



Project Definition Rating Index



Industrial Projects



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PDRI:
Project Definition Rating Index –
Industrial Projects

Prepared by the
Front End Planning Research Team

Updated by the
Support for Pre-Project Planning Research Team and
Front End Planning for Renovation and Revamp Research Team

Implementation Resource 113-2

Version 4.1

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Version 4.0 (October 2013) – Made significant changes to spreadsheet functions; made stylistic revisions to match companion products.

Version 4.1 (November 2014) – Updated book scoresheets to match scoring in standardized software tool.

Foreword

Welcome to the fourth edition of *PDRI: Project Definition Rating Index – Industrial Projects*. The first edition of this document was developed and written by the CII Front End Planning Research Team and published in 1996. In 2006, the CII Support for Pre-Project Planning Project Team reviewed and updated all CII front end planning documentation, including that first edition. The team drew upon materials from the National Institute for Standards and Technology (NIST) Security Study performed by CII, and the collective knowledge of research team members. The resulting update (the second edition) significantly clarified the methods for using the PDRI–Industrial Projects tool, discussed tool usage by both owner and contractor organizations, and referenced security and sustainability issues.

The Front End Planning for Renovation/Revamp Research Team later revisited the second edition to clarify its usage on renovation projects and to provide specific comments on needed front end planning efforts for renovation projects. In addition, the team developed a macro-enabled spreadsheet to accompany this book that allows the project team to score projects automatically.

In this most current version, the team fixed minor bugs in the scoring software and made significant changes to the functionality of the spreadsheets, also reformatting them to match the features of subsequently released PDRI for buildings and infrastructure projects. The research team believes that with these changes, this fourth edition significantly improves the usability of the PDRI–Industrial Projects tool.

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What Is the PDRI?

The PDRI–Industrial Projects is a simple and easy-to-use tool for measuring the degree of scope development.

The Project Definition Rating Index (PDRI) – Industrial Projects is a powerful and easy-to-use tool that offers a method to measure project scope definition for completeness. It identifies and precisely describes each critical element in a scope definition package and allows a project team to quickly predict factors impacting project risk. It is intended to evaluate the completeness of scope definition at any point prior to detailed design and construction.

The PDRI is intended to be used during front end planning, which encompasses the project activities shown in Figure 1.1 up to Phase Gate 3 and includes feasibility, concept and detailed scope definition. Note that front end planning has many other terms associated with it, including front end loading, pre-project planning, programming, schematic design, design development, sanctioning, and others. Understand that the term front end planning is used in this document, but it may be replaced to adapt to a particular business process. More information will be given concerning timing and process is provided later in this document. The PDRI was originally intended to be used as a tool to decide whether to proceed with project execution at Phase Gate 3, but experience has shown that it should be used more than once prior to this gate.

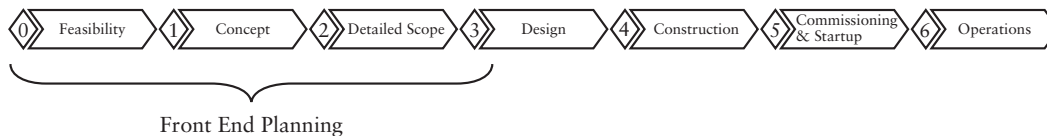


Figure 1.1. Project Life Cycle Diagram

The PDRI offers a comprehensive checklist of 70 scope definition elements in an easy-to-use score sheet format. Each element is weighted based on its relative importance to the other elements. Since the PDRI score relates to risk, those areas

Note: CII has developed three PDRI publications/tools. This book (IR 113-2) addresses industrial projects. The building projects version is IR 155-2. IR 268-2 focuses on infrastructure projects.

that need further work can easily be isolated. (A PDRI score of 200 or less has been shown to greatly increase the probability of a successful project as described in Chapter 4.) Applicable industrial-type projects may include the following:

- oil/gas production facilities
- textile mills
- chemical plants
- pharmaceutical plants
- paper mills
- steel/aluminum mills
- power plants
- manufacturing facilities
- food processing plants
- refineries
- civil/industrial infrastructure
- plant upgrade/retrofit.

PDRI–Building Projects (IR155-2) is typically applied to the following types of facilities:

- offices
- schools (classrooms)
- banks
- research and laboratory facilities
- medical facilities
- nursing homes
- institutional buildings
- stores and shopping centers
- dormitories
- apartments
- hotels and motels
- parking structures
- warehouses
- light assembly and manufacturing
- churches
- airport terminals
- recreational and athletic facilities
- public assembly and performance halls
- industrial control buildings
- government facilities.

PDRI–Infrastructure Projects (IR 268-2) is typically applied to the following types of facilities:

People and freight:

- highways
- railroads
- access ramps
- tunnels
- airport runways
- security fencing

Energy:

- electricity transmission/distribution
- fiber optic networks
- electrical substations/switch gears
- towers
- wide area networks

Fluids:

- pipelines
- aqueducts
- pumping and compressor stations
- locks, weirs
- reservoirs
- meters and regulator stations

Nodes/centralized facilities:

- dams
- power generation facilities
- steam or chilled water production
- marine, rail or air terminals
- water/waste water/solid waste processing
- refineries.

All three PDRIIs include specific risk factors relating to new construction (“greenfield”) projects and renovation-and-revamp (“R&R”) projects. An R&R project is defined as one that is focused on an existing facility but does not involve routine maintenance activities. It includes the act, process, or work of replacing, restoring, repairing, or improving this facility with capital funds or non-capital funds. It may include additional structures and systems to achieve a more functional, serviceable, or desirable condition, including improvement in: profitability, reliability efficiency, safety, security, environmental performance, or compliance with regulatory requirements. R&R projects may be known by numerous other names, such as repair, upgrade, modernization, restoration and so forth. More details will be given later in this document about how to adapt the PDRI to R&R projects. (For more information on how to manage front end planning of R&R projects, see Implementation Resource 242-2, *Front End Planning of Renovation and Revamp Projects*.)

PDRI

The PDRI consists of three main sections, each of which is further divided into a series of categories. These categories also are divided into elements, as shown in Figure 1.2. A complete list of the PDRI's three sections, 15 categories, and 70 elements is given in Table 1.1 (next page).

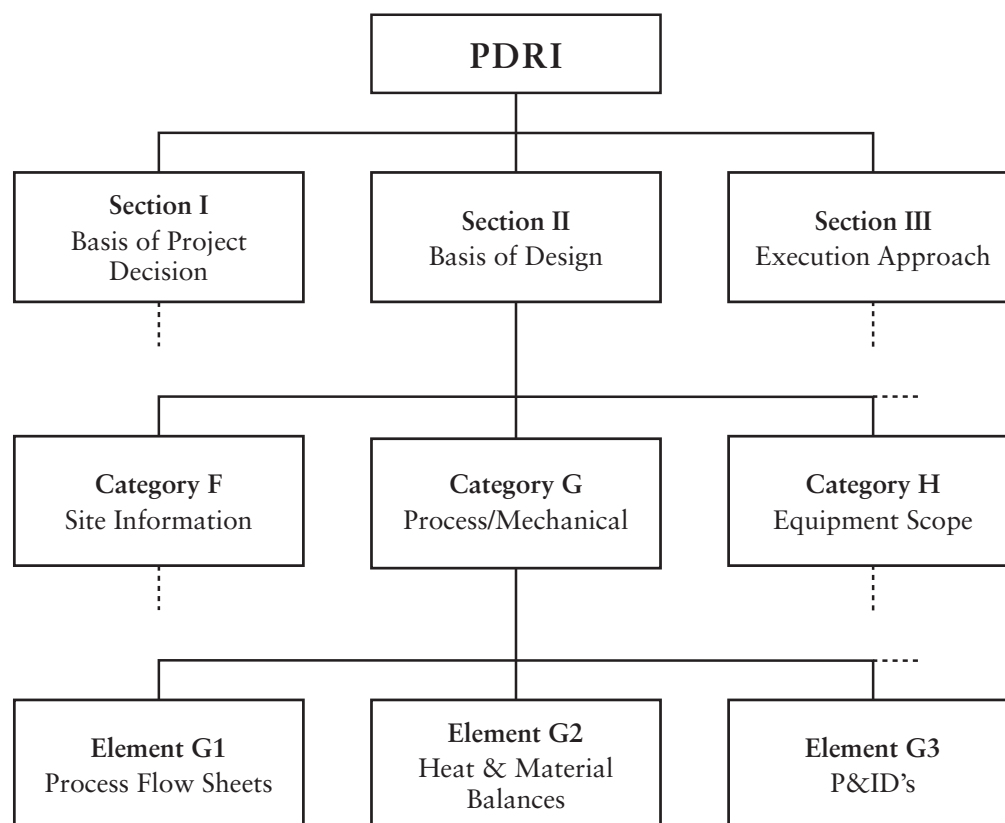


Figure 1.2. PDRI Partial Hierarchy

The PDRI should be used in conjunction with CII Implementation Resource 113-3, *Alignment During Pre-Project Planning*, to ensure that critical risk issues are addressed and that stakeholder interests are represented effectively in the front end planning process.

Table 1.1. PDRI–Industrial Projects Sections, Categories, and Elements

I. BASIS OF PROJECT DECISION	
A. Manufacturing Objectives Criteria	G9. Mechanical Equipment List
A1. Reliability Philosophy	G10. Line List
A2. Maintenance Philosophy	G11. Tie-in List
A3. Operating Philosophy	G12. Piping Specialty Items List
	G13. Instrument Index
B. Business Objectives	H. Equipment Scope
B1. Products	H1. Equipment Status
B2. Market Strategy	H2. Equipment Location Drawing
B3. Project Strategy	H3. Equipment Utility Requirements
B4. Affordability/Feasibility	I. Civil, Structural, & Architectural
B5. Capacities	I1. Civil/Structural Requirements
B6. Future Expansion Considerations	I2. Architectural Requirements
B7. Expected Project Life Cycle	J. Infrastructure
B8. Social Issues	J1. Water Treatment Requirements
C. Basic Data Research & Development	J2. Loading/Unloading/Storage Facilities Requirements
C1. Technology	J3. Transportation Requirements
C2. Processes	K. Instrument & Electrical
D. Project Scope	K1. Control Philosophy
D1. Project Objectives Statement	K2. Logic Diagrams
D2. Project Design Criteria	K3. Electrical Area Classifications
D3. Site Characteristics Available vs. Required	K4. Substation Requirements/Power Sources Identified
D4. Dismantling & Demolition Requirements	K5. Electric Single Line Diagrams
D5. Lead/Discipline Scope of Work	K6. Instrument & Electrical Specifications
D6. Project Schedule	
E. Value Engineering	III. EXECUTION APPROACH
E1. Process Simplification	L. Procurement Strategy
E2. Design & Material Alternatives Considered/Rejected	L1. Identify Long Lead/Critical Equipment & Materials
E3. Design for Constructability Analysis	L2. Procurement Procedures & Plans
	L3. Procurement Responsibility Matrix
II. BASIS OF DESIGN	M. Deliverables
F. Site Information	M1. CADD/Model Requirements
F1. Site Location	M2. Deliverables Defined
F2. Surveys & Soil Tests	M3. Distribution Matrix
F3. Environmental Assessment	N. Project Control
F4. Permit Requirements	N1. Project Control Requirements
F5. Utility Sources with Supply Conditions	N2. Project Accounting Requirements
F6. Fire Protection & Safety Considerations	N3. Risk Analysis
G. Process/Mechanical	P. Project Execution Plan
G1. Process Flow Sheets	P1. Owner Approval Requirements
G2. Heat & Material Balances	P2. Engineering/Construction Plan & Approach
G3. Piping & Instrumentation Diagrams (P&IDs)	P3. Shut Down/Turn-Around Requirements
G4. Process Safety Management (PSM)	P4. Pre-Commissioning Turnover Sequence Requirements
G5. Utility Flow Diagrams	P5. Startup Requirements
G6. Specifications	P6. Training Requirements
G7. Piping System Requirements	
G8. Plot Plan	

Use the PDRI score sheet most closely related to the project's use or type.

With a hybrid of industrial and building types, which PDRI score sheet should be used (building version or industrial version)? In general, if the primary designers for the project are architects, then the PDRI for Buildings should be used. If the primary designers are process (chemical) engineers or industrial (mechanical) engineers, then the PDRI for Industrial Projects should be used. Alternatively, the team can look at the composition of the project in terms of work (design or construction expenditures) to make the decision. In some circumstances, the team may decide to use both in concert. Figure 1.3 provides a mechanism for making the decision.

