



PDRI: An Effective Tool for Feasibility Study and Project Pre-Planning

¹Bhosale Sayee Deepak Jyoti, ²Prof. Dige Sandeep Gunpal, ³Prof. Anjal S. Jadhav

¹Post- Graduate Student, ²Professor, ³Professor

¹S.P.S.M.B.H's College of Architecture, Kolhapur, Maharashtra, India

Abstract: It has been found that insufficient scope specification is one of the primary causes of project failure in the construction industry. Both owner and contractor businesses, however, feel that it is not financially viable to devote the time and resources required to precisely define the scope of work at an early point in a project's life cycle. Project participants might not always see the value of having a well-defined scope of work. A tool called the Project Definition Rating Index (PDRI) was created to solve these problems. With its 68 scope definition components, the PDRI is an easy-to-use checklist that lets users keep track of and manage the scope definition's level as project planning progresses. When paired with a feasibility study, PDRI can assist in uncovering several hidden areas that the feasibility study might miss, and vice versa. By combining these two prediction methods, pre-planning can be made even more effective.

Index Terms - Project Definition Rating Index (PDRI) Project Pre-Planning, Project's Life Cycle, Feasibility Study, Project management risk management risk analysis

I. INTRODUCTION:

In India, it is common knowledge that government projects frequently experience delays and cost overruns. The recently completed Bandra-Worli sea link offers a glimpse into India's project delivery methodology. The project, which was initially estimated to cost Rs. 300 crores and be completed in 2004, ended up costing Rs. 1,600 crore and taking five years longer to complete. It is undeniable that a comparatively tiny portion of projects are completed on time and under budget. It is referred to as "starting on the wrong foot" when a project is initiated without sufficient planning to ascertain the amount of land required, its source, or the availability of money. Prolonged legal actions and political interferences, unclear terms and conditions, incomplete tendering procedures, or simply a lack of management coordination lead projects to stall until problems are fixed.

The CII has frequently provided funding for research projects that are centred on pre-project planning. More pre-project preparation has been linked to improved project success in terms of budget, schedule, and operational elements, according to studies. These studies have led to the widespread use of the PDRI as a scope-defining tool by planners in the building, industrial, and infrastructure sectors.

In pre-project planning, one of the most important steps is creating the project scope definition package. During the pre-project planning phase, the project scope is determined, preparing the project for execution. This is the moment at which the project execution plan is set and project hazards can already be identified.

II Project Definition Rating Index:

Using the PDRI tool is one technique to evaluate how comprehensive the project scope specification is. Comprehensive explanations are provided for key elements of a package for scope specification. Members of the project team now have a checklist or other tool to help them define a project when it comes time for analysis. Subsequently, the technique might be employed to predict the success or failure of subsequent projects with respect to budget, schedule, and adjustments. Project teams

can focus on challenging regions or unclear scopes thanks to it. The PDRI is used as a front-end planning tool in project stages prior to design and construction.

The process of defining and being ready to execute a project is called project scope definition. This is the crucial phase where the risks associated with the project are evaluated and a specific implementation strategy is created. The quality of a project during its detailed design, building, and start-up phases will depend on the quantity of work done during this scope defining phase.

Pre-project planning is crucial for capital projects and has a significant impact on project success, according to research. Recent study results show that significant cost and schedule reductions might result from higher levels of pre-project planning activity. Specifically, the research study separated 53 capital facility projects into three pre-project planning effort intensities. The total prospective cost and schedule performance discrepancies were then analysed as follows:

- 20% cost reduction with extensive pre-project preparation.
- Schedule savings of 39% when significant pre-project preparation is done

The 70 scope defining items in PDRI for Industrial Project are organized into a weighted checklist structure. There are 15 categories and three primary sections for the 70 components. Each of the 70 aspects is evaluated by the project team, and a score is determined; the lower the number, the better specified the project is. It has been demonstrated that utilizing this technique to score 200 points or less would statistically boost the predictability of the project's outcome. Using the industrial version of the PDRI, a sample of forty projects revealed that the following characteristics separated projects scoring below 200 from those scoring over 200:

- A 19% average cost reduction over expected design and construction costs.
- A 13% decrease in schedule compared to the design and construction estimates.
- Less alterations to projects.
- Enhanced operational performance predictability.

