to identify the constraints in a construction business project working condition and apply the Theory of Constraints (TOC), which gives reasonable strides to settling on management decisions in circumstances in which constraints exist. On the off chance if constraints are better comprehended at the start, it is trusted that better execution can be guaranteed. I have recognized the constraints in six classifications, they are: technical constraints, legal constraints, economical constraints, time constraints, social constraints, and management constraint. The effects of these constraints to the construction project were contemplated. I would like to propose creating attention to overseeing and controlling the constraints in construction project working condition for accomplishing high and effective construction project working condition.

Keywords: constraints, construction, project management, theory of constraints (TOC).

I. INTRODUCTION

Constraint is a component, factor, or subsystem that fills in as a bottleneck. It confines a substance, venture, or framework, (for example, an assembling or basic leadership process) from accomplishing its potential (or larger amount of yield) with reference to its objective.

constraint is characterized as a compelling condition, office, or power that confines the frameworks' execution in a given setting/condition (Mayer, Painter and Lingineni 1995, Whelton, Penneanen and Ballard 2004). Each generation framework will have at least one limitation (Chua, Shen and Bok, 2003). Constraints portrays the connections among items and procedures (Whelton, Penneanen and Ballard 2004; Tam, 2006). It is whatever obstructs advance toward a target or an objective (Mcmullen 1998). Requirements may cause unwanted results or are not strong of the authoritative objectives. It is the environment and the confinements of the framework which directs the arrangements (Stein 1997). These constraints ought to be diminished or disposed of so as to limit waste and make the stream progressively proficient.

constraints must not be overseen. For all intents and purposes, in all cases the constraints' restricting effect can be decreased or disposed of. Constraints management contributes to two noteworthy project functions, planning and control (Chua et al. 2005). Arranging capacities underscore creating ideal calendars utilizing straightforward or complicated calculations with the goal of satisfying venture objectives, for example, span, cost, and quality. Control capacities are centred around both arrangement and usage, for example, work task and asset assignment, and store network the board, for example, material conveyance and stock control. Recognizing and evacuating requirements (Chua et al. 2003) from bottleneck exercises help to decrease vulnerabilities in development procedures and expands the straightforwardness of venture the executives. Yates (2002) proposes that evasion measures can be taken in the event that they comprehend the reason for clashes and question. They proposed a structure to distinguish the harsh variables of the contention and debate in the development business.

Mcmullen (1998) arranged the constraints into two groups: the constraints with lesser effect and the ones with more noteworthy effect. He recommended that each circumstance contains numerous relative lower sway requirements yet just a solitary or a couple of higher effect constraints. The higher effect requirements are called core problems or root causes. He proposed that as time is everybody's prime limitation, keeping up the focal point of an individual or the board on distinguishing and following up on the higher effect constraints will help utilizing the rare time successfully. There are two essential kinds of requirements as per Goldratt (1990): physical constraints and non-physical constraints. A physical constraint is something like the physical limit of a machine, at the end of the day, it is something that is rigid and in its present state has a point of confinement on its capacity or throughput (for example materials, machines, individuals, request level). A non-physical limitation may be something like interest for an item, a corporate method, or a person's worldview for taking a glance at the world.

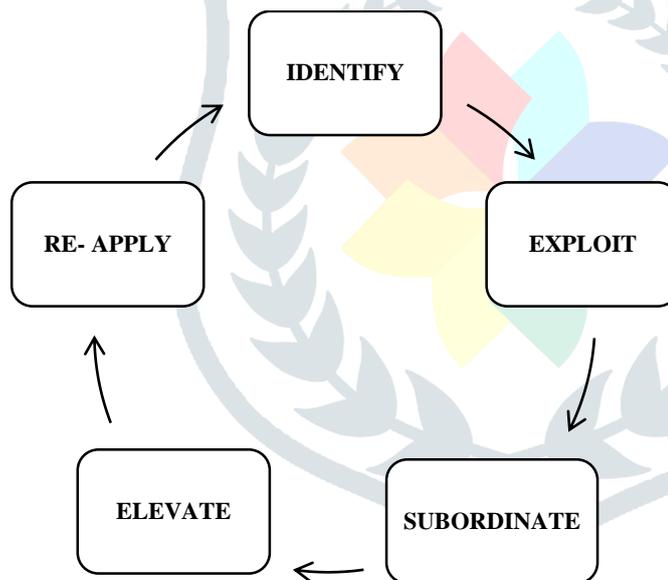
constraints are an element of two factors: capacity and demand. An examination of the two at the framework level gives a solid marker of advancement towards its objective (Dettmer, 1998). The imperatives can be ordered into two kinds: (1) internal constraints and (2) external constraints.