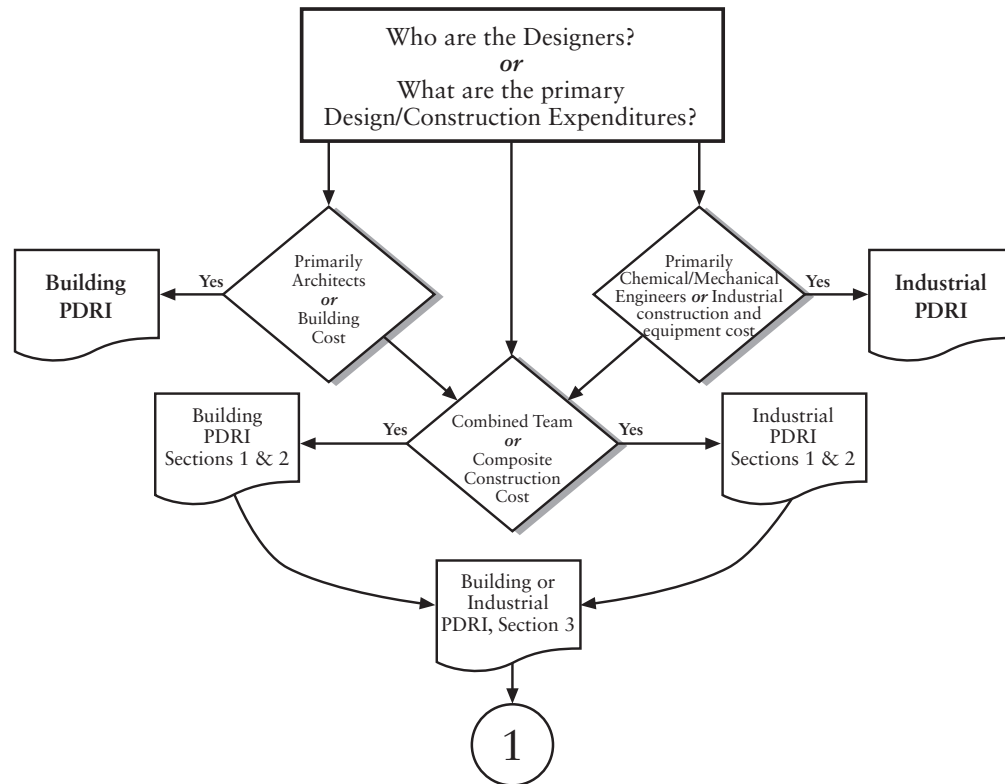


Figure 1.3. Flowchart for Deciding on PDRI Version

For example, many industrial facilities (chemical plants or refineries) require various types of buildings to support the operations and maintenance effort. These facilities often consist of the following types of facilities:

- administration buildings
- laboratories
- warehouses
- security facilities
- control buildings
- training centers.
- maintenance facilities

In these cases, the Industrial PDRI should be used on the primary facility, but the team may want to use the Building PDRI on each type of building. Use the score sheet as a check list if an entire assessment is not desirable.

Another example would be that of a building used for research or office space, but some of the space in the facility may be designated for product production and include engineered equipment, process flows and dedicated utility requirements. The Building PDRI would be used to plan the major portion of the facility, but the Industrial PDRI could be used to help plan the production space. At a minimum the Industrial PDRI could be used as a checklist in this situation.

In addition, determine whether the project is a renovation or revamp project and use the additional descriptions provided in the tool to further address critical R&R issues during front end planning. Figure 1.4 provides a decision diagram to determine this further effort. Note, if the project includes a shutdown/turnaround/outage scenario, it is highly recommended that the Shutdown Turnaround Alignment Readiness (STAR) front end planning tool be used (Implementation Resource 242-2, *Front End Planning of Renovation and Revamp Projects*), to help with the unique issues associated with these types of events.

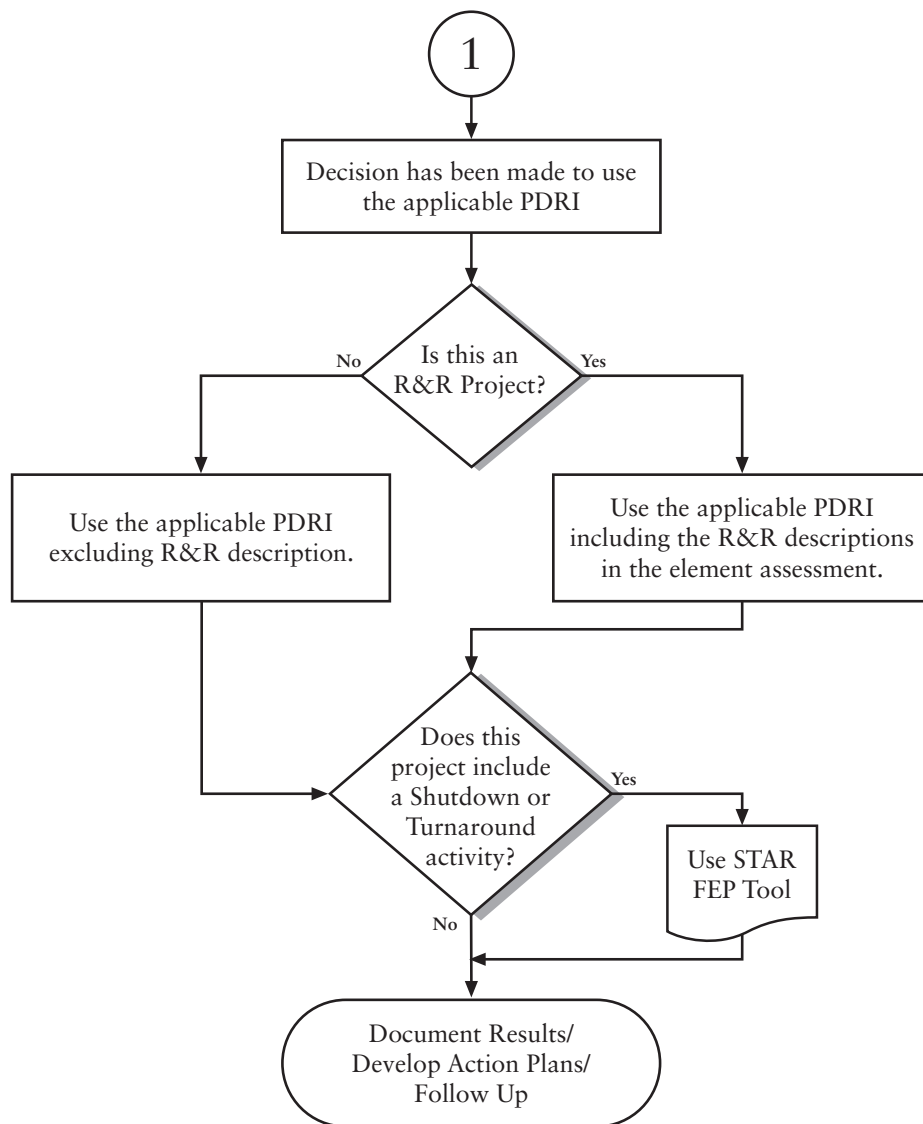


Figure 1.4. Use of Additional Tools to Supplement PDRI

Benefits of the PDRI

Effective early project planning improves project performance in terms of both cost and schedule, reinforcing the importance of early scope definition and its impact on project success. The PDRI allows a project planning team to quantify, rate, and assess the level of scope development on projects prior to detailed design and construction.

A significant feature of the PDRI is that it can be utilized to fit the needs of almost any individual project, small or large. Elements that are not applicable to a specific project can be zeroed out, thus eliminating them from the final scoring calculation.

The PDRI provides the following:

- a **checklist** that a project team can use for determining the necessary steps to follow in defining the project scope, for both greenfield and R&R projects
- a listing of **standardized scope definition terminology** for industrial projects
- an industry standard for rating the completeness of the project scope definition package to facilitate **risk assessment** and prediction of escalation, potential for disputes
- a means to **monitor progress** at various stages during the front end planning effort
- a tool that aids in **communication and promotes alignment** between owners and design contractors by highlighting poorly defined areas in a scope definition package
- a means for project team participants to **reconcile differences** using a common basis for project evaluation
- a **training tool** for organizations and individuals throughout the industry
- a **benchmarking tool** for organizations to use in evaluating completion of scope definition versus the performance of past projects, both within their organization and externally, in order to predict the probability of success on future projects.

Use Among CII Membership

A survey from previous CII research regarding the PDRI indicates extensive usage among the membership. A 2004 questionnaire, distributed when the CII membership level was 92 (70 member companies responded to the survey), indicated 43 CII member organizations (18 of 34 contractors and 25 of 36 owners who responded) were using the PDRI on capital projects. PDRI–Industrial had been used for an average of 4.3 years, and PDRI–Buildings had been used for an average of 2.7 years. Figure 2.1 provides usage by type, while Table 2.1 details PDRI usage within the responding CII organizations.

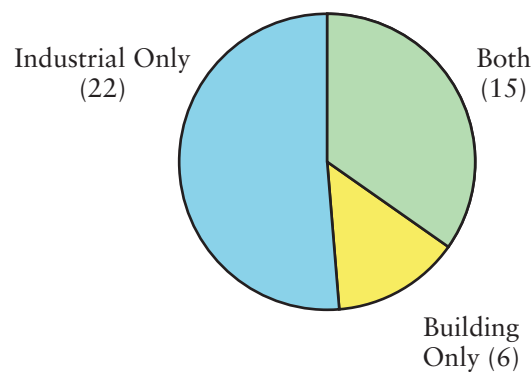


Figure 2.1. PDRI Usage by Type (N=43) (CII 2004)

Table 2.1. Frequency of Use Among Organizations Using PDRI (N=43)

The PDRI is used:	Frequency
As a planning checklist in early project development	81%
As a “gate” check before moving to project execution	72%
In conjunction with other front end planning measurement methods (i.e., prepare for third party evaluations, internal measures)	72%
As a means of measuring or benchmarking front end planning process performance	70%
More than once on most projects	42%
As an audit tool	42%
In a modified form for small or unusual projects	33%
To help capture lessons-learned	28%
With the help of an outside facilitator	29%

Who Should Use the PDRI?

Any organization wishing to improve the overall performance on its projects should use the PDRI.

The PDRI can benefit owners, designers, and constructors. Owners can use it as an assessment tool for establishing a “comfort” level at which they are willing to move forward with projects. Designers and constructors can use it as a method of identifying poorly-defined project scope elements. The PDRI provides a means for all project participants to communicate and reconcile differences using an objective tool as a common basis for project scope evaluation.

Owners should use the tool as a formal checklist of items that need to be clearly defined and communicated to ensure that the design team fully understands the project business objectives and drivers. Initially, owners should focus on Section I, the Basis of Business Decision elements. Accurate definition of these items will provide the best payback for the design team to make future decisions. These items should be well-defined at Phase Gate 2. As the project passes through the other phases, the owners should participate in the PDRI assessment sessions to ensure that the design team has correctly understood its requirements and is meeting the owner team expectations. This provides an opportunity for the owner stakeholders to question the design team for understanding and compliance. This provides an opportunity for the owner and stakeholders, including operations and maintenance, to question the design team for understanding and compliance. Communication is essential to ensure the design team is proceeding to meet the expectations and requirements of the owner stakeholders.

Contractors may become involved in projects at various points of the front end planning process and should use the PDRI to organize their work. Contractors should use the PDRI as an alignment tool to understand and participate in the development of the owner’s business objectives and drivers, facilitating the design team’s understanding of the elements defined in Section I, the Basis of Project Decision. The team will utilize this criterion to make decisions concerning cost, quality, and schedule as the project progresses through the scope definition stage and into Execution. As front end planning progresses, the PDRI helps the contractor clarify requirements outlined in Sections I and II (Basis of Design) of the PDRI, and ensures the right input from key owner stakeholders representing such as operations and maintenance, process engineering, research and development,

manufacturing, and business among others. The PDRI also assists in coordination and execution planning in conjunction with the owner organization as outlined by elements contained in Section III, Execution Approach.

Contractors are often given a request for proposal (RFP) on a project that has had all or a portion of the project scope defined by the owner, or the owner has utilized a third party engineering firm to develop the scope definition package. In these instances it is imperative that the contractor perform a PDRI assessment as a risk assessment to determine the degree of definition and identify the potential weaknesses/areas of concern before responding to the RFP. The contractor should make every attempt to get as many of the project stakeholders as possible involved in the PDRI assessment session to assure that the team is making the correct evaluations and assumptions before proceeding to the next stage.

Contractors also may use the PDRI to determine if the work within their control is ready to move to the next step. Many contractors spend a portion of the project performing design, procurement, and constructability prior to the work starting in the field. The PDRI can be used to determine, for instance, if prior to start of underground work or selection of a subcontractor to perform the work, there is sufficient definition developed to minimize schedule and/or cost impacts that may trigger mitigating strategies. This can also be done prior to other major activities starting at the construction site.

Instructions for Assessing a Project

Assessing a project is as easy as 1-2-3.

Individuals involved in front end planning should use the Project Score Sheets shown in Appendices A and B when assessing a project. Note that two score sheets are provided—the first is simply an unweighted checklist in Appendix A. The second contains the weighted values and allows a front end planning team to quantify the level of scope definition at any stage of the project on a 1000-point scale. The unweighted version should be used in the team scoring process to prevent bias in choosing the level of definition and in “targeting” a specific score. The team leader or facilitator can easily score the project as the weighting session is being held. If the project includes renovation work, the team should use the “supplemental issues to consider” provided in selected element descriptions.