I.II PDRI Tool:

- A project team's go-to guide for figuring out what has to be done to define the project's scope.
- A collection of terms for infrastructure project scope definitions that are standardized.
- a system used by the industry to rate how comprehensive the project scope definition package is in order to help with risk assessment, escalation prediction, and dispute possibility.
- A way to track development over time at different phases of the front-end planning endeavors when applied consecutively.
- A tool that, by drawing attention to vague regions in a scope definition package, facilitates communication and encourages alignment between owners and design contractors.
- A way for members of the project team to work out disagreements based on a shared standard for project assessment.
- A way for project team members to recognize enabling tasks and take action on them prior to a delay in the project timeline.
- A resource for industry-wide training for both people and organizations.
- A benchmarking tool that firms may use to assess scope definition completion against previous project performance, both internally and externally, in order to forecast the likelihood of success on upcoming initiatives

I.III Structure of PDRI:

Comprehensive scope definition evaluation is supported by the PDRI technique. Three components comprise the templates, which are arranged for a methodical evaluation of the following:

- a) Basis of project decision – The choice of project is based on the business motivations and objectives. The information in this area is required to understand the project objectives. The degree of completion of this component will have an impact on the project team's capacity to work together to meet the business objectives of the project.

- b) Basis of design – Procedures and technical information required for the framework of the design. To fully understand the design concepts of the project, it is necessary to examine the space, site, and technological design components that are covered in this part.
- c) Execution approach – The construction and closeout stages are included in the project's execution plan. It is crucial to examine the elements in this part in order to fully comprehend the prerequisites for the owner's execution strategy. The Industrial and Building PDRI were established in 1996 and 1999, respectively.

I.IV Pre- Project Planning:

The process of creating enough strategic knowledge to enable owners to handle risk and choose how best to allocate resources to increase the likelihood of a successful project is known as pre-project planning, 1995- CII. One of the primary goals of pre-project planning is to create a comprehensive definition of the project scope. Research has shown that a thorough scope definition improves project success in terms of schedule, money, quality, and operational aspects. Extreme risks might result from unforeseen events or unresolved scope issues. Just before to detailed design, in the PDRI review phase, the owner's organization finds that several scope definition items are not sufficiently described. It is necessary to consider these ambiguous scope definition elements as significant factors of risk that might negatively impact the project's outcomes.

Pre project planning is a crucial phase of the project life cycle. This phase, which begins when a business unit chooses to proceed with a project concept, continues until the detailed design is initiated. Planning actions carried out early in the project life cycle are often seen to have a greater influence on the project's success than planning actions carried out later in the project delivery process, according to industry practitioners. Figure No.1 illustrates the conceptual connection between influence and expenditure in a project life cycle. The "influence" curve in Figure No.1 illustrates how a corporation might impact a project's result at different phases of the project. The graphic shows how much simpler it is to influence a project's result when planning is underway and costs are relatively low, as opposed to when the project is being executed or the facility is being operated, when costs are higher.

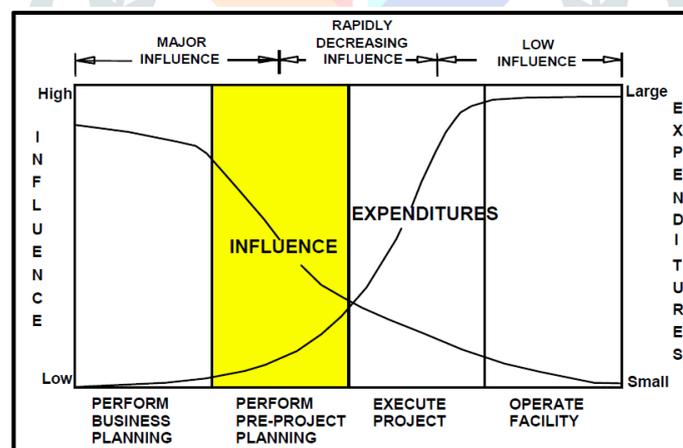


Figure No. 1: Project Life Cycle - Influence and Expenditure Curve

Cost and impact curves are displayed in the graphic as the project progresses through its various life cycle stages. The project has a low starting cost that rises as it goes into operation. Most of the expenditures have already been incurred at this time. From highly high during the planning phase to extremely low during the operational phase, the influence curve shifts in the opposite way. During the design stage, the lines intersect. Due to this fact, it is imperative that planning be done from the outset of the asset's life rather than at the point of handover following construction.

