IDENTIFICATION OF CONSTRAINTS IN CONSTRUCTION PROJECTS

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Abstract - The goal of this project and its scope is to recognize the constraints in infrastructure construction projects. If constraints are well understood at the commencement of the project, enhanced performance can be guaranteed in future. Classifying and eliminating constraints from obstruction activities will help to decrease the suspicions in construction procedures and will escalate the limpidity of project management. This study was carried out on the basis of literature review and a questionnaire survey. The data for this study was collected through a questionnaire survey. The questionnaire forms were distributed to various construction companies by the means of email. The objectives of the study are to successfully diminish the constraints which will help in the lessening of needless wastage and loss of money and time because of poor planning. Importance Performance Analysis method (IPA) was used to analyze the collected data. Final results show the top limiting factors aka constraints causing delay, cost overrun and poor quality work.

Key Words: Constraints, TOC (Theory of Constraints), Five Focusing Steps, Importance Performance Analysis (IPA).

1. INTRODUCTION

In current construction situation, it is vital to grow with the new technology & concepts. The ultimate goal is nonstop improvement. Essentially in India, where the appropriate system of work is not followed, TOC will not only help in controlling the limiting factors but also help in continuously approaching the new techniques to overcome delay and cost overrun. Theory of Constraints (TOC) presented by Dr. Goldratt in his book titled The Goal. It is an overall management philosophy. Constraint is point where the project or task fails to perform at it is predicted.

“Anything that bounds an organization or individual from moving toward or achieving its goal” is known as a constraint. Constraints exists in all working environments. Though, there can be situations that we are not aware of the existence of the constraints, we tend to put more importance on the project goals. Even though constraints have been discussed in much of the management works, there is little detailed study on constraints in construction projects. The construction projects involve multi-party involvement. Complications can occur in project management in a multi-party working situation which can further develop into conflicts and disputes, resulting in cost consequences, direct and indirect, to clients and contractors. The project team members have to meet client's requirements on one hand and to overcome constraints on the other hand. It is important to identify the probable constraints in the construction project, which will help in the reduction of the unnecessary wastage and loss of money and time because of poor planning. Thus, controlling the constraints is a pre-condition for extraordinary performance of the project.

The five categories in which the constraints may be divided are as follows:

<table>
<thead>
<tr>
<th>TYPES OF CONSTRAINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic constraints</td>
</tr>
<tr>
<td>Legal constraints</td>
</tr>
<tr>
<td>Environmental constraints</td>
</tr>
<tr>
<td>Technical constraints</td>
</tr>
<tr>
<td>Social constraints</td>
</tr>
</tbody>
</table>

Fig -1: Type of Constraints

THE FIVE FOCUSING STEPS:

Fig -2: Five Focusing Steps

2. OBJECTIVE

The objective of this study was to explore the following aspects:

- To successfully diminish the constraints to overcome delay, cost overrun and poor quality work.
- To study the reasons behind the occurrence these kind of constraints and find out the ways to reduce and ultimately eliminate them.
To show the importance of identifying and reducing the constraints in the current construction industry and its effects.

- To improve quality.
- To reduce pointless wastage of materials.

3. SCOPE OF WORK

To make the study more precise, general and realistic, surveys and analysis is limited within the definite boundary. The scope of study is limited to Gujarat state. All types of construction companies executing hard-core construction projects are considered and made a part of this research work.

4. RESEARCH METHODOLOGY

Following methodology was implemented to complete the research work.

1. Primary data was gathered by conducting a questionnaire survey and expert interview amongst many specialists like construction manager, architects, professors, contractors and builders.

2. Review of literature was done by referring local and global research papers, reference books, construction journals etc.

3. Data analysis was done on the basis of the collected data. Importance Performance Analysis (IPA) method.

4. Declaring the results and conclusion from the analyzed data.

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5. MEASUREMENT OF DATA IN QUESTIONNAIRE SURVEY

The constraints disturbing the construction work (and responsible for delay & poor quality work) will be answered by giving number from 1-5. The numbers in questionnaires signify the scale as:

<table>
<thead>
<tr>
<th>Numeric scale</th>
<th>Weight of each scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very low</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Very high</td>
</tr>
</tbody>
</table>

Fig -4: Measurement of Data

There are a total of 43 limiting factors (constraints) which I found during literature study and by interviewing various experts from the construction industry. These limiting factors falls under the 5 main types of constraints which are shown in the below figure.

Fig -5: Types of Constraints
6. DATA ANALYSIS

42 responses were received from the questionnaire survey and now that collected data was analyzed to find out the most vital constraints affecting the construction projects. So, here Importance Performance Analysis method has been applied.