When to Use PDRI

PDRI is a powerful tool that should be used at points throughout front end planning to ensure continued alignment, process checkups and a continual focus on the key project priorities. Many companies now find value in utilizing this tool at various points in the early project planning process.

Project size, complexity and duration will help determine the optimum times that the PDRI tool should be used. To aide in the expanded use of this tool, Figure 3.1 illustrates four potential application points where PDRI could be useful.

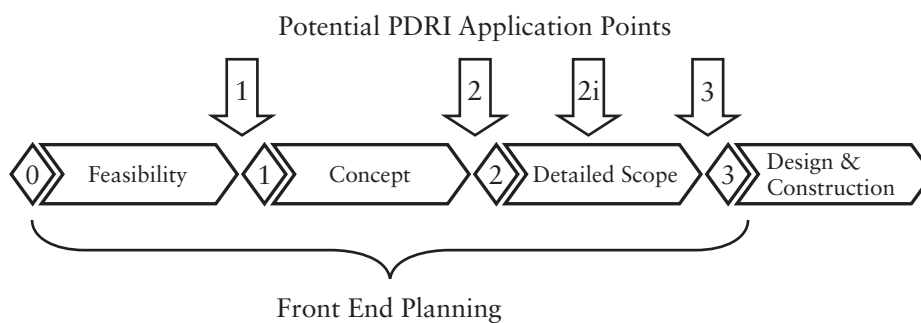


Figure 3.1. Employing the PDRI, Application Points

Regardless of the timing for the PDRI assessment, utilize the same checklist/descriptions and conduct the evaluation according to the guidelines outlined below.

PDRI 1 Review – This is a high level assessment of the project following Feasibility prior to Phase Gate 1 and is part of the decision criteria for proceeding to the next phase. This assessment is typically held for projects at the initial kickoff meeting when bringing an architect/engineer firm on board early in the project. The PDRI 1 Review should focus on the following areas:

- aligning the team with project objectives
- ensuring good communication between business/sponsor to project/contractor team
- highlighting stakeholder expectations to facilitate reasonable engineering estimates.

Typical PDRI scores at this assessment will be in the range of 550–800.

PDRI 2 Review – This is a high level assessment of the project following the Concept Development phase of the project, or Phase Gate 2, and is part of the decision criteria for proceeding to the next phase. PDRI Section I, the Basis of Project Decision, should be well-defined (with a low relative PDRI score) at the end of this phase. For small projects, this assessment may not be necessary. In addition, the PDRI 2 Review should focus on the following areas:

- aligning project objectives and stakeholders needs
- identifying high priority project deliverables that need to be completed
- helping to eliminate late project surprises
- facilitating communication across the project team and stakeholders.

Typical PDRI scores at this phase of the project may be in the range of 450–600. The assessment will highlight the areas where resources need to be focused during the next phase of front end project.

PDRI 2i Review – This is an intermediate (i) assessment of the project during the Detailed Scope phase of a project, and typically should be held midway through this phase. Section II, Basis of Design, and Section III, Execution Approach, should be well-defined during this phase of the project. The PDRI 2i Review should focus on the following areas:

- assuring alignment of project objectives and stakeholders needs
- confirming that resources are properly deployed to get the largest value for the time and effort being applied
- verifying scope in relation to the original project goals
- identifying and planning remaining activities to achieve the level of detail necessary to complete front end planning in preparation for Phase Gate 3.

Typical PDRI scores at this phase of the project may be in the range of 300–450.

PDRI 3 Review – This is typically the final assessment of the project at the end of front end project planning prior to Phase Gate 3. The PDRI 3 assessment should be conducted for all projects. At this stage, risk issues have been identified and mitigation plans are in place or are being developed. Typical scores for this review are 150 to 250, with a target of typically 200 or below.

In addition to the four PDRI reviews outlined above, the tool can be used at other points. For instance, it can be used early in Feasibility as a checklist to help organize work effort or during the design phase (after Phase Gate 3) to verify the design before moving on to construction. It has been used effectively as an alignment tool during the kickoff of design/build projects.

As noted earlier, the PDRI consists of three main sections that are subdivided into 15 categories. The categories are further subdivided into 70 elements. The elements are individually described in Appendix C, Element Descriptions. Elements should be rated numerically from 0 to 5. The scores range from 0 – not applicable, 1 – complete definition to 5 – incomplete or poor definition as indicated in the legend at the bottom of the score sheet. The elements that are as well-defined as possible should receive a perfect definition level of 1. Elements that are not completely defined should receive a 2, 3, 4, or 5, depending on their levels of definition as determined by the team. Those elements deemed not applicable for the project under consideration should receive a 0, thus not affecting the final score.

The basis for determining the level of definition is focused on developing the overall project scope of work such that the project has a higher probability of achieving a cost or schedule estimate at the ± 10 percent level at Phase Gate 3. This level of definition roughly relates to approximately 25–30 percent of design completion for the entire project.

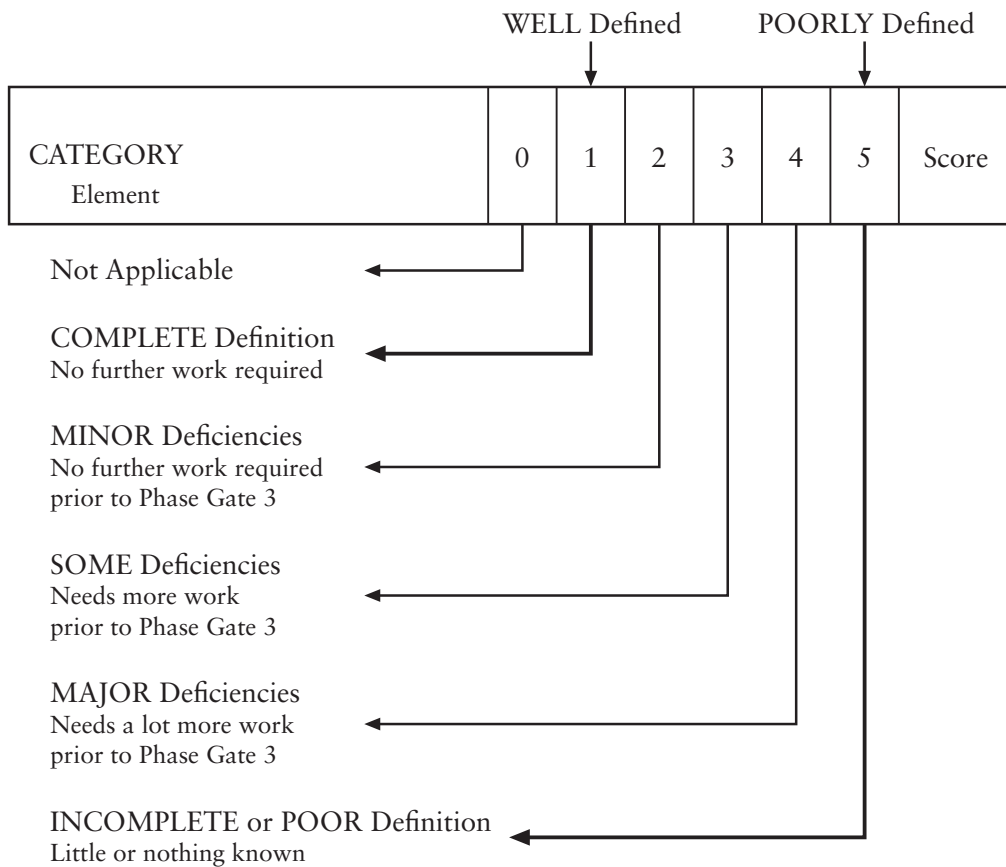
Figure 3.2 outlines a method of assessing the level of definition of an element at a given point in time. For those elements that are completely defined, no further work is needed during front end planning. For those elements with minor deficiencies, no further work is needed during the front end planning phase and the issue will not impact cost and schedule performance; however, the minor issues identified will need to be tracked and addressed as the project proceeds into the design phase. For those elements that are assessed as having some or major deficiencies, or are incomplete, further mitigation will need to be performed during front end planning prior to moving through Phase Gate 3.

The relative level of definition of a PDRI element is also tied to its importance to the project at hand. The flexibility of the PDRI allows the project team some leeway in assessing individual element definitions. For instance, if the issues missing from the scope documentation of a particular PDRI element are integral to project success (and reduction of risk), the team can rate the issue perhaps at a definition level 3 or 4. On a different project, the absence of definition of these same issues within a PDRI element may not be of concern and the team might decide to rate the element as a definition level 2. As the old saying goes, “Do not turn off your brain” when you are using this tool.

Assessing a PDRI Element

To assess an element, first refer to the Project Assessment Sheet in Appendix A or B. Next, read its corresponding description in Appendix C. Some elements contain a list of items to be considered when evaluating their levels of definition. These lists may be used as checklists. Additional issues may be applicable for renovation projects. All elements have six pre-assigned scores, one for each of the six possible levels of definition.

Choose only one definition level (0, 1, 2, 3, 4, or 5) for that element based on the perception of how well it has been addressed. The suggested method for making this determination is through open discussion among the project team members. Ensure understanding of the element issues by all participants and promote a



**Figure 3.2. PDRI Definition Levels vs. Further Work Required
During Front End Planning**

common understanding of the work required to achieve complete definition. Defer to the most knowledgeable team members (for example, storm water issues are deferred to the civil and environmental discipline leads) while respecting the concerns of the other team members. As the discussion unfolds, capture action items or “gaps.” An example action item list is given in Appendix G.

Once the appropriate definition level for the element is chosen, write the value of the score that corresponds to the level of definition in the “Score” column. Do this for each of the 70 elements in the Project Score Sheet. Be sure to assess each element.

Each of the element scores within a category should be added to produce a total score for that category. The scores for each of the categories within a section should then be added to arrive at a section score. Finally, the three section scores should be added to achieve a total PDRI score.

Assessment Example

Consider, for example, that you are a member of a front end planning team responsible for developing the scope definition package for a retrofit to an existing chemical plant. Your team has identified major milestones throughout front end planning at which time you plan to use the PDRI to evaluate the current level of “completeness” of the scope definition package. Assume that at the time of this particular evaluation the scope development effort is underway, but it is not yet complete.

Your responsibility is to evaluate how well the project infrastructure requirements have been identified and defined to date. This information is covered in Category J of the PDRI as shown below and consists of three elements: “Water Treatment Requirements,” “Loading/Unloading/Storage Facilities Requirements,” and “Transportation Requirements.” It is recommended to use the unweighted assessment sheet when evaluating a project in a team setting.

CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE							
J1. Water Treatment Requirements							
J2. Loading/Unloading/Storage Facilities Req'mts							
J3. Transportation Requirements							

Definition Levels

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

To fill out Category J, Infrastructure, follow these steps:

- Step 1:** Read the description for each element in Appendix C. Some elements contain a list of items to be considered when evaluating their levels of definition. These lists may be used as checklists.
- Step 2:** Collect all data that you may need to properly evaluate and select the definition level for each element in this category. This may require obtaining input from other individuals involved in the scope development effort.

Step 3: Select the definition level for each element as described below.

Element J1: Requirements for treating process and sanitary wastewater have been well defined. However, procedures for handling storm water runoff and treatment have not been identified. You feel that this element has *some deficiencies* that should be addressed prior to authorization of the project. **Definition Level = 2.**

Element J2: Your team decides that this element is *not applicable* to your particular project. **Definition Level = 0.**

Element J3: Although your team plans to specify methods for receiving and shipping materials within the plant, it has not yet been done. The team is particularly concerned about coordination of equipment and material movement with existing operation. It is *incomplete*. **Definition Level = 5.**

CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE							
J1. Water Treatment Requirements			X				
J2. Loading/Unloading/Storage Facilities Req'mts	X						
J3. Transportation Requirements						X	

Definition Levels

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

Be sure to capture action items/comments as the discussion progresses for reference in Step 6. This list is referred to as a “gap” list in that it identifies those issues that need to be addressed to move the project forward and identifies a gap in the planning activities.

Step 4: For each element, circle the score that corresponds to its level of definition. If the team feels that any or all of the elements were **not applicable for this project, they would have had a definition level of “0” and been zeroed out.** The weighted score sheet is given below. Circle the chosen definition levels for the assessed element.

CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	3	5	7	10	
J2. Loading/Unloading/Storage Facilities Req'mts	0	1	3	5	7	10	
J3. Transportation Requirements	0	1	2	3	4	5	
CATEGORY J TOTAL							

Definition Levels

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

Step 5: Add the element scores to obtain a category score. Repeat this process for each element in the PDRI. In this example, the category has a total score of 8. Add category scores to obtain section scores.