I.V Project Feasibility Study:

Essentially, feasibility refers to an idea's likelihood of success or failure. It is aware in advance of the potential market size for the suggested good or service, the required investment and source of money, and the existence and source of the technical know-how to turn the concept into a workable product. A feasibility report is created at the project's definition or early phase, and it must be

updated and validated before the project can be carried out. In order for the owner to make an informed investment choice and for the project to be correctly planned and executed, the project can be carried out in accordance with the findings of the techno-economic analysis that was conducted on the project. This analysis includes both technical and economic valuation results.

Any project's feasibility is primarily determined by the analysis that follows:

1. Economic Analysis
2. Risk Analysis
3. Technical Analysis
4. Ecological Analysis
5. Financial Analysis
6. Market Analysis
7. Legal and Administrative Analysis

Therefore, it is clear that a feasibility study is the cornerstone of a project's success, and that a sound technical, economical, and financial analysis plays a significant role in that success. When evaluating a construction project's technical, financial, and economic viability, it is crucial to take into account the many risks that will be involved at different phases of the project.

II. LITERATURE REVIEW:

a) A construction project's state was looked at during pre-project planning. The project scope specification's principal elements are listed. The applications of the PDRI are outlined, and its benefits for the building industry of construction are briefly discussed. The development process of the PDRI is covered, along with its fundamental structure and format. The paper's conclusion discusses the PDRI's possible uses and provides an overview of how it might benefit individuals in the building construction sector.

The PDRI's main framework, format, and development history are described. Its validation on 33 finished building projects and its application on 20 current projects are summarized.

Among the issues noted include inadequate space planning, oversized utilities, inadequate equipment listings, code breaches, and more. These issues are found early in the project, when they may be resolved with little expense or disruption. The article wraps up by outlining the PDRI's possible applications and providing a summary of its advantages for professionals in building construction. (George Edward Gibson Jr & Chung-Suk Cho, December 2001)

b) Monitored and controlled the extent of scope definition during the course of project planning. The highlights of their research are listed below. According to their research, one of the main reasons why projects fail in the US construction sector is widely acknowledged to be inadequate scope specification. Participants in the project are unaware of what constitutes a suitably specified scope of work. In order to improve scope definition, the paper's conclusion explains how PDRI offers an organized method for managing project scope. When properly applied, the PDRI may significantly increase the likelihood that a project will succeed by lowering the possibility of failure brought on by vague scope definitions. The PDRI might be a useful tool for firms to consider integrating into their scope creation and management processes. (Peter R Dumont, Member, ASCE, G. Edward Gibson Jr., & Member, ASCE, and John R. Fish, October 1997)

c) The activity of the Construction Industry Institute (CII) results in PDRI sheet for infrastructure. An effective PDRI score sheet can be useful in predicting investor interest, the hazards associated, and the completion rate.

There are several benefits to doing a PDRI study, which is developed from a feasibility study, and these benefits will assist any project be completed with the fewest possible issues.

The findings of a feasibility study are utilised to calculate PDRI in the approach used to construct a score sheet consisting of three components.

- i. Basis Of Project Design
- ii. Basis Of Design
- iii. Execution Approach

The analysis's findings demonstrated that integrating the feasibility report and PDRI score card produced a greater success rate than carrying out the PDRI and feasibility research separately. Despite various problems with the project's financial viability, the PDRI and the feasibility study worked together to deliver some very excellent outcomes. The conducted inquiry demonstrated that the success rate of the PDRI score card in conjunction with the feasibility report was higher than that of the PDRI and feasibility study conducted independently. Bangalore, India's Intermodal Transit Hub was the subject of a study. Despite certain issues with the project's ability to generate money, the PDRI and feasibility study worked together to provide some impressive results. (Mahirajsinh S. Parmar, December 2014.)