Internal constraints are inside the framework and are generally increasingly levelled out. This implies when the framework can't stay aware of the interest, move should be made to wipe out the constraint. Be that as it may, proceeding such an activity will thusly convey to a point where limit surpasses request and requirement exists in another structure. Middle managers habitually experience circumstances when an undertaking is allotted by the best administration with constraints. The managers at that point need to go over these requirements so as to finish the project. The outcome is that they may need to take additional time or assets than what has been arranged. In the event that they face constraints that can't be survived, there is a plausibility that they may need to do things exceeding their capacity so as to achieve the assignment. A few supervisors should take erratic activities, for example, unlawful activity, misleading activity, or power the others to agree with no change. External constraints are outside the framework and are less levelled out. This implies the framework has slack ability to deal with external constraints and move made can only limit the impact of unwanted result as opposed to breaking the constraints. Nonetheless, constraints can never be for all time broken. They just move starting with one spot then onto the next and TOC needs to re-apply.

The theory of constraints (TOC) is an administration worldview that sees any sensible framework as being restricted in accomplishing a greater amount of its objectives by an extremely modest number of requirements. There is dependably something like one constraint, and TOC utilizes a focusing procedure to recognize the constraint and rebuild whatever remains of the association around it. TOC embraces the idiom "a chain is no stronger than its weakest link ". This implies processes, associations, and so forth., are powerless in light of the fact that the weakest individual or part can generally harm or break them or if nothing else combatively influence the result.

Theory of constraints (TOC) developed by Goldratt (1990) is a process aimed at finding the constraints and removing them from the organisational process that are a barrier in the way of completion any assignment and project of the organisation. TOC logic shapes real bits of the association's logic of persistent improvement. It is connected to distinguish what factors limit an association from accomplishing its objectives, building up an answer for the issue, and motivating the people in the process to design the imperative changes for themselves. Goldratt has presented 5 steps in applying theory of constraints which is depicted in the Figure 1.

Figure 1.1: Goldratt's five steps of theory of constraints (TOC)



Identifying the constraint: strengthening any connection of a chain is an exercise in ineffectiveness and strength. So also, by far most of the efforts to "improve" something in the organisation's neglect to result in more benefits for investors, charm for clients, or fulfilment for workers. This is on the grounds that most activities are not focused around the constraint of the association/organisation.

Exploit the constraint: The yield of the constraint administrators or confines the yield of the organisation in general. It is in this manner basic to crush however much as could reasonably be expected out of it. Boost the use and efficiency of the requirement not usage and profitability of non-limitations. As opposed to promptly obtaining a greater amount of the constraints by purchasing machines, procuring specialists, expanding the publicizing spending plan, and so forth. It is best to first figure out how to utilize the assets that we as of now have all the more effectively.

Subordinate everything else to the constraint: By definition, any non-requirement has more ability to create than the constraint itself. Left unchecked, this outcomes in enlarged WIP stock, extended lead times, and continuous facilitating/firefighting. Subsequently, it is vital to abstain from creating beyond what the limitation can deal with. In an assembling situation this is cultivated by choking the arrival of raw material in accordance with the limit of the constraint. Similarly, vital is guaranteeing that whatever is left of the framework crafted by the constraint consistently. It should never at any point be famished for information sources, or sustained low quality materials. which can be accomplished by keeping up a sensible cradle of security stock.

Elevate the constraint: once the ability of a specific system is exhausted, it becomes necessary to expand the functional system by investing in all the possible measure like equipment, human resource, land and building or any other factors as per the requirement

Re-apply: prevent the inertia to come back, when elevated, the powerless connection may not stay weakest. Consider elevating different assets to hold the old constraints, contingent upon where you wish to have the constraint in the long haul. Another constraint requests an entirely different method for dealing with the framework. it is consequently to come back to Step 1.

II. RESEARCH METHODOLOGY

Constraints in any project create an imbalance of sources and form a barrier in completion of the project effectively while in turn might affect the productivity of the project. Construction projects are usually followed in a methodical way which will include going about one step at a time towards completion. Theory of constraints helps in identifying the constraint that is limiting the project and eliminate the same to an extend. In my study the constraints are identified in six different types based on some of the review of literature (J.B. yang (2013), M. Maryam & Victoria j. Mabin (2014), Ellen Lau1, Janet Jiahui Kong) and construction industry's factors induced in a project.

