Project Definition Rating Index (PDRI) and its use in Construction Management

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Abstract- *Many delays in project planning are caused mainly due to poor definitions of various aspects of projects in context with Project Objectives, Technical design and Execution strategy in resources. The need is to define all aspects clearly without vagueness in pre- planning stage. An important tool for measuring level of scope definition in pre planning stage is Project Definition Rating Index (PDRI). The PDRI is determined by team of project management consultants, owner and contractor discussing all aspects of each definition in detail with a view to better mutual understanding and very precise idea about each definition. The Construction Industry Institute (CII), which is the authorized body, has standardized the format and procedure for PDRI, along with detailed tables and questionnaires. Using the Project Definition Rating Index (PDRI) in the survey, investigators were able to collect important information regarding the wholeness of project scope definition. In this paper, PDRI score has been calculated for one of project "E-Learning Center (Educational Building)" in Pune, India. The score obtained from the Project Definition Rating Index was used for finding the reasons of poor definition and to measure the completeness level of pre-project planning.*

Keywords- Pre-project planning, Project Definition Rating Index (PDRI), Construction Industry Institute (CII), Scope definition.

I. INTRODUCTION

Pre-project planning is a "Process encompassing all the tasks between project initiation and the beginning of detailed design. It begins with a project concept to meet a business need and ends with a decision whether to proceed with detailed design of the proposed project."[1] PDRI is a tool designed to solve the problems of poor scope definition.

The construction industry has recognized the importance of scope definition during pre-project planning and inadequate or poor scope definition, which negatively correlates to the project performance, is among the most problems affecting a construction project. [1]

Researchers conducted by the Construction Industry Institute (CII) have developed the PDRI to address scope definition in pre-project planning for both the industrial and building sectors. The PDRI is a comprehensive, weighted checklist of crucial scope definition elements that have to be addressed in pre-project planning process. It provides the project team a simple and easy-to-use tool to objectively evaluate the current status of a project during pre-project planning. Since its development, researchers at the University of Texas at Austin and CII have been collecting pre-project planning information using the PDRI.

A scope definition tool, Project Definition Rating Index (PDRI) is used as a survey instrument in this case study to measure the completeness level of pre-project planning of E learning center (Educational Building) in Pune..

II. THEORETICAL CONTENT

A. Project Definition Rating Index

CII constituted a research team in 1994 to produce effective and easy-to-use pre-project planning tools that extended previous research efforts so that owner and contractor companies would be able to better achieve business, operational, and project objectives. [3] This research effort led to the development of the Project Definition Rating Index (PDRI). The PDRI for industrial projects is a weighted matrix with 70 scope definition elements (issues that need to be addressed in pre-project planning) grouped into 15 categories and further grouped into three main sections. In responding to the needs of the building industry, CII developed the PDRI for Building Projects in 1999. [8] A complete list of the PDRI's 3 sections, 11 Categories and 64 Elements is given in Fig. 1. The PDRI provides a means for an individual or team to evaluate the status of a construction project during pre-project planning with a score corresponding to the project's overall level of definition. The PDRI helps the Project manager to quickly analyze the scope definition package and to predict factors that may impact project risk specifically with regard to industrial and building projects. [1] For illustration purposes, Section II – Category D of the PDRI for Building Projects (both elements and their weights) is shown in Figure 2. This is one category of 11 in the PDRI for buildings and encompasses eight of 64 scope definition elements. [8]. The total weight (score) of 64 elements is 1000 Point.

Each element has a corresponding detailed description Fig.3 gives an example of an element description. [8]

SECTION I. BASIS OF PROJECT DECISION

A. Business Strategy
- A1. Building Use
- A2. Business Justification
- A3. Business Plan
- A4. Economic Analysis
- A5. Facility Requirements
- A6. Future Expansion/Alteration Considerations
- A7. Site Selection Considerations
- A8. Project Objectives Statement

B. Owner Philosophies
- B1. Reliability Philosophy
- B2. Maintenance Philosophy
- B3. Operating Philosophy
- B4. Design Philosophy

C. Project Requirements
- C1. Value-Analysis Process
- C2. Project Design Criteria
- C3. Evaluation of Existing Facilities
- C4. Scope of Work Overview
- C5. Project Schedule
- C6. Project Cost Estimate