Add section scores to obtain a total PDRI score. A completed PDRI score sheet for a power project is included in Appendix D for reference.

CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	3	5	7	10	3
J2. Loading/Unloading/Storage Facilities Req'mts	0	1	3	5	7	10	0
J3. Transportation Requirements	0	1	2	3	4	5	5
CATEGORY J TOTAL							8

Definition Levels

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

Step 6: Take Action. In this example, Category J has a total score of 8 (out of 25 total points) and probably needs more work particularly for element J3. Use the gap list to identify issues that need additional attention.

Philosophy of Use

Ideally, the project team conducts a PDRI evaluation at various points in the project. Experience has shown that the scoring process works best in a team environment with a neutral facilitator familiar with the process. The facilitator provides objective feedback to the team and controls the pace of team meetings. See Appendix F for details of facilitation. If this arrangement is not possible, an alternate approach is to have key individuals evaluate the project separately, then evaluate it together, ultimately agreeing on a final evaluation. Even using the PDRI from an individual standpoint provides a method for project evaluation.

Experience has shown that the PDRI is best used as a tool to help project managers (project coordinators, project planners) organize and monitor progress of the front end planning effort. In many cases, a planner may use the PDRI prior to the existence of a team in order to understand major risk areas. Using the PDRI early in the project life cycle will usually lead to high PDRI scores. This is normal and the completed score sheet gives a road map of areas that are weak in terms of definition.

The PDRI is an excellent tool to use in early project team meetings in that it provides a means for the team to align itself on the project and organize its work. Experienced PDRI users feel that the final PDRI score is less important than the process used to arrive at that score. The PDRI also can provide an effective means of handing off the project to other entities or helping maintain continuity as new project participants are added to the project.

If the organization has front end planning procedures and execution standards and deliverables in place, many PDRI elements may be partially defined when the project begins front end planning. An organization may want to standardize many of the PDRI elements to improve cycle time of planning activities.

PDRI scores may change on a day-to-day or week-to-week basis as team members realize that some elements are not as well-defined as initially assumed. It is important to assess the elements honestly. Any changes that occur in assumptions or planning parameters need to be resolved with earlier planning decisions. The target score may not be as important as the team's progress over time in resolving issues that harbor risk.

The PDRI was developed as a “point in time” tool with elements that are as independent as possible. Most of the elements constitute deliverables to the planning process. However, a close review of the elements shows an imbedded logic. Certain elements must first be defined well in order for others to be defined.

Figure 3.3 outlines the logic at a “section” level. In general, Section I elements must be well-defined prior to defining Section II and III elements. Note that this is not a Critical Path Method (CPM) logic in that certain elements are completed prior to the point where the next elements start. Many times elements can be pursued concurrently. As information is gained downstream, elements already defined must be revisited.

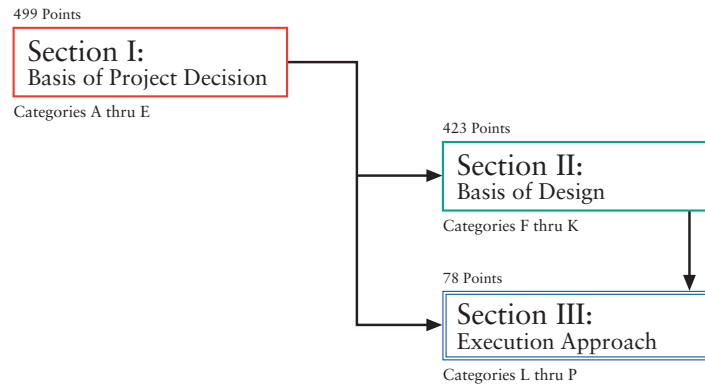


Figure 3.3. Industrial PDRI Section Logic Flow Diagram

Figure 3.4 outlines the general logic flow of the PDRI categories. Again, the flow is not traditional CPM. Many other ways are available to organize the work differently than the flow shown in this diagram, which is provided as a guideline. For instance, if information gained in Category F, Site Information, is different than expected (assumed), then a planner should assess the impact of that difference on Categories A, B, C, and D.

If an organization wants to standardize its front end planning process, the logic presented in these diagrams could provide the basis for that development. Color versions of Figures 3.3 and 3.4, as well as a detailed logic flow diagram that shows all PDRI elements, are provided in Appendix E.

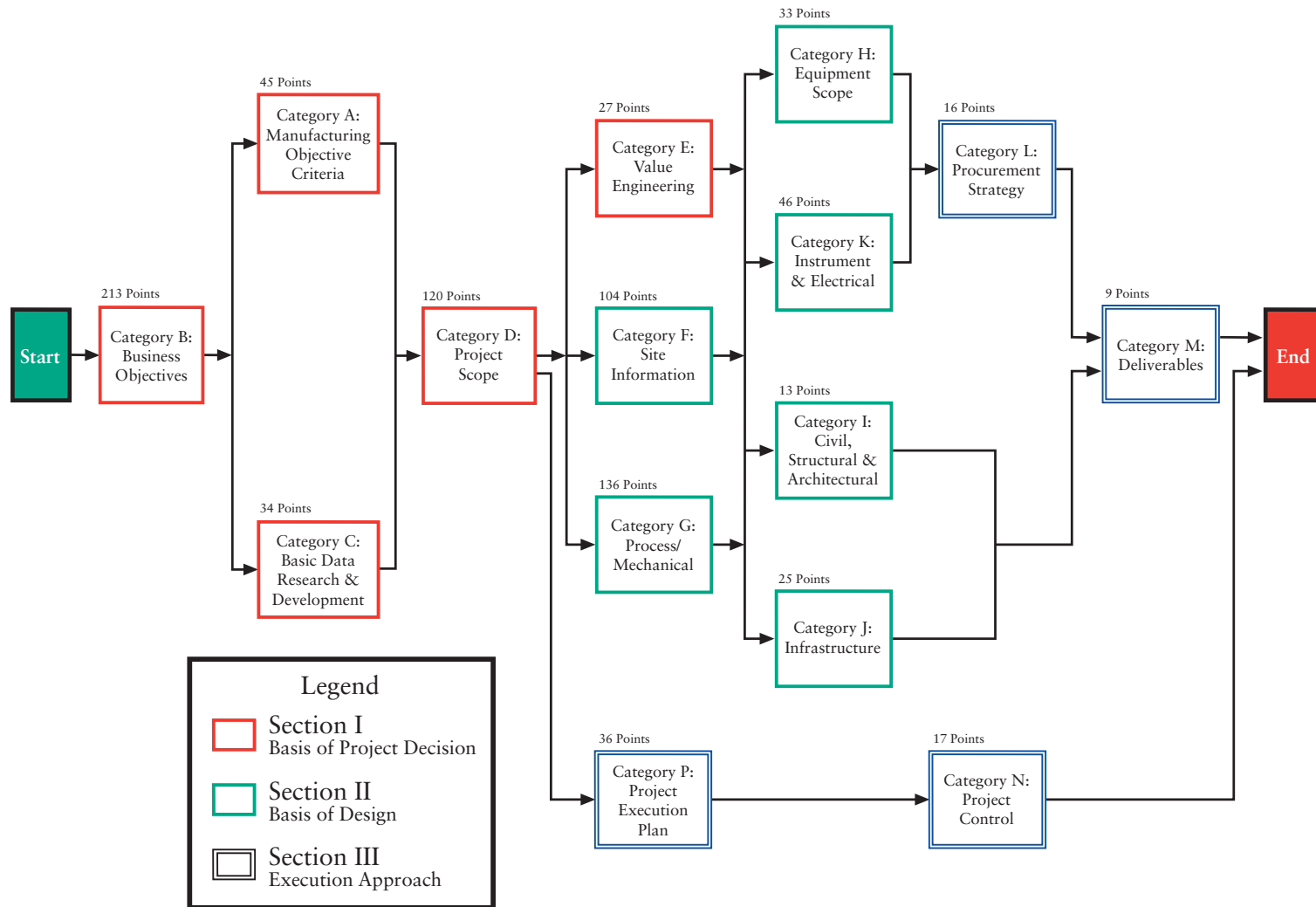


Figure 3.4. Industrial PDRI Category Logic Flow Diagram

Use of PDRI on Small or Renovation Projects

The PDRI can be customized to meet each organization's needs.

Small or renovation/upgrade projects can also benefit from using the PDRI even if these projects are small, short in duration and frequently performed. Many large organizations have a number of these projects at any one time. Project such as these may be driven by environmental regulations or by the need to keep a facility in repair or operation. Projects may also be focused on restoring a historically significant building, or relocate a business function or production line.

On small projects, the scope may not encompass many of the elements contained in the entire PDRI. In particular, some of the Basis of Project Decision elements found in Section I of the PDRI may not be clearly defined. Although business planning is generally performed on an owner's overall program of small projects, it may be difficult to determine if specific business decisions directly apply to one individual project. Long-term use has shown that customizing the PDRI to reflect each individual project is highly beneficial.

On small or renovation projects, the scope may not encompass many of the elements contained in the entire PDRI. In particular, some of the Basis of Project Decision elements found in Section I of the PDRI may not be clearly defined. Although business planning is generally performed on an owner's overall program of small projects, it may be difficult to determine if specific business decisions directly apply to one individual project. Long-term use has shown that customizing the PDRI to reflect each individual project is highly beneficial.

After the release of the initial PDRI in 1999, many companies attempted to customize the elements to fit the needs of smaller projects. The current edition of the PDRI has modified language that should make it more applicable to smaller or renovation projects. Experience has proven that gathering the project team around a well understood and customized PDRI can save time, money, and frustration.

These smaller projects may range in size from \$50,000 to \$5,000,000 in total project costs. Some may consist of one or two disciplines such as the following:

- environmental project to improve drainage and capture storm runoff
- instrument upgrade project
- replacing a roof.

In any of the above projects, the PDRI can be a helpful tool in highlighting gaps in thinking and execution. The following are some guidelines when using the PDRI on small or single-discipline projects:

1. Delete all elements that clearly do not apply.

Example: A storm water or drainage improvement project may not have any architectural or instrumentation requirements. Simply draw a line through all Instrument and Electrical elements (category K), Architectural Requirements (I2), and other elements prior to the assessment session. Note: if there is any doubt regarding an element, then leave it in until the team has had time to discuss it.

2. Convene the project team and assess the project using only the PDRI elements that remain to be assessed, including especially those elements specifically designated for renovation projects if applicable. At the conclusion of the PDRI assessment session, have representatives of each discipline sign off, signifying their agreement with the definition of the project.
3. Revert to the normalized score (percentage) as a basis for determining how well the project is defined. (See discussion in the next section.)
4. Since some of the most heavily weighted items of Section I could receive a score of “0,” the facilitator should make the team aware of the elements that have the most impact on the final score. Other elements may become more important to predicting project success.
5. Alternatively, the tool can be used strictly as a checklist to identify issues that need to be addressed to develop a good scope. Use of the PDRI as an early checklist can have a great influence on the project and will serve to focus the project team toward a common goal. If the project is a renovation, pay particular attention to those issues that have been identified for these types of projects.

Normalizing the Score

If an organization decides to create a scaled-down version of the PDRI, this procedure will alter the maximum possible score from 1000 points to some lower number. Each time an element is deleted from the checklist, the maximum score for the project is reduced by that element's total weight. Not only will the maximum score be reduced, but the lowest possible score that can be achieved with complete definition will drop from 70 points to some lower number.

For example, on an industrial revamp project, the PDRI can be used effectively for these projects with some modification. Some elements may be “zeroed” as not applicable for these projects (e.g., Site Location (F1), Surveys and Soil Tests (F2)). A “not applicable” element essentially provides no risk (no potential negative impact) to the project. Other elements may become more critical (e.g., Environmental Assessment (F3), Site Characteristics Available vs. Required (D3)). After the assessment, if the organization's scaled-down version has a maximum possible score of 752 (after certain elements are given a not applicable in the score sheet), it may determine that a score of 120 (16 percent of the total applicable points) must be reached before authorizing its small projects for design.

When using the PDRI on small projects, the team must determine a new target score at which it feels comfortable when authorizing a project for detailed design and construction. Each organization should develop an appropriate threshold range of scores for the particular phase of front end planning. The threshold is dependent upon the size, type, and complexity of the project.

Caution: Using the PDRI for this purpose should be done carefully or else elements that are more important for small projects may be given less emphasis than needed. The operative phrase for using the PDRI in these situations is “common sense.” An experienced facilitator can help in this regard.

Implementation across the Organization

The first requirement for implementation of the PDRI across any organization (i.e., using it on all projects) is the unwavering support of upper management. Upper management must create a procedure that lists the utilization of the PDRI as a requirement prior to authorizing a project to proceed with the execution phase.