- d) Primary investigations conducted early in a project are called feasibility studies. They are often completed when there is a significant investment and the project is huge or difficult. Every building project needs to provide returns for the investors. These advantages include of financial gain, company expansion, etc. For investors to be eager to invest their money, the gains must be realised over an extended period of time and with a precise investment projection. An examination of a feasibility study can also reveal information about the potential returns on investment and value to investors. The feasibility study shows the return on investment.

Project expenditures are directly impacted by delays in the building phase, which causes a negative cash flow. Project costs typically rise by 10% to 15% annually throughout the delay period. These expenses include of worker payments, operational charges, and other ancillary works. The project for this one is expected to take three years to complete. The calculations take into consideration a lead time of six months after the project is finished. In this case, the project's income increases at a rate of 15% each year, but expenditures remain constant.

The following is the project work's approach and scope:

- i. To gather all necessary information.
- ii. To create a project schedule that will establish how long the task will take.
- iii. To create a project's initial cost estimate.
- iv. To figure out how much money was made once the project was finished.
- v. To determine the IRR, NPV, and Benefit-Cost ratio.

To provide recommendations on the project's viability. Investment proposals should be evaluated from every angle via a feasibility analysis. The decision-making process for large projects is quite complicated, and it is obvious that not all factors can be taken into account. Most decisions are based on several factors, most of which are impossible to measure. (Pranav B. Maske, Dr. Ajay K. Gaikwad, Volume: 08 Issue: 05 | May 2021)

III. RESEARCH METHODOLOGY

The reports that cover the project's scope should be consulted during the conceptualization and feasibility study phases of the project in order to verify their completeness using the PDRI score-sheet.

Depending on the project's duration, this can be done two or three times prior to the execution beginning. It is anticipated that the final PDRI score would gradually decline. All of the experts in the planning department are required to complete the grading. By consulting the feasibility study reports, industry experts were contacted for this research's element grading. Subsequently, the CII researchers determine the respective weights of every component. The weights of each component in the three parts are added together to determine the PDRI Score.

The process used to create a score sheet with three sections in total by derived the PDRI from the feasibility study

- a) Basis Of Project Design
- b) Basis Of Design
- c) Execution Approach

The list of elements with ratings of four and five is the result of the rating process. These are appropriately referred to be inadequately defined scope definition items that require attention. Otherwise, they may subsequently become possible risk factors that impact the project's timely completion. Additionally, it can result in budget overruns, which would lead to a failure in project management.

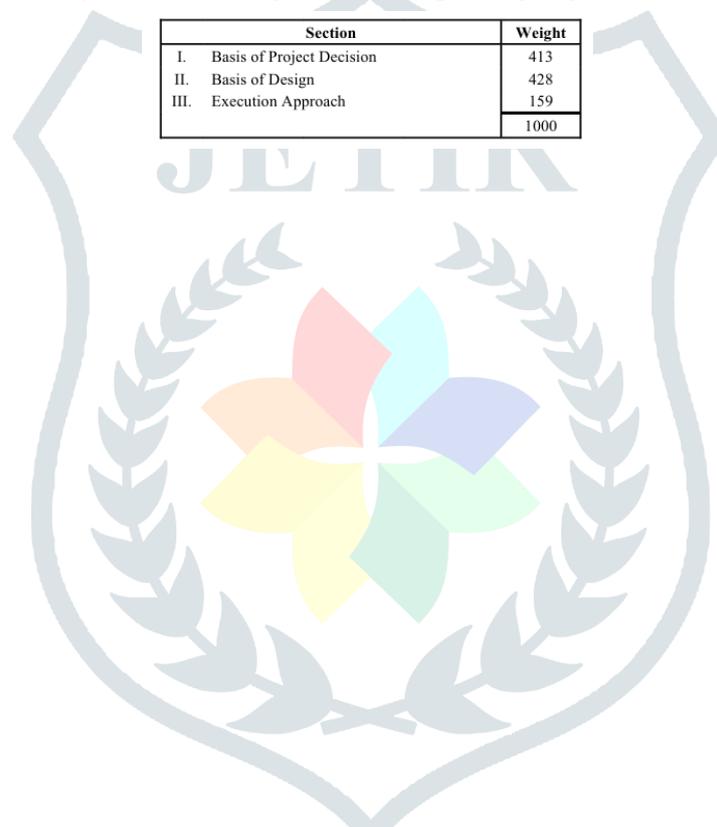
IV. DATA ANALYSIS

IV.I. PDRI for Building Projects:

Following years of success with the PDRI for Industrial projects and in response to member requests for the development of a tool comparable to that linked to buildings, CII financed the establishment of the PDRI for Building Projects in 1998. Front end planning tools are essential, as the creators of this PDRI tool have reiterated. A project team may create a comprehensive project definition package with the help of the PDRI for Building Projects.

The PDRI for Building Projects' important results and the development process were strongly correlated with the PDRI for Industrial Projects' conclusions. Through an element weighting approach, the PDRI for Buildings discovered that items were ranked based on how much risk they contributed.

Based on the Level 5 weights assigned to each element in each part and category according to the specification, Figure No.2 presents a section and category breakdown of the finalized PDRI score sheet. In order of highest total weight to lowest total weight, the parts and categories are mentioned. Based on the description Level 5 weights, Figure No.2 also lists the top ten most weighted items in the PDRI-Building. Of the 64 aspects in the tool, these 10 were found to be the most important to project success; as a result, they should be fully addressed during the front-end planning stage of a building project.



Section	Weight
I. Basis of Project Decision	413
II. Basis of Design	428
III. Execution Approach	159
	1000

Category	Weight
A. Business Strategy	214
B. Owner Philosophies	68
C. Project Requirements	131
D. Site Information	108
E. Building Programming	162
F. Building/Project Design Parameters	122
G. Equipment	36
H. Procurement Strategy	25
I. Deliverables	11
J. Project Control	63
K. Project Execution Plan	60
	1000

Element	Weight
A.1 Building Use	44
A.5 Facility Requirements	31
A.7 Site Selection Considerations	28
A.2 Business Justification	27
C.6 Project Cost Estimate	27
A.3 Business Plan	26
C.2 Project Design Criteria	24
C.3 Evaluation of Existing Facilities	24
A.6 Future Expans./Alt. Considerations	22
F.2 Architectural Design	22
	275/1000

Figure No. 2: PDRI-Building Section Weights of Individual Category Top 10 Elements Weighted High

SECTION I. BASIS OF PROJECT DECISION	
A. Business Strategy	E7. Functional Relationship Diagrams/ Room by Room
A1. Building Use	E8. Loading/Unloading/Storage Facilities Requirements
A2. Business Justification	E9. Transportation Requirements
A3. Business Plan	E10. Building Finishes
A4. Economic Analysis	E11. Room Data Sheets
A5. Facility Requirements	E12. Furnishings, Equipment, & Built-Ins
A6. Future Expansion/Alteration Considerations	E13. Window Treatment
A7. Site Selection Considerations	F. Building/Project Design Parameters
A8. Project Objectives Statement	F1. Civil/Site Design
B. Owner Philosophies	F2. Architectural Design
B1. Reliability Philosophy	F3. Structural Design
B2. Maintenance Philosophy	F4. Mechanical Design
B3. Operating Philosophy	F5. Electrical Design
B4. Design Philosophy	F6. Building Life Safety Requirements
C. Project Requirements	F7. Constructability Analysis
C1. Value-Analysis Process	F8. Technological Sophistication
C2. Project Design Criteria	G. Equipment
C3. Evaluation of Existing Facilities	G1. Equipment List
C4. Scope of Work Overview	G2. Equipment Location Drawings
C5. Project Schedule	G3. Equipment Utility Requirements
C6. Project Cost Estimate	SECTION III. EXECUTION APPROACH
SECTION II. BASIS OF DESIGN	H. Procurement Strategy
D. Site Information	H1. Identify Long Lead/Critical Equipment and Materials
D1. Site Layout	H2. Procurement Procedures and Plans
D2. Site Surveys	J. Deliverables
D3. Civil/Geotechnical Information	J1. CADD/Model Requirements
D4. Governing Regulatory Requirements	J2. Documentation/Deliverables
D5. Environmental Assessment	K. Project Control
D6. Utility Sources with Supply Conditions	K1. Project Quality Assurance and Control
D7. Site Life Safety Considerations	K2. Project Cost Control
D8. Special Water and Waste Treatment Requirements	K3. Project Schedule Control
E. Building Programming	K4. Risk Management
E1. Program Statement	K5. Safety Procedures
E2. Building Summary Space List	L. Project Execution Plan
E3. Overall Adjacency Diagrams	L1. Project Organization
E4. Stacking Diagrams	L2. Owner Approval Requirements
E5. Growth and Phased Development	L3. Project Delivery Method
E6. Circulation and Open Space Requirements	L4. Design/Construction Plan & Approach
	L5. Substantial Completion Requirements