SECTION II. BASIS OF DESIGN

D. Site Information
- D1. Site Layout
- D2. Site Surveys
- D3. Civil/Geotechnical Information
- D4. Governing Regulatory Requirements
- D5. Environmental Assessment
- D6. Utility Sources with Supply Conditions
- D7. Site Life Safety Considerations
- D8. Special Water and Waste Treatment Requirements

E. Building Programming
- E1. Program Statement
- E2. Building Summary Space List
- E3. Overall Adjacency Diagrams
- E4. Stacking Diagrams
- E5. Growth and Phased Development
- E6. Circulation and Open Space Requirements
- E7. Functional Relationship Diagrams/ Room by Room
- E8. Loading/Unloading/Storage Facilities Requirements
- E9. Transportation Requirements
- E10. Building Finishes
- E11. Room Data Sheets
- E12. Furnishings, Equipment, & Built-Ins
- E13. Window Treatment

F. Building/Project Design Parameters
- F1. Civil/Site Design
- F2. Architectural Design
- F3. Structural Design
- F4. Mechanical Design
- F5. Electrical Design
- F6. Building Life Safety Requirements
- F7. Constructability Analysis
- F8. Technological Sophistication

G. Equipment
- G1. Equipment List
- G2. Equipment Location Drawings
- G3. Equipment Utility Requirements

SECTION III. EXECUTION APPROACH

H. Procurement Strategy
- H1. Identify Long Lead/Critical Equipment and Materials
- H2. Procurement Procedures and Plans

J. Deliverables
- J1. CADD/Model Requirements
- J2. Documentation/Deliverables

K. Project Control
- K1. Project Quality Assurance and Control
- K2. Project Cost Control
- K3. Project Schedule Control
- K4. Risk Management
- K5. Safety Procedures

L. Project Execution Plan
- L1. Project Organization
- L2. Owner Approval Requirements
- L3. Project Delivery Method
- L4. Design/Construction Plan & Approach
- L5. Substantial Completion Requirements

Fig. 1 PDRI for Building Projects Sections, Categories and Elements.

The PDRI score sheet is used to evaluate the level of completeness of the project scope definition. Each of the 64 Elements is subjectively evaluated by owner, Engineer and contractor based on its level of definition verses its corresponding description.

In PDRI score sheet has six levels of definition are listed across top of sheet. These definition level (0,1,2,3,4, & 5), level 0 for not applicable, level 1 stands for Complete Definition, level 2 stands for Minor Deficiencies, level 3 stands for Some Deficiencies, level 4 Major Deficiencies, level 5 stands for Incomplete or Poor Definition. Refer Fig. 2

The lower the total PDRI score the better project scope defined. The CII given bench mark of 200 point out of 1000. PDRI score of 200 was analyzed and it was determined that projects scoring below 200 performed significantly better than projects scoring over 200 in performance of Cost, Schedule, Change order. [1]

SECTION II - BASIS OF DESIGN							
CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
D. SITE INFORMATION (Maximum = 108)							
D1. Site Layout	0	1	4	7	10	14	
D2. Site Surveys	0	1	4	8	11	14	
D3. Civil/Geotechnical Information	0	2	6	10	14	19	
D4. Governing Regulatory Requirements	0	1	4	8	11	14	
D5. Environmental Assessment	0	1	5	9	12	16	
D6. Utility Sources with Supply Conditions	0	1	4	7	10	13	
D7. Site Life Safety Considerations	0	1	2	4	6	8	
D8. Special Water and Waste Treatment Req'mts	0	1	3	6	8	11	
CATEGORY D TOTAL							

Fig. 2 PDRI for Building Projects, Category D

D3. Civil / Geotechnical Information

The civil/geotechnical site evaluation provides a basis for foundation, structural, and hydrological design. Evaluations of the proposed site should include items such as:

- Depth to bedrock
- General site description (e.g., terrain, soils type, existing structures, spoil removal, areas of hazardous waste, etc.)
- Expansive or collapse potential of soils
- Spoil area for excess soil (i.e., location of on-site area or off-site instructions)
- Seismic requirements
- Water table elevation
- Flood plain analysis
- Soil percolation rate and conductivity
- Ground water flow rates and directions
- Need for soil treatment or replacement
- Description of foundation design options
- Allowable bearing capacities
- Overall site analysis