Many successful organizations require a PDRI report as a part of their project approval to proceed checklist. Some organizations require a specific score of 200 or less for a project to be approved for the next phase. There is some danger in too much focus on scoring. Some smaller, maintenance projects may be fully acceptable at a much higher PDRI score as long as the project risks have been defined and a mitigation plan is in place to control the project. As stated before, common sense should prevail when reviewing PDRI results from a project. Requiring teams to reach a specific score could result in a team artificially adjusting the score so that project can be executed (to the detriment of the organization, project, and team participants). In most cases, it is more beneficial for the sponsor to have a PDRI assessment (at the PDRI 3 review) with a score above 200 along with identified risk issues (gap list) and corresponding mitigation steps than to have a PDRI assessment with a lower score and no commentary. Sponsors should focus on the gap list generated in the assessment session, not just the PDRI score. Placing too much emphasis on the score can lead to use of the tool as an administrative exercise.

The second requirement for implementation across an organization is a local champion. This person is an enthusiastic supporter of the application of this tool. He or she is in contact with other organizations using the PDRI and fosters widespread application of the tool.

The third requirement for implementation is training. Several facilitators should be trained, and the number will vary by organization and the projects that require approval. The objective is to ensure that every project has access to a trained facilitator in a timely manner. The facilitator should NOT be a member of that project team. In many organizations, project managers are trained as facilitators for their peer's projects.

In addition to a cadre of facilitators, all key members of the organization should understand the PDRI. In most cases, this is accomplished with just-in-time training. The facilitator will brief the participants on the purpose and their role to make the session a success, and then will comment on specific behaviors as they progress through the assessment session.

If the PDRI is implemented across an organization, its use should be monitored. Many organizations have modified PDRI element descriptions to add discussion concerning proprietary concerns, lessons-learned, or specific terminology based on the business environment.

What Does A PDRI Score Mean?

A low PDRI score represents a project definition package that is well-defined and, in general, corresponds to an increased probability for project success. Higher scores signify that certain elements within the project definition package lack adequate definition.

The PDRI has been used on hundreds of projects representing billions of dollars in investment. A large number of projects was recently evaluated with the PDRI by CII. For each of these projects, PDRI scores and project success criteria were computed. (Note: these projects were scored after the fact.) An analysis of these data yielded a strong correlation between low (good) PDRI scores and high project success. (For more information on the validation sample and methodology, see Reference 7.)

The analysis revealed a significant difference in performance between the projects scoring above 200 and the projects scoring below 200 prior to development of construction documents.

Table 4.1 compares project performance for a sample of 108 building projects worth \$2.3 billion using a 200-point PDRI score cutoff. These data show the mean performance for the projects versus execution estimate for design and construction and the absolute value of changes as a percentage of total project cost. Projects with a PDRI score under 200 (a lower score is better) statistically outperformed projects with a PDRI score above 200 in terms of cost, schedule,

Table 4.1. Comparison of Projects with PDRI–Building Projects Scores Above and Below 200

Performance	PDRI Score	
	< 200	> 200
Cost	3% above budget	9% above budget
Schedule	5% behind schedule	21% behind schedule
Change Orders	8% of budget (N=25)	11% of budget (N=83)

and change orders. The PDRI score was determined just prior to the beginning of detailed design and the differences in performance parameters are statistically significant.

A similar evaluation was performed on a sample of 129 industrial projects representing approximately \$6.7 billion. Table 4.2 summarizes the project performance and PDRI score using the same 200-point PDRI score cutoff. Again, projects with better scope definition (lower PDRI score) outperformed projects with poorly defined scope in terms of cost performance at the 95 percent confidence level.

Table 4.2. Comparison of Projects with PDRI–Industrial Projects Scores Above and Below 200

Performance	PDRI Score	
	< 200	> 200
Cost	4% below budget	4% over budget
Schedule	4% behind schedule	10% behind schedule
Change Orders	7% of budget (N=75)	8% of budget (N=54)

The projects used in these samples were voluntarily submitted. The Building PDRI sample includes data from 24 organizations, including office, control building, recreation, institutional, and research facilities. Project sizes ranged from approximately \$630,000 to \$251 million with an average cost of approximately \$22 million. The Industrial PDRI sample included data from 53 organizations and represents heavy and light industrial projects including chemical, pharmaceutical, power, pulp and paper, refining, and metals facilities. Project size ranged from \$120,000 to \$635 million with an average of approximately \$53 million.

The evaluations provided here are valid for the samples as given. These samples may or may not be indicative of projects in a specific organization and the samples may be biased because of the size and types of projects making up the sample. However, the results are convincing in terms of performance predictability.

Analyzing PDRI Scores — What to Look For

The PDRI is of little value unless the user takes action based on the analysis and uses the assessment to identify and mitigate risk for the project. Among the potential uses when analyzing the PDRI score are the following:

- Track project progress during front end planning, using the PDRI score as a macro-evaluation tool. Individual elements, categories, and sections can be tracked as well.
- Compare project-to-project scores over time to identify trends in developing scope definition within your organization.
- Compare different types of projects (e.g., R&D vs. medical vs. retail; chemical vs. product assembly; or new vs. renovation) and determine a threshold PDRI score for those projects and identify critical success factors from that analysis. The PDRI also can be used to compare projects for different clients or different size projects with the same client.

Depending on the nature of your business, your internal scope definition practices, and your requirements, you may wish to determine a comfort level (range of PDRI scores) at which you are willing to move from phase to phase.

- Look at weak areas of the project on a section, category, or element level. For example, if any element has a definition level of 3, 4, or 5, further define this element or develop a risk mitigation strategy. This provides an effective method of risk analysis since each element, category, and section is weighted relative to each other in terms of potential risk exposure. The identification of the project's weak areas is critical as the project team continues its progress toward execution and should provide "path forward" action items.
- Another method of evaluation is to look at the score of each section or category as a percentage of its maximum score in order to focus attention on critical items for the project. For example, if your score for Section I, Basis of Project Decision, is 250 points, then it is roughly 50 percent of its potential maximum score (499). The elements in this section would then need much more work.
- Section III, Execution Approach, does not have as much weighting as the other two PDRI Sections. Do not underestimate the importance of this section. Procurement strategy (Category L), project control (Category N),

particularly the project control requirements and work breakdown structure (WBS), and project execution plan (Category P) including contracting strategy and turnover and commissioning are important. These issues can significantly impact the project in regard to schedule performance.

- Sometimes project teams are pressured to develop a scope of work in a short period of time. To streamline the process, the team could focus on the top 10 elements. These 10 elements comprise almost 40 percent of the total score. When addressing smaller projects, the team may want to select a different “top 10” depending on the circumstances. See Appendix C for a description of each of the top 10 elements.

1. Products (B1)
2. Capacities (B5)
3. Technology (C1)
4. Processes (C2)
5. Process Flow Sheets (G1)
6. Site Location (F1)
7. P&IDs (G3)
8. Site Characteristics Available vs. Required (D3)
9. Market Strategy (B2)
10. Project Objectives Statement (D1)
TOTAL POINTS = 384/1000

Figure 4.2. Ten Highest Ranking PDRI Elements

Historical PDRI Scores

Keeping a corporate or organizational database of PDRI scores for various project sizes and types may be desirable. As more projects are completed and scored using the PDRI, the ability to predict the probability of success on future projects should improve. The PDRI may serve as a gauge for an organization in deciding whether to authorize the development of construction documents and ultimately construction of a project. Another use for PDRI is as an external benchmark for measurement against the practices of other industry leaders.

Concluding Remarks

The PDRI can benefit owners, developers, designers, and contractors. Facility owners, developers, and lending institutions can use it as an assessment tool for establishing a comfort level at which they are willing to move forward on projects. Designers and constructors can use it as a means of negotiating with owners in identifying poorly defined project scope definition elements. The PDRI provides a forum for all project participants to communicate and reconcile differences using an objective tool as a common basis for project scope evaluation. It also provides excellent input into the detailed design process and a solid baseline for design management.

**Anyone who wishes to improve the overall performance
on their industrial projects should use the PDRI.**

How to Improve Performance on Future Projects

The following suggestions can help those who adopt the PDRI with the desire to improve performance on their industrial projects:

- **Commit to early project planning.** Effective planning in the early stages of industrial projects can greatly enhance cost, schedule, and operational performance while minimizing the possibility of financial failures and disasters.
- **Gain and maintain project team alignment** by using the PDRI throughout front end planning. Discussions around the scope definition checklists are particularly effective in helping with team alignment.
- **Use the CII Front End Planning Toolkit.** This interactive Toolkit has been developed to guide the project team through the front end planning process, including where and how to employ the PDRI. Encourage its usage across the organization.
- **Be especially cognizant of specific scope elements on renovation and revamp projects.** Use the specific R&R issues identified in the element descriptions. Also, use CII Implementation 242-2, *Front End Planning of Renovation and Revamp Projects*, if your project is an R&R project and especially if it includes a shutdown/turnaround/outage scenario.

- **Adjust the PDRI as necessary to meet the specific needs of your project.** The PDRI was designed so that certain elements considered not applicable on a particular project can be “zeroed out,” thus eliminating them from the final scoring calculation.
- **Use the PDRI to improve project performance.** Build your own internal database of projects that are scored using the PDRI. Compute PDRI scores at the various times during scope development and compare versus project success. Based upon the relationship between PDRI scores and project success, establish a basis for the level of scope definition that is acceptable for moving forward from phase to phase.
- **Use caution when beginning detailed design of projects with PDRI scores greater than 200.** CII data has shown a direct correlation exists between high PDRI scores and poor project performance.

CII research has shown that the PDRI can effectively be used to improve the predictability of project performance. However, the PDRI alone will not ensure successful projects. When combined with sound business planning, alignment, and good project execution, it can greatly improve the probability of meeting or exceeding project objectives.

Appendix A: Unweighted Project Score Sheet

An Excel™ version of this matrix is on the compact disc that accompanies this book.

SECTION I – BASIS OF PROJECT DECISION							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
A. MANUFACTURING OBJECTIVES CRITERIA							
A1. Reliability Philosophy							
A2. Maintenance Philosophy							
A3. Operating Philosophy							
CATEGORY A TOTAL							
B. BUSINESS OBJECTIVES							
B1. Products							
B2. Market Strategy							
B3. Project Strategy							
B4. Affordability/Feasibility							
B5. Capacities							
B6. Future Expansion Considerations							
B7. Expected Project Life Cycle							
B8. Social Issues							
CATEGORY B TOTAL							
C. BASIC DATA RESEARCH & DEVELOPMENT							
C1. Technology							
C2. Processes							
CATEGORY C TOTAL							
D. PROJECT SCOPE							
D1. Project Objectives Statement							
D2. Project Design Criteria							
D3. Site Characteristics Available vs. Required							
D4. Dismantling and Demolition Requirements							
D5. Lead/Discipline Scope of Work							
D6. Project Schedule							
CATEGORY D TOTAL							
E. VALUE ENGINEERING							
E1. Process Simplification							
E2. Design & Material Alts. Considered/Rejected							
E3. Design for Constructability Analysis							
CATEGORY E TOTAL							
Section I Total							

Definition Levels

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

SECTION II – BASIS OF DESIGN							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
F. SITE INFORMATION							
F1. Site Location							
F2. Surveys & Soil Tests							
F3. Environmental Assessment							
F4. Permit Requirements							
F5. Utility Sources with Supply Conditions							
F6. Fire Protection & Safety Considerations							
CATEGORY F TOTAL							
G. PROCESS/MECHANICAL							
G1. Process Flow Sheets							
G2. Heat & Material Balances							
G3. Piping & Instrumentation Diagrams (P&IDs)							
G4. Process Safety Management (PSM)							
G5. Utility Flow Diagrams							
G6. Specifications							
G7. Piping System Requirements							
G8. Plot Plan							
G9. Mechanical Equipment List							
G10. Line List							
G11. Tie-in List							
G12. Piping Specialty Items List							
G13. Instrument Index							
CATEGORY G TOTAL							
H. EQUIPMENT SCOPE							
H1. Equipment Status							
H2. Equipment Location Drawings							
H3. Equipment Utility Requirements							
CATEGORY H TOTAL							
I. CIVIL, STRUCTURAL, & ARCHITECTURAL							
I1. Civil/Structural Requirements							
I2. Architectural Requirements							

Definition Levels

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

SECTION II – BASIS OF DESIGN (continued)							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE							
J1. Water Treatment Requirements							
J2. Loading/Unloading/Storage Facilities Req'mts							
J3. Transportation Requirements							
CATEGORY J TOTAL							
K. INSTRUMENT & ELECTRICAL							
K1. Control Philosophy							
K2. Logic Diagrams							
K3. Electrical Area Classifications							
K4. Substation Req'mts Power Sources Ident.							
K5. Electric Single Line Diagrams							
K6. Instrument & Electrical Specifications							
CATEGORY K TOTAL							
Section II Total							

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

SECTION III – EXECUTION APPROACH							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
L. PROCUREMENT STRATEGY							
L1. Identify Long Lead/Critical Equip. & Mat'ls							
L2. Procurement Procedures and Plans							
L3. Procurement Responsibility Matrix							
CATEGORY L TOTAL							
M. DELIVERABLES							
M1. CADD/Model Requirements							
M2. Deliverables Defined							
M3. Distribution Matrix							
CATEGORY M TOTAL							
N. PROJECT CONTROL							
N1. Project Control Requirements							
N2. Project Accounting Requirements							
N3. Risk Analysis							
CATEGORY N TOTAL							
P. PROJECT EXECUTION PLAN							
P1. Owner Approval Requirements							
P2. Engineering/Construction Plan & Approach							
P3. Shut Down/Turn-Around Requirements							
P4. Pre-Commiss. Turnover Sequence Req'mts							
P5. Startup Requirements							
P6. Training Requirements							
CATEGORY P TOTAL							
Section III Total							

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

Appendix B: Weighted Project Score Sheet

An Excel™ version of this matrix is on the compact disc that accompanies this book.