Importance Performance Analysis (IPA) is a quantitative approach for measuring how people feel about a certain characteristic of an issue.

Cartesian diagram comprises of four quadrants which are:

Quadrant I (top priority)
Quadrant II (keep achievement)
Quadrant III (excessive)
Quadrant IV (low priority)

Both the above images shows the average values of Impact and Performance level which are calculated on the basis of the data received from the respondents through the questionnaire survey.
From the above calculations, a two-dimensional graph is plotted which is of Impact vs Performance level. This graph is divided into four quadrants.

The graph is divided into four quadrants using two lines which are drawn from the points that we get by taking the average of the average values of impact and performance level. The average values of impact and performance level are shown in the above figure.

The below figure shows the Cartesian diagram of IPA on the basis of which we can find out the factors which are most important for delay and over budgeting.

- All the factors whose values of impact is high and performance is low will be in 1st quadrant and they would be considered of the highest priority.
- All the factors whose values of impact is low and performance is high will be in 3rd quadrant and they would be considered of the lowest priority.
- The below image shows the value of impact and performance of each factor.

![IPA CARTESIAN DIAGRAM](image)

**Fig - 10: Average values of Impact & Performance level**

IPA CARTESIAN DIAGRAM

The below figure shows the value of impact and performance of each factor.

![IPA Cartesian Diagram](image)

**Chart -1: IPA Cartesian Diagram**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Factors (Constraints)</th>
<th>Impact</th>
<th>Performance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soundness in financing the project by owner</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Premising of completion of project</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Difficulties in project financing by owner (Budget limit)</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Improper allocation of money to related parties</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Difficulties in obtaining work permits</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Land acquisition</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Chances of change in drawing/design</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>8</td>
<td>Building Regulations</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>9</td>
<td>Safety regulations</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>10</td>
<td>Disputes related to contractual documents</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>11</td>
<td>Work laws (of the current government)</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>12</td>
<td>Non-availability of land within city limits</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>13</td>
<td>NCC’s from different departments</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>14</td>
<td>Practicability of completing the project as given duration</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>15</td>
<td>Delay in solving design problems</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>16</td>
<td>Inappropriate project cost estimation</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>17</td>
<td>Imperfect drawings &amp; details</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>18</td>
<td>Inappropriate power</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Fig - 11: Impact – Performance measurement**

![Impact – Performance measurement](image)

![Impact – Performance measurement](image)

![Impact – Performance measurement](image)
7. RESULTS

The restricting factors (constraints) coming in the 1st quadrant has high importance and low performance. These are the factors having high priority which are responsible for delay and over budgeting.

So, by doing the analysis by IPA method, we found out that 15 constraints from a total of 43 constraints have top most effect on the construction project. Those factors (constraints) are:

- Improper allocation of money to related parties E
- Difficulties in obtaining work permits L
- Land acquisition L
- Building Regulations L
- Environmental clearance certificate EN
- Topography & Soil strata EN
- Natural hazards O
- Accidents on site during execution O
- Unavailability of competent sub-contractors T
- Lack of labor(skilled workforce) O
- Unavailability of skilled Engineers and Project Managers T
- NOC’s from different departments L
- Politicking S
- Inappropriate project cost estimation T
- Imperfect drawings & details T
- Disputes related to contractual documents L

Fig-13: Result

Where,
L = Legal Constraints
T = Technical Constraints
E = Economic constraints
EN = Environmental Constraints
S = Social Constraints
O = Other Constraints

Thus, from the above results, we can say that the LEGAL CONSTRAINTS has the most important impact on the construction projects followed by Technical constraints up to other constraints.

8. CONCLUSION

From this research work, it can be specified that finding and eradicating constraints from obstructing activities helps us to reduce the uncertainties in construction processes and upsurges the transparency and efficiency of project management. Construction projects are subject to abundant constraints of various types, including contractual due dates, resource limitations, and safety, land acquisition etc. This research is done to identify the constraints and to find out the major ones prevailing in the construction industry that affects the construction projects in a very adverse manner. From this research, Legal Constraint (and the factors falling under this section responsible for delay) was found out to be a major one.

9. RECOMMENDATIONS

First of all, one should find out the constraint prevailing in the project. Once the constraints are known, different steps should be taken accordingly to eliminate those constraints. The main reason for the delay of land acquisition should be known and a way to overcome it should be found. Different methodologies should be adopted according to the type of the constraint to know its intensity and the overall impact to make its elimination process much easier.

REFERENCES