Fig. 3: Example description of Element D3: Civil / Geotechnical Information

B. Case Study

The E learning center (Educational Building) ongoing project of Pune Municipal Corporation (PMC) was taken in this study to measure PDRI score. Total budget of project was of Approximately Rs. 1.2 Billion

In the PDRI specific questions were asked to obtain project information. The questionnaires included questions regarding project basics (location, type, budget and schedule), operating information, and evaluation using a weighted PDRI score sheet.

C. Field Observations

The data is collected from the site of E learning center (Educational Building) project. This project is under Pune Municipal Corporation. Some facts were observed on the site during the execution. They are as follows:

1. Lack of Planning in Geotechnical Investigation.
2. Extra Activity
    a. Removal of Black cotton Soil
3. Increased in Excavation quantity.
4. Delay in completion of 1st tender of 4 months which was completed in 11 months.

5. Revision in drawing due to increased RL of Plinth beam.
6. Consideration which was not taken properly
    a. RL of Access Road
    b. RL of Drainage system.
7. Rework of Water tank.

III. DATA ANALYSIS AND FINDINGS

A. PDRI weighting Process:

The associated parameters for the reasons of the delays are shown in the table 1 column 3 and their associated elements are shown in the column 2. The weights as referred from CII handbook for Building Projects are shown in Column 4. The reasons of delay in column 5 and PDRI Score given on scale of 0 to 5 based on the factual data and reasons of Delay. The levels of definitions ranking from level 1, completely defined to level 5, incomplete of poor definition. The levels 2, 3 and 4 allow for the ranking of elements between the complete definition and poor definition levels.

As in the table there are two elements with poor definition level i.e. D3 & C5 the parameters associated with it are Civil/Geotechnical Information and Project Schedule. The geotechnical investigation was not done in the Planning stage hence there were changes in the excavation quantity and resulted change in the estimate of the Project.

Table 1: Highest weighted PDRI Elements and reasons of Delay

Sr. No.	PDRI Elements as applicable for the Building project, based on the data collected	Parameter Associated	Weights as referred from CII handbook for Building Projects	Reasons of Delay	PDRI Score given on scale of 0 to 5 based on the factual data and reasons of Delay	Weights obtained by the Elements
1	C5	Project Schedule	20	Delay in completion of 1st tender of 4 months which was completed in 11 months.	5	20
2	C6	Project Cost Estimate	27	1. Increased in Excavation Quantity 2. Shifting of plinth level upward by 1.2 m 3. Rework of water tank	2	8
3	D2	Site Surveys	14	Consideration which was not taken properly a. RL of Access Road b. RL of Drainage system.	3	8
4	D3	Civil / Geotechnical Information	19	Lack of Planning in Geotechnical Investigation.	5	19
5	F2	Architectural Design	22	Revision in drawings Plinth level shifted upward by 1.2 m	2	7
6	K2	Project Cost Control	13	Increased in work a. Extra work like Rework of water tank, b. Removal of black cotton soil c. Excavation quantity increased	3	8
7	K3	Project Schedule Control	14	Delay in revised work order	4	11
8	K4	Risk Management	18	Management Risk: Timely decision	2	6
Total			**147**	**Total**		**87**

Total PDRI Score= 87 / 147
The PDRI score out of 591 out of 1000

IV. CONCLUSIONS AND RECOMMENDATIONS

This paper studied the pre-project planning of E-Learning Center (Educational Building) in Pune, India. The score obtained from the Project Definition Rating Index was used to measure the completeness level of pre-project planning. The score obtained is 591/1000 which is much higher than bench mark value of CII of 200/1000. The Project thus Resulted Delay in project schedule & Increased cost. This shows the bad performance of the project. The study shows

that Project Definition Rating Index (PDRI) is effective tool in Project Preplanning.

Thus PDRI score as forecasting tool for cost, schedule, and change order. The PDRI score can however point areas of focus that could improve the final costs, schedule and other measurements that relate to project success.

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