SECTION I – BASIS OF PROJECT DECISION							
CATEGORY	Definition Level						Score
Element	0	1	2	3	4	5	
A. MANUFACTURING OBJECTIVES CRITERIA (Maximum Score = 45)							
A1. Reliability Philosophy	0	1	5	9	14	20	
A2. Maintenance Philosophy	0	1	3	5	7	9	
A3. Operating Philosophy	0	1	4	7	12	16	
CATEGORY A TOTAL							
B. BUSINESS OBJECTIVES (Maximum Score = 213)							
B1. Products	0	1	11	22	33	56	
B2. Market Strategy	0	2	5	10	16	26	
B3. Project Strategy	0	1	5	9	14	23	
B4. Affordability/Feasibility	0	1	3	6	9	16	
B5. Capacities	0	2	11	21	33	55	
B6. Future Expansion Considerations	0	2	3	6	10	17	
B7. Expected Project Life Cycle	0	1	2	3	5	8	
B8. Social Issues	0	1	2	5	7	12	
CATEGORY B TOTAL							
C. BASIC DATA RESEARCH & DEVELOPMENT (Maximum Score = 94)							
C1. Technology	0	2	10	21	39	54	
C2. Processes	0	2	8	17	28	40	
CATEGORY C TOTAL							
D. PROJECT SCOPE (Maximum Score = 120)							
D1. Project Objectives Statement	0	2	8	14	19	25	
D2. Project Design Criteria	0	2	6	11	16	22	
D3. Site Characteristics Available vs. Required	0	2	9	16	22	29	
D4. Dismantling and Demolition Requirements	0	2	5	8	12	15	
D5. Lead/Discipline Scope of Work	0	1	4	7	10	13	
D6. Project Schedule	0	2	6	9	13	16	
CATEGORY D TOTAL							
E. VALUE ENGINEERING (Maximum Score = 27)							
E1. Process Simplification	0	0	2	4	6	8	
E2. Design & Material Alts. Considered/Rejected	0	0	2	4	5	7	
E3. Design for Constructability Analysis	0	0	3	5	8	12	
CATEGORY E TOTAL							
Section I Maximum Score = 499							SECTION I TOTAL

Definition Levels

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

SECTION II – BASIS OF DESIGN							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
F. SITE INFORMATION (Maximum Score = 104)							
F1. Site Location	0	2	10	18	26	32	
F2. Surveys & Soil Tests	0	1	4	7	10	13	
F3. Environmental Assessment	0	2	5	10	15	21	
F4. Permit Requirements	0	1	3	5	9	12	
F5. Utility Sources with Supply Conditions	0	1	4	8	12	18	
F6. Fire Protection & Safety Considerations	0	1	2	4	5	8	
CATEGORY F TOTAL							
G. PROCESS/MECHANICAL (Maximum Score = 196)							
G1. Process Flow Sheets	0	2	8	17	26	36	
G2. Heat & Material Balances	0	1	5	10	17	23	
G3. Piping & Instrumentation Diagrams (P&IDs)	0	2	8	15	23	31	
G4. Process Safety Management (PSM)	0	1	2	4	6	8	
G5. Utility Flow Diagrams	0	1	3	6	9	12	
G6. Specifications	0	1	4	8	12	17	
G7. Piping System Requirements	0	1	2	4	6	8	
G8. Plot Plan	0	1	4	8	13	17	
G9. Mechanical Equipment List	0	1	4	9	13	18	
G10. Line List	0	1	2	4	6	8	
G11. Tie-in List	0	1	2	3	4	6	
G12. Piping Specialty Items List	0	1	1	2	3	4	
G13. Instrument Index	0	1	2	4	5	8	
CATEGORY G TOTAL							
H. EQUIPMENT SCOPE (Maximum Score = 33)							
H1. Equipment Status	0	1	4	8	12	16	
H2. Equipment Location Drawings	0	1	2	5	7	10	
H3. Equipment Utility Requirements	0	1	2	3	5	7	
CATEGORY H TOTAL							
I. CIVIL, STRUCTURAL, & ARCHITECTURAL (Maximum Score = 19)							
I1. Civil/Structural Requirements	0	1	3	6	9	12	
I2. Architectural Requirements	0	1	2	4	5	7	
CATEGORY I TOTAL							

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

SECTION II – BASIS OF DESIGN (continued)							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	3	5	7	10	
J2. Loading/Unloading/Storage Facilities Req'mts	0	1	3	5	7	10	
J3. Transportation Requirements	0	1	2	3	4	5	
CATEGORY J TOTAL							
K. INSTRUMENT & ELECTRICAL (Maximum Score = 46)							
K1. Control Philosophy	0	1	3	5	7	10	
K2. Logic Diagrams	0	1	2	3	3	4	
K3. Electrical Area Classifications	0	0	2	4	7	9	
K4. Substation Req'mts Power Sources Ident.	0	1	3	5	7	9	
K5. Electric Single Line Diagrams	0	1	2	4	6	8	
K6. Instrument & Electrical Specifications	0	1	2	3	5	6	
CATEGORY K TOTAL							
Section II Maximum Score = 423							SECTION II TOTAL

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

SECTION III – EXECUTION APPROACH							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
L. PROCUREMENT STRATEGY (Maximum Score = 16)							
L1. Identify Long Lead/Critical Equip. & Mat’ls	0	1	2	4	6	8	
L2. Procurement Procedures and Plans	0	0	1	2	4	5	
L3. Procurement Responsibility Matrix	0	0	1	2	2	3	
CATEGORY L TOTAL							
M. DELIVERABLES (Maximum Score = 9)							
M1. CADD/Model Requirements	0	0	1	1	2	4	
M2. Deliverables Defined	0	0	1	2	3	4	
M3. Distribution Matrix	0	0	0	1	1	1	
CATEGORY M TOTAL							
N. PROJECT CONTROL (Maximum Score = 17)							
N1. Project Control Requirements	0	0	2	4	6	8	
N2. Project Accounting Requirements	0	0	1	2	2	4	
N3. Risk Analysis	0	1	2	3	4	5	
CATEGORY N TOTAL							
P. PROJECT EXECUTION PLAN (Maximum Score = 36)							
P1. Owner Approval Requirements	0	0	2	3	5	6	
P2. Engineering/Construction Plan & Approach	0	1	3	5	8	11	
P3. Shut Down/Turn-Around Requirements	0	1	3	4	6	7	
P4. Pre-Commiss. Turnover Sequence Req’mts	0	1	1	2	4	5	
P5. Startup Requirements	0	0	1	2	3	4	
P6. Training Requirements	0	0	1	1	2	3	
CATEGORY P TOTAL							
Section III Maximum Score = 78		SECTION III TOTAL					

PDRI TOTAL SCORE

Maximum Score = 1000

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

Appendix C:

Element Descriptions

The following descriptions have been developed to help generate a clear understanding of the terms used in the Project Score Sheets located in Appendices A and B. Some descriptions include checklists to clarify concepts and facilitate ideas when scoring each element. Note that these checklists are not all-inclusive and the user may supplement these lists when necessary.

The descriptions are listed in the same order as they appear in the Project Score Sheet. They are organized in a hierarchy by section, category, and element. The Project Score Sheet consists of three main sections, each of which is a series of categories that have elements. Scoring is performed by evaluating the levels of definition of the elements. Note that some of the elements have issues listed that are specific to projects that are renovations and revamps and are identified as “Additional items to consider for Renovation & Revamp projects.” Use these issues for discussion if applicable. The sections, categories, and elements are organized as follows:

SECTION I – BASIS OF PROJECT DECISION

This section consists of information necessary for understanding the project objectives. The completeness of this section determines the degree to which the project team will be able to achieve alignment in meeting the project’s business objectives.

CATEGORIES:

- A – Manufacturing Objectives Criteria
- B – Business Objectives
- C – Basic Data Research & Development
- D – Project Scope
- E – Value Engineering

SECTION II – BASIS OF DESIGN

This section consists of processes and technical information elements that should be evaluated to fully understand the scope of the project.

CATEGORIES:

- F – Site Information
- G – Process/Mechanical
- H – Equipment Scope
- I – Civil, Structural, & Architectural
- J – Infrastructure
- K – Instrument & Electrical

SECTION III – EXECUTION APPROACH

This section consists of elements that should be evaluated to fully understand the requirements of the owner's execution strategy.

CATEGORIES:

- L – Procurement Strategy
- M – Deliverables
- N – Project Control
- P – Project Execution Plan

The following pages contain detailed descriptions for each element in the Project Definition Rating Index (PDRI).

SECTION I – BASIS OF PROJECT DECISION

A. MANUFACTURING OBJECTIVES CRITERIA

A1. Reliability Philosophy

A list of the general design principles to be considered to achieve dependable operating performance from the unit/facility or upgrades instituted for this project. Evaluation criteria should include:

- ☐ Justification of spare equipment
- ☐ Control, alarm, security and safety systems redundancy, and access control
- ☐ Extent of providing surge and intermediate storage capacity to permit independent shutdown of portions of the plant
- ☐ Mechanical/structural integrity of components (metallurgy, seals, types of couplings, bearing selection)
- ☐ Identify critical equipment and measures to be taken to prevent loss due to sabotage or natural disaster
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Potential impacts to existing operations

A2. Maintenance Philosophy

A list of the general design principles to be considered to meet unit/facility (or upgrades instituted for this project) has been developed to maintain operations at a prescribed level. Evaluation criteria should include:

- ☐ Scheduled unit/equipment shutdown frequencies and durations
- ☐ Equipment access/monorails/cranes/other lifting equipment
- ☐ Maximum weight or size requirements for available repair equipment
- ☐ Equipment monitoring requirements (e.g., vibrations monitoring)
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Maintenance impact of renovation projects
- ☐ Common/ spare parts (repair vs. replace existing components)
- ☐ Interruptions to existing and adjacent facilities during R&R work
- ☐ Compatibility of maintenance philosophy for new systems and equipment with existing use and maintenance philosophy
- ☐ Coordination of the project with any maintenance projects

A3. Operating Philosophy

A list of the general design principles that need to be considered to achieve the projected overall performance requirements (such as on-stream time or service factor) for the unit/facility or upgrade. Evaluation criteria should include:

- ☐ Level of operator coverage and automatic control to be provided
- ☐ Operating time sequence (ranging from continuous operation to five day, day shift only)
- ☐ Necessary level of segregation and clean out between batches or runs
- ☐ Desired unit turndown capability
- ☐ Design requirements for routine startup and shutdown
- ☐ Design to provide security protection for material management and product control
- ☐ Other

B. BUSINESS OBJECTIVES

B1. Products

A list of product(s) to be manufactured and/or the specifications and tolerances that the project is intended to deliver. It should address items such as:

- | | |
|--|---|
| <input type="checkbox"/> Chemical composition | <input type="checkbox"/> Allowable impurities |
| <input type="checkbox"/> Physical form/properties | <input type="checkbox"/> By-products |
| <input type="checkbox"/> Raw materials | <input type="checkbox"/> Wastes |
| <input type="checkbox"/> Packaging | <input type="checkbox"/> Hazards associated with products |
| <input type="checkbox"/> Intermediate/final product form | <input type="checkbox"/> Other |

For projects that do not apply directly to products (e.g., instrument upgrade, environmental improvements, structural integrity, regulatory compliance, infrastructure improvement, etc.), this element should be considered not applicable.