Figure No. 3: PDRI for Building Projects – Sections, Categories and Elements

IV.II. Rating of elements on the basis of level of definition:

The three primary components of the PDRI are each subdivided into a number of categories. Elements are further subdivided into categories. Each component is evaluated and rated to determine the final score. Depending on how well defined they are, elements should be ranked from 0 to 5.

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

Figure No. 4: PDRI Definition Levels

A perfect score of "one" should be given to the clearly specified elements. A "five" should be assigned to any entirely ambiguous elements. Based on their degrees of definition, the remaining elements ought to be assigned a score of "two," "three," or "four." Items deemed unsuitable for the project ought to be assigned a "zero." Here is how the ratings are defined

IV.III. Significance of PDRI Score:

It was demonstrated that projects with a score below 200 performed worse than those with a score above 200 in three important design/construction outcome areas: cost performance, schedule performance, and the relative value of modification orders relative to the approved cost. Furthermore, compared to projects with a score above 200, those with a score below 200 demonstrated superior financial performance, fewer modification orders, less variation in design size during the preparation of construction documents and the construction phase, and an overall higher average rating of success.

The findings of a study on project performance and how it relates to the 200-level PDRI score are shown in Figure No.5. There was a statistical difference in every value.

Performance	PDRI Score < 200	PDRI Score > 200	Difference
Cost	3% above budget	9% above budget	6%
Schedule	5% behind schedule	21% behind schedule	16%
Change Orders	8% of budget	11% of budget	3%

Figure 5: PDRI Validation's cost, schedule, and change order compared to the authorization estimate

Lower PDRI scores often indicate well-defined scope definition packages and are associated with better project success. Conversely, higher PDRI ratings indicate that some items in the scope definition package are not well defined. If this continues with the preparation of construction documents, it may lead to a lower success rate and inferior project performance. Just before the start of the comprehensive design and construction phase.

V. LIMITATIONS

- There's a chance that the PDRI's components won't apply to the current site circumstances. Similarly, some aspects may be included in the PDRI score-sheet but not mentioned in the essential parts of the feasibility study.
- In order to demonstrate a better definition of scope and avoid embarrassment, the PDRI assessment staff may enter a bogus rating.
- Additionally, there can be problems with the feasibility report's financial disclosure, which could have an impact on the ratings on the PDRI score sheet and raise the final score, ultimately leading to a negative decision

VI. CONCLUSION

It was determined that the PDRI score card and feasibility report together had a higher success rate than the PDRI and feasibility study alone. Study was carried out on Government Mass Housing Project, Malegaon, India. Even though there were some problems regarding revenue generation from the project PDRI with feasibility report combined were able to generate some strong result. Even though there were some issues with the project's ability to generate revenue, the feasibility report and PDRI together produced some impressive results.

Project execution performance is improved by PDRI, which helps the project be implemented successfully. During the initial planning phase of projects, the PDRI tool should be utilised to save delays and expenses. To determine the project's viability, a thorough feasibility analysis should be conducted at the planning stage. Project Definition Rating is a useful instrument for accurate quantification in the aforementioned research.

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