Questionnaire was used as a tool to collect data from various parties involved in the construction project in a contractor company, among the 50-questionnaire circulated 10 were not responded. the population for the study were asked to fill a set of question with some five-point scale question and some ranking questions regarding the constraints they faced during the completion of the project in the company. the impact of a given constraint on the project was to be ranked by the respondents.

III. RESULTS AND DISCUSSIONS:

The questionnaires were analysed and following are the constraints in detail which effect the construction project.

3.1. Technical constraints:

There are a few technical constraints that forma barrier in the project these constraints usually arise due to defect in the design of the project, site environment, surroundings of the working place, transportation patterns and storage capacity. these constraints must be monitored by the design engineers closely and planned out carefully, coordination of services also consist technical constraints. Technical constraints are all the more promptly perceived at the beginning and at the phase of plan, yet this does not imply that all limitations can be survived.

3.2. Economical constraints:

The financial or economical constraint primarily occurred with budget limitation and allotment of the cash. Because of as far as possible, the received construction framework may not be the best alternative for accomplishing the construction objective and quality. It will influence the procedure of the construction. With respect to the allotment of cash to be utilized in the task, if the cash isn't adequately designated, it will influence the advancement of the project. The impact on the task is the item quality and execution of the undertaking. thus, if economic constraints for the undertaking couldn't be overseen well, the item/execution/work/nature of the project will be influenced.

3.3. Legal constraint:

The legal constraints exist on the grounds that there are numerous guidelines that are administering the projects in construction industry. The legal constraints are mainly identified with work law, safety regulations & guidelines, and supervision plan. For instance, as denied by law, like minors cannot be recruited for work and people with disability cannot be forced to work on a construction site. With respect to the effect of the legal constraint, from one side, it might influence the schedule and lead to extend delay. For instance, when traffic redirection requests quick choice, the group needs to hang tight to procedural approval before continuing on location. From the opposite side, it might influence the arranging and advancement of the project, for example, traffic mandate and removal grant, where endorsement is required before the work begins.

3.4. Time constraints:

Time constraints refer to the obstacles on the begin and end times of each activity in a project's basic way, which is the succession of each activity that can't be postponed without delaying the whole project. The more fantastic the idea, the more it can take and the costlier the task moves toward becoming. When you're feeling the pressure to deliver, the project may finish up downsizing the scale so as to convey on time and inside the budget. On the other hand, you may need to add assets to ensure the project is finished on time.

3.5. Management constraint:

The hierarchical structure of an organization can incredibly affects the project's prosperity, since it's characterizing the undertaking's condition. stakeholders could affect choices that should be taken. Or then again, the moderate correspondence stream or slow communication among managers and executives and undertaking supervisors could result in unusual project decelerations. Adapting to hierarchical structure and restrictions can be troublesome. The management is regularly not ready to get through the organisation's current methods and patterns, make the due date, and remain inside the financial plan.

3.6. Social constraint:

No construction work could continue in any zone without peoples' inclusion. The social elements establish constraint in the development working condition. It isn't astonished to discover that unwanted impacts originate from a relatively modest number of key people and the limitations are human constraints. These social constraints may seem minor and immaterial, however is exceptionally difficult to manage. In some cases, it might stir enormous issues for the project and

will in the meantime influence the advancement of the project. Other public concern and media weight additionally comprise requirements to the construction project. public concern and internal audit on "appropriate" utilization of public cash, in reality force restriction on new activities and commitment of better contractual worker on cost of higher contract whole. Here and there, when another innovation or configuration is proposed to complete in a project, general society, for example, the media and the review division, will limit the underwriting of the use of the cash. The checking framework lean towards utilizing each rupee adequately. This constraint will influence the reception of new innovation use in construction business. It additionally influences the plan and contracting of the project.

The average score of the rating on the level of impact of constraints on the project is depicted below in the table 1

Table 3.1: level of impact of constraints on the project.

| Constraints | Level of impact on the project (according to ranking) |
|-----------------------|---|
| Technical constraint | 6.00 |
| Economical constraint | 8.00 |
| Legal constraint | 6.10 |
| Time constraint | 7.80 |
| Management constraint | 4.25 |
| Social constraint | 6.20 |

The economical constraint has the highest score among all which tells us that the impact of the high costs and low budget factor is a very big limitation in completion of the project as the limited budget won't suffice if the costs of raw materials and other sources rises during the tenure project and lead to incompleteness or under satisfactory work. The second highest score is of time constraint which has an above average impact on the project, any project done in proper stipulated time is efficient but if one needs a good and perfect it might take time and hence the tenure of the project might increase which will also increase the cost of the project. time consuming activities cannot be avoided or skipped as the whole construction project has to follow a method of production and building.