B2. Market Strategy

A market strategy has been developed and clearly communicated. It identifies the driving forces (other than safety) for the project and specifies what is most important from the viewpoint of the business group. It should address items such as:

- ☐ Cost:
 - ☐ Maximum project cost that market will accept
 - ☐ Production cost
 - ☐ Cost reduction over time
- ☐ Schedule:
 - ☐ Product demand schedule (over operational life)
 - ☐ First product sales date
- ☐ Quality, including critical product specifications
- ☐ Other

B3. Project Strategy

The project strategy has been defined. This strategy supports the market and/or business strategy or drivers. Address the priorities among the following items:

- | | |
|-----------------------------------|---|
| <input type="checkbox"/> Cost | <input type="checkbox"/> Environmental Sustainability |
| <input type="checkbox"/> Schedule | <input type="checkbox"/> Security |
| <input type="checkbox"/> Quality | <input type="checkbox"/> Other |

B4. Affordability/Feasibility

Items that may improve the affordability of the project should be considered during scope development and communicated to the project team. These items may include incremental cost criteria such as:

- ☐ Consideration of feedstock availability and transport to the job site
- ☐ Understanding of raw material or feedstock and product variability in relation to cost and volume
- ☐ Reduction in manufacturing costs
- ☐ Performing an analysis of capital and operating cost versus sales and profitability
- ☐ Long-term environmental sustainability considerations
- ☐ Other

B5. Capacities

The design output or benefits to be gained from this project should be documented. Capacities are usually defined in terms of:

- | | |
|--|---|
| <input type="checkbox"/> On-stream factors | <input type="checkbox"/> Regulatory driven requirements |
| <input type="checkbox"/> Yield | <input type="checkbox"/> Product quality improvement |
| <input type="checkbox"/> Design rate | <input type="checkbox"/> Other |
| <input type="checkbox"/> Increase in storage or throughput | |

B6. Future Expansion Considerations

A list of items to be considered in the unit design that will facilitate future expansion should be developed. Evaluation criteria may include:

- ☐ Providing space for future equipment or phased development
- ☐ Guidelines for over design of systems to allow for additions. For example, extra power, structure, storage, or control devices
- ☐ Guidelines for design that consider future expansion without compromising on-going operations, safety or security. For example, providing tie-ins for future expansion without necessitating a shutdown
- ☐ Environmental considerations and impacts
- ☐ Other

B7. Expected Project Life Cycle

The time period that the facility is expected to be able to satisfy the products and capacities required should be documented. The life cycle will affect the selection of critical equipment, materials, and control devices. Requirements for ultimate disposal and dismantling should also be considered. Issues to consider may include:

- ☐ Operating life cycle (i.e., 10, 15, 20 years)
- ☐ Cost of ultimate dismantling and disposal
- ☐ Disposal of hazardous materials
- ☐ Possible future uses
- ☐ Environmental sustainability considerations
- ☐ Other

B8. Social Issues

Identify and document any social issues, that if not addressed, could adversely impact the successful implementation of the project. These may include issues affecting the local or regional population. Evaluation of various social issues such as:

- ☐ Domestic culture vs. international culture
- ☐ Community relations
- ☐ Labor relations
- ☐ Government relations
- ☐ Education/training
- ☐ Safety and health considerations
- ☐ Environmental assessment/sustainability
- ☐ Other

C. BASIC DATA RESEARCH & DEVELOPMENT

C1. Technology

The technology(ies) being used in this project to gain the desired results should be identified. Technologies may include chemical, biological, or mechanical processes, as well as information technology. Proven technology involves less risk than experimental technology to project cost or schedule. Issues to evaluate when assessing technologies include:

- | | |
|---|---|
| <input type="checkbox"/> Existing/proven or duplicate | <input type="checkbox"/> Organization's experience with the process steps |
| <input type="checkbox"/> New | <input type="checkbox"/> Software development |
| <input type="checkbox"/> Experimental | <input type="checkbox"/> Other |
| <input type="checkbox"/> Scale up from bench or pilot application to commercial scale | |

Additional items to consider for Renovation & Revamp projects

- ☐ Integration of new technology with existing systems, including interface issues
- ☐ Safety systems potentially compromised by any new technology

C2. Processes

A particular, specific sequence of steps to change the raw materials, intermediates, or sub-assemblies into the finished product or outcome. These process steps may involve conversion of an existing process stream into a new sequence of steps to meet facility requirements. Proven sequences of steps involve the least risk, while experimental processes have a potential for change or problems. Issues to evaluate include:

- | | |
|---|---|
| <input type="checkbox"/> Existing/proven or duplicate | <input type="checkbox"/> Scale up from bench or pilot application to commercial scale |
| <input type="checkbox"/> New | <input type="checkbox"/> Organization's experience with the process steps |
| <input type="checkbox"/> Experimental | <input type="checkbox"/> Other |

D. PROJECT SCOPE**D1. Project Objectives Statement**

This statement defines the project objectives and priorities for meeting the business strategy. It should be clear, concise, measurable, and specific to the project. It is desirable to obtain total agreement from the entire project team regarding these objectives and priorities to ensure alignment. Specifically, the priorities among cost, schedule, and value-added quality features should be clear. To ensure the project is aligned to the applicable objectives, the following should be considered:

- | | |
|---|--|
| <input type="checkbox"/> Stakeholder's understanding of objectives, including questions or concerns | |
| <input type="checkbox"/> Constraints or limitations placed on the project | |
| <input type="checkbox"/> Typical objectives: | |
| <input type="checkbox"/> Safety | <input type="checkbox"/> Communication |
| <input type="checkbox"/> Quality | <input type="checkbox"/> Operational performance |
| <input type="checkbox"/> Cost | <input type="checkbox"/> Maintainability |
| <input type="checkbox"/> Schedule | <input type="checkbox"/> Security |
| <input type="checkbox"/> Technology usage | <input type="checkbox"/> Sustainability |
| <input type="checkbox"/> Capacity or size | <input type="checkbox"/> Other |
| <input type="checkbox"/> Startup or commissioning | |

D2. Project Design Criteria

The requirements and guidelines that govern the design of the project should be developed. When performing repetitive projects for the same facility, these may be well understood. Evaluation criteria may include:

- ☐ Level of design detail required
- ☐ Climatic data
- ☐ Codes and standards
 - ☐ National
 - ☐ Local
- ☐ Utilization of engineering standards
 - ☐ Owner's
 - ☐ Contractor's
 - ☐ Mixed
- ☐ Security standards/guidelines to be utilized
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Clearly define controlling specifications, especially where new codes and regulations will override older requirements
- ☐ Ensure that specifications support replacement of any obsolete systems or equipment

D3. Site Characteristics Available vs. Required

An assessment of the available versus the required site characteristics is needed. The intent is to ensure that the project team has taken into consideration the need to improve or upgrade existing site utilities and support characteristics. Issues to consider should include:

- ☐ Capacity:
 - ☐ Utilities
 - ☐ Fire water
 - ☐ Flare systems
 - ☐ Cooling water
 - ☐ Power
 - ☐ Pipe racks
 - ☐ Waste treatment/disposal
 - ☐ Storm water containment system

- ☐ Type of buildings/structures
- ☐ Land area
- ☐ Amenities:
 - ☐ Food service
 - ☐ Recreation facilities
 - ☐ Change rooms
 - ☐ Ambulatory access
 - ☐ Medical facilities
- ☐ Product shipping facilities
- ☐ Material receiving facilities
- ☐ Material storage facilities
- ☐ Product storage facilities
- ☐ Security:
 - ☐ Setbacks
 - ☐ Access and egress
 - ☐ Sight lines
 - ☐ Fencing, gates, and barriers
 - ☐ Clear zones
 - ☐ Security lighting
- ☐ Sustainability considerations, including possible certification (for example, by the U.S. Green Building Council).
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Complete condition assessment of existing facilities and infrastructure
- ☐ As-Built accuracy and availability (update/verify as-built documentation prior to project initiation)
- ☐ Worksite availability and access for R&R activities
- ☐ Existing space available to occupants during renovation work
- ☐ Uncertainty of “as-found” conditions, especially related to:
 - ☐ Structural integrity: steel or concrete loading
 - ☐ Piping capacity/ integrity/ routing
 - ☐ Condition of required isolation points
 - ☐ Location, condition, and capacity of electrical systems components

- ☐ Investigation tools to assist in the documentation of existing conditions:
 - ☐ Photographs / Video
 - ☐ Remote inspection
 - ☐ Laser scanning
 - ☐ Infrared scanning
 - ☐ Non-Destructive Testing
 - ☐ Ground Penetrating Radar
 - ☐ Ultrasonic Testing
 - ☐ Other

D4. Dismantling and Demolition Requirements

A scope of work has been defined and documented for the decommissioning and dismantling of existing equipment and/or piping which may be necessary for completing new construction. This scope of work should support an estimate for cost and schedule. Evaluation criteria should include:

- ☐ Timing/sequencing
- ☐ Permits
- ☐ Approval
- ☐ Safety requirements
- ☐ Hazardous operations and/or materials
- ☐ Plant/operations requirements
- ☐ Storage or disposal of dismantled equipment/materials
- ☐ Narrative (scope of work) for each system
- ☐ Environmental assessment
- ☐ Are the systems that will be decommissioned/dismantled:
 - ☐ Named and marked on process flow diagrams
 - ☐ Named and marked on P&IDs
 - ☐ Denoted on line lists and equipment lists
 - ☐ Denoted on piping plans or photo-drawings
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Use of photographs, video records, etc. in scope documents to ensure existing conditions clearly defined
- ☐ Physical identification of extent of demolition to clearly define limits
- ☐ Segregation of demolition activities from new construction, and operations (e.g., physical disconnect or “air gap”)
- ☐ Establish decontamination and purge requirements to support dismantling.

D5. Lead/Discipline Scope of Work

A complete narrative description of the project laying out the major components of work to be accomplished, generally discipline oriented, should be developed. This narrative should be tied to a high level Work Breakdown Structure (WBS) for the project. Items to consider would include:

- ☐ Sequencing of work
- ☐ Interface issues for various contractors, contracts, or work packages
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Identification of specific interface or coordination efforts with operations and owner’s staff

D6. Project Schedule

A project milestone schedule should be developed, analyzed, and agreed upon by the major project participants. It should include milestones, unusual schedule considerations and appropriate master schedule contingency time (float), procurement of long-lead or critical pacing equipment, and required submissions and approvals. This schedule should involve obtaining early input from:

- ☐ Owner/Operations
- ☐ Procurement
- ☐ Design/Engineering
- ☐ Other
- ☐ Construction

Additional items to consider for Renovation & Revamp projects

- ☐ The schedule should involve obtaining early input from the Shutdown/Turnaround Manager

R&R projects require a high level of planning to minimize risk because they interface with existing operations and are many times performed in conjunction with other on-going projects. Shutdowns/turnarounds/outages are special cases in that they are particularly constrained in terms of time and space, requiring very detailed plans and schedules.

E. VALUE ENGINEERING

E1. Process Simplification

A structured value analysis approach should be in place to identify and document activities or strategies (through studies, reviews) for reducing the number of steps or the amount of equipment needed in the process in order to optimize performance without compromising security. Items to evaluate include:

- ☐ Redundancies
- ☐ Excessive controls
- ☐ Over capacity
- ☐ Other
- ☐ Discretionary spares

E2. Design & Material Alternatives Considered/Rejected

A structured approach is in place to consider design and material alternatives including sustainability considerations. Specific activities have been identified to ensure that this process will take place. Items that impact the economic viability of the project should be considered. Items to evaluate include issues such as:

- ☐ Discretionary scope issues
- ☐ Expensive materials of construction
- ☐ Life-cycle analysis of construction methods
- ☐ Other

E3. Design for Constructability Analysis

A structured process is in place for constructability analysis. CII defines constructability as, “the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives. Maximum benefits occur when people with construction knowledge and experience become involved at the very beginning of a project.” Provisions have been made to provide this on an ongoing basis. This process includes examining design options that minimize construction costs while maintaining standards of safety, security, quality, and schedule. This process should be initiated in the front end planning process during concept or detailed scope definition. Elements of constructability during front end planning include:

- ☐ Constructability program in existence
- ☐ Construction knowledge/experience used in project planning
- ☐ Early construction involvement in contracting strategy development
- ☐ Developing a construction-sensitive project schedule (with operations input and considering operational needs)
- ☐ Considering major construction methods in basic design approaches
- ☐ Developing site layouts for efficient construction
- ☐ Early identification of project team participants for constructability analysis
- ☐ Usage of advanced information technologies
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Installability (e.g., smaller components/modules/pre-assembly to facilitate installation in congested areas)
- ☐ Opportunities to perform as much work as possible outside of shutdowns or outages
- ☐ Developing an operations-sensitive project schedule (e.g., minimization of Shutdown/Turnaround work and hot work in operating areas)

SECTION II – BASIS OF DESIGN

F. SITE INFORMATION

F1. Site Location

The geographical location(s) of the proposed project has been defined and documented. This involves an assessment of the relative strengths and weaknesses of alternate site locations. A site that meets owner requirements and maximizes benefits for the owner company should be selected. Evaluation of sites may address issues relative to different types of sites (i.e., global country, local, “inside the fence,” or “inside the building”). This decision should consider the long-term needs of the owner company. The selection criteria should include items such as:

- ☐ General geographic location
 - ☐ Access to the targeted market area
 - ☐ Near sources of raw materials
 - ☐ Local availability and cost of skilled labor (e.g., construction, operation)
 - ☐ Available utilities
 - ☐ Existing facilities
- ☐ Land availability and costs
- ☐ Environmental/sustainability impact
- ☐ Access (e.g., road, rail, marine, air)
- ☐ Construction access and feasibility
- ☐ Security constraints (consider potential security breach points, e.g., storm water system, watercourses)
- ☐ Political constraints
- ☐ Legal constraints
- ☐ Regulatory constraints
- ☐ Financing requirements
- ☐ Social issues
- ☐ Weather
- ☐ Climate
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Change in intended use of the facility
- ☐ Zoning, permitting or other regulatory changes brought about by R&R