Constraints such as legal constraints, technical constraints & social constraints almost have the similar impact on the construction of project it may not be as high as economical and time constraint but even then they create a barrier in completion of the project, legal constraints delay the project as the procedural work takes time and technical constraint may result in defect in the plan or minor changes made in the plan for convenience purpose leading to bigger problems but the social constraint will have the most impact as the human capital is one of the core requirements of the industry and it is provided by the society which may or may not be in favour of the company for various reasons like trusting the company with the public money and trusting the quality of materials used and so on.

Although management constraint may have the lowest score but the impact still remains a problem if not adhered to, management constraints can be overcome with some easy and effective implications like dynamic management and organisation policy that can be tailored as per the requirements of the project rather than relying upon one rigid policy or structural methodologies for completion of a project.

This confirms that if one constraint isn't managed well in time it can lead to giving rise to another constraint. For example, if the project encounters problems due to legal issues it might halt the project till the issue is solved and the raw material already in the project may not have long shelf life and hence will lead to spoiling the raw material and increasing the losses and cost of the project.

The distinguishing proof of the constraints helps project managers comprehend the attributes of the requirements, yet additionally foresee the time and stage that the constraints might be experienced. The economical constraint, legal constraint and the management constraints are for the most part showed up in the early phases of the project. It influences the proposition and structure of the organization. The technical constraints and social constraints are relied upon to be experienced in between the project execution and support period. A decent forecast of the constraints helps make good project resource allocation and planning. Project managers can pass judgment on whether the constraint is kept up through the entire tenure of the project, which is named as "permanent constraints"; or where the constraints could be evacuated, which is named as "temporary constraints".

IV. CONCLUSION

To have a decent comprehension of the various constraints identified at the early stages, I recommend the administration to have the constraints reported and to consider these constraints in the relevant plan and schedule just as the planning of the organisational structure. At the execution stage, the managers should monitor the advancement and know about the constraints they experience. The organisation ought to guarantee that enough assets, cash, offices, staffing and efforts, are assigned to diminish the restrictions from the constraints experienced. In perspective on the idea of the diverse sorts of limitations, I propose that the managers enabled to take up versatile management in light of the prevailing conditions. In spite of the fact that during the time spent gathering information is less, I regard the outcomes adequately demonstrative of how constraints in construction project would resemble. It is without saying that further research in different zones of TOC should be considered as it is important to comprehend the complex idea of development.

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REFERENCES

- [1] Aleksandar Zivaljevic, (2015) "Theory of constraints – application in land transportation systems", *Management of Environmental Quality: An International Journal*, Vol. 26 Issue: 4, pp.505-517
- [2] C. Carl Pegels, Craig Watrous, (2005) "Application of the theory of constraints to a bottleneck operation in a manufacturing plant", *Journal of Manufacturing Technology Management*, Vol. 16 Issue: 3, pp.302-311,
- [3] Cunningham, J. B. 1979. *The management system: its functions and process*. Management Science. 25(7). pp. 657-670.
- [4] Goldratt, E. M. 1990. *Theory of constraints*. Croton-On-Hudson, NY: North River Press.
- [5] Goldratt, E. M. 1993. 2nd edition. *The goal: a process of ongoing improvement / by Eliyahu M. Goldratt and Jeff Cox*. Aldershot, Hampshire: Gower.
- [6] 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.
- [7] J.-B. Yang. 2003. *Applying the Theory of Constraints to Construction Scheduling*
- [8] Mahesh C. Gupta, Lynn H. Boyd, (2008) "Theory of constraints: a theory for operations management", *International Journal of Operations & Production Management*, Vol. 28 Issue: 10, pp.991-1012
- [9] Maryam Mirzaei and Victoria J. Mabin. 2014. *Exploring constraints in projects: A construction industry case study*
- [10] McMullen, T. B. 1995. *Introduction to the theory of constraints (TOC) management system*. St. Lucie Press/ APICS Series on Constraints Management. Neave
- [11] Rahman, S. 1998. "Theory of constraints: A review of the philosophy and its applications", *International Journal of Operations & Production Management*, Vol. 18 Issue: 4, pp.336-355,
- [12] Walker, A. 1989. *Project Management in Construction*. 2nd Edition. Oxford: BSP Professional Books
- [13] Yates D.J. and Hardcastle C. 2002. *The Causes of Conflict and Disputes in Construction; A Review of Current Research*, *Journal of Financial Management of Property and Construction*. 7(3). pp. 203-214.