F2. Surveys & Soil Tests

Survey and soil test evaluations of the proposed site should be developed and include items such as:

- ☐ Topography map
- ☐ Overall plant plot plan
- ☐ General site description (e.g., terrain, existing structures, spoil removal, areas of hazardous waste)
- ☐ Definition of final site elevation
- ☐ Benchmark (coordinate and elevation) control system identified
- ☐ Spoil area (i.e., location of on-site area or off-site instructions)
- ☐ Seismic requirements
- ☐ Water table
- ☐ Soil percolation rate & conductivity
- ☐ Existing contamination
- ☐ Ground water flow rates and directions
- ☐ Downstream uses of ground water
- ☐ Need for soil treatment or replacement
- ☐ Description of foundation types
- ☐ Allowable bearing capacities
- ☐ Pier/pile capacities
- ☐ Other

F3. Environmental Assessment

An environmental assessment should be performed for the site to evaluate issues that can impact the cost estimate or delay the project. These issues may include characteristics such as:

- ☐ Location in an air quality non-compliance zone (such as identified by the U.S. Environmental Protection Agency (EPA) or others)
- ☐ Location in a wetlands area
- ☐ Environmental permits now in force
- ☐ Location of nearest residential area
- ☐ Ground water monitoring in place
- ☐ Containment requirements
- ☐ Existing environmental problems with the site such as:
 - ☐ Asbestos/PCB
 - ☐ Radioactive materials
 - ☐ Contaminated soils
 - ☐ Lead or other heavy metal (e.g. Chromium, Mercury)
 - ☐ Hazardous or toxic chemical/biological contamination
- ☐ Past/present use of site
- ☐ Sustainability
- ☐ Archeological
- ☐ Endangered species
- ☐ Erosion/sediment control
- ☐ Other

F4. Permit Requirements

A permitting plan for the project should be in place. The local, state or province, and federal government permits necessary to construct and operate the unit/facility should be identified. These should include items such as:

- | | |
|--|--------------------------------------|
| <input type="checkbox"/> Construction | <input type="checkbox"/> Building |
| <input type="checkbox"/> Local | <input type="checkbox"/> Occupancy |
| <input type="checkbox"/> Environmental | <input type="checkbox"/> Railroad |
| <input type="checkbox"/> Transportation | <input type="checkbox"/> Levee board |
| <input type="checkbox"/> Coastal Development | <input type="checkbox"/> Highway |
| <input type="checkbox"/> Security | <input type="checkbox"/> Other |
| <input type="checkbox"/> Fire | |

Additional items to consider for Renovation & Revamp projects

- ☐ Original intent of codes and regulations and any “grandfathered” requirements

F5. Utility Sources with Supply Conditions

A list has been made identifying availability/nonavailability or redundancy of site utilities needed to operate the unit/facility. This list includes supply conditions such as temperature, pressure, and quality. Items to consider include:

- | | |
|---|---|
| <input type="checkbox"/> Potable water | <input type="checkbox"/> Instrument air |
| <input type="checkbox"/> Drinking water | <input type="checkbox"/> Plant air |
| <input type="checkbox"/> Cooling water | <input type="checkbox"/> Gases |
| <input type="checkbox"/> Fire water | <input type="checkbox"/> Steam |
| <input type="checkbox"/> Sewers | <input type="checkbox"/> Condensate |
| <input type="checkbox"/> Power (voltage levels) | <input type="checkbox"/> Other |

F6. Fire Protection & Safety Considerations

A list of fire and safety related items to be taken into account in the design of the facility should include fire protection practices at the site, available firewater supply (amounts and conditions), special safety and security requirements unique to the site. Evaluation criteria should include:

- | | |
|---|--|
| <input type="checkbox"/> Eye wash stations | <input type="checkbox"/> Deluge requirements |
| <input type="checkbox"/> Safety showers | <input type="checkbox"/> Wind direction indicator devices (i.e., wind socks) |
| <input type="checkbox"/> Fire monitors & hydrants | <input type="checkbox"/> Alarm systems |
| <input type="checkbox"/> Foam | <input type="checkbox"/> Medical facilities |
| <input type="checkbox"/> Evacuation plan | <input type="checkbox"/> Other |
| <input type="checkbox"/> Perimeter security | |

Additional items to consider for Renovation & Revamp projects

- ☐ Interruption to any existing fire and life safety systems
- ☐ Disarming existing safety systems for renovation work (with appropriate contingency planning)

G. PROCESS/MECHANICAL

G1. Process Flow Sheets

Drawings that provide the process description of the unit/facility should be developed. Evaluation criteria should include:

- ☐ Major equipment items
- ☐ Flow of materials to and from the major equipment items
- ☐ Primary control loops for the major equipment items
- ☐ Sufficient information to allow sizing of all process lines
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Definition of owner's requirements for updating existing process flow sheets

G2. Heat & Material Balances

Heat balances are tables of heat input and output for major equipment items (including all heat exchangers) within the unit. Material balances are tables of material input and output for all equipment items within the unit. The documentation of these balances should include:

- ☐ Special heat balance tables for reaction systems
- ☐ Information on the conditions (e.g., temperature and pressure)
- ☐ Volumetric amount (e.g., gallons per minute (GPM), liters per second (LPS), cubic feet per minute (CFM)) or mass flow rates
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Definition of owner's requirements for updating existing heat and material balances

G3. Piping and Instrumentation Diagrams (P&IDs)

These are often referred to by different companies as:

- EFDs – Engineering Flow Diagrams
- MFDs – Mechanical Flow Diagrams
- PMCDs – Process & Mechanical Control Diagrams

In general, P&IDs are considered to be a critical element within the scope definition package of an industrial project. P&IDs should address the following areas:

- | | |
|---|--|
| <input type="checkbox"/> Equipment | <input type="checkbox"/> Instrumentation |
| <input type="checkbox"/> Piping | <input type="checkbox"/> Safety systems |
| <input type="checkbox"/> Valves | <input type="checkbox"/> Special notations |
| <input type="checkbox"/> Piping specialty items | <input type="checkbox"/> Other |
| <input type="checkbox"/> Utilities | |

Additional items to consider for Renovation & Revamp projects

- ☐ Tie-in points
- ☐ Accuracy of existing P&ID's (field verify)
- ☐ Scope of Work on existing P&IDs (clouding or shading to indicate: new, refurbished, modified, and/or relocated equipment, piping, instruments, and controls).

Since incomplete information on P&IDs is frequently identified as a source of project escalation, it is important to understand their level of completeness. It is unlikely for P&IDs to be completely defined in a project's scope definition package. However, the P&IDs must be complete enough to support the accuracy of estimate required. P&IDs are traditionally completed in the following iterations or "issues":

- ☐ Preliminary issue – comment and work input from other disciplines and the owner's representatives
- ☐ Issue for approval – critical information is complete, including lines sized, specifications developed, equipment identified, and blocks complete for owner approval
- ☐ Issue for design – all owner comments have been incorporated and P&IDs are ready for the appropriate level of process safety management (PSM) review
- ☐ Issue as basis of estimate—all of process safety review has been completed and all comments incorporated
- ☐ Other

G4. Process Safety Management (PSM)

This element refers to a formal Process Safety Management Hazards Analysis to identify potential risk of injury to the environment or populace. Each national government (or organization) will have its specific PSM compliance requirements (for example, in the U.S., OSHA Regulation 1910.119 compliance is required). The important issue is whether the owner has clearly communicated the requirements, methodology, and responsibility for the various activities. If the PSM has not been conducted, the team should consider the potential of risk that could affect the schedule and cost of the project.

G5. Utility Flow Diagrams

Utility flow diagrams are similar to P&IDs in that they show all utility lines from generation or supply (i.e., pipeline). They are generally laid out in a manner to represent the geographical layout of the plant.

Utility flow diagrams are evaluated using the same issue process as P&IDs.

Additional items to consider for Renovation & Revamp projects

- ☐ Tie-in points
- ☐ Accuracy of existing UFD's (field verify)
- ☐ Scope of Work on existing UFD's (clouding or shading to indicate: new, refurbished, modified, and/or relocated equipment, piping, instruments, and controls)

G6. Specifications

General specifications for the design, performance, manufacturing, material, and code requirements should be documented. These specifications should include items such as:

- ☐ Classes of equipment (e.g., pumps, exchangers, vessels)
- ☐ Process pipe heating
 - ☐ Process
 - ☐ Freeze
 - ☐ Jacketed
- ☐ Process pipe cooling
 - ☐ Jacketed
 - ☐ Traced
- ☐ Piping
- ☐ Protective coating
- ☐ Insulation
- ☐ Valves
- ☐ Bolts/gaskets
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Reconciliation of original specifications with current project specifications

G7. Piping System Requirements

Piping system stress guidelines and requirements should be provided to ensure that piping system design can be estimated and scheduled. The owner must communicate the standards, methodology, and record documentation required to support the piping systems design effort. Criteria for design of piping systems should include:

- ☐ Allowable forces and moments on equipment
- ☐ Graphical representation of piping line sizes that require analysis based on:
 - ☐ Temperature
 - ☐ Pressure
 - ☐ Cyclic conditions
 - ☐ Flex
 - ☐ Stress
 - ☐ Pulsation
 - ☐ Seismic
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Verification of existing conditions: hangers, supports, anchors, wall thickness, etc.
- ☐ Field verify existing lines that will be modified and requiring stress analysis back to all anchor points
- ☐ Ensure lines are functioning, available, and active

G8. Plot Plan

The plot plan will show the location of new work in relation to adjoining units or facilities. It should include items such as:

- ☐ Plant grid system with coordinates
- ☐ Unit limits
- ☐ Gates, fences and/or barriers
- ☐ Lighting requirements
- ☐ Off-site facilities
- ☐ Tank farms
- ☐ Roads and access ways
- ☐ Rail facilities
- ☐ Green space
- ☐ Buildings
- ☐ Major pipe racks
- ☐ Laydown areas
- ☐ Construction/fabrication areas
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Establish project specific vertical and horizontal reference points for all participants

G9. Mechanical Equipment List

The mechanical equipment list should identify all mechanical equipment by tag number, in summary format, to support the project. The list should define items such as:

- | | |
|--|--|
| <input type="checkbox"/> Existing sources: | <input type="checkbox"/> Location |
| <input type="checkbox"/> Modified | <input type="checkbox"/> Capacities |
| <input type="checkbox"/> Relocated | <input type="checkbox"/> Materials |
| <input type="checkbox"/> Dismantled | <input type="checkbox"/> Power requirements |
| <input type="checkbox"/> Re-rated | <input type="checkbox"/> Flow diagrams |
| <input type="checkbox"/> New sources: | <input type="checkbox"/> Design temperature and pressure |
| <input type="checkbox"/> Purchased new | <input type="checkbox"/> Insulation & painting requirements |
| <input type="checkbox"/> Purchased used | <input type="checkbox"/> Equipment related ladders and platforms |
| <input type="checkbox"/> Relative sizes | <input type="checkbox"/> Other |
| <input type="checkbox"/> Weights | |

G10. Line List

The line list designates all pipe lines in the project (including utilities). It should include items such as:

- | | |
|---|--|
| <input type="checkbox"/> Unique number for each line: | <input type="checkbox"/> Design temperature and pressure |
| <input type="checkbox"/> Size | <input type="checkbox"/> Test requirements |
| <input type="checkbox"/> Termination | <input type="checkbox"/> Pipe specifications |
| <input type="checkbox"/> Origin | <input type="checkbox"/> Insulation requirements |
| <input type="checkbox"/> Reference drawing | <input type="checkbox"/> Paint requirements |
| <input type="checkbox"/> Normal and upset operating: | <input type="checkbox"/> Other |
| <input type="checkbox"/> Temperature | |
| <input type="checkbox"/> Pressure | |

G11. Tie-in List

A list of all piping tie-ins to existing lines should be developed. It should include items such as:

- ☐ Location
- ☐ Insulation removal requirements
- ☐ Decontamination requirements
- ☐ Reference drawings
- ☐ Pipe specifications
- ☐ Timing/schedule
- ☐ Type of tie-in/size:
 - ☐ Hot tap ☐ Cold cut
 - ☐ Flange ☐ Screwed
 - ☐ Weld ☐ Cut and weld
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Field verify condition of isolation points
- ☐ Sequencing of tie-ins with production planning requirements to ensure safety and on-going operations
- ☐ Establish decontamination and purge requirements to support tie-ins
- ☐ Tie-in locations approved by Operations
- ☐ Ensure and conduct a structured process to validate tie-ins and tie-in strategy

G12. Piping Specialty Items List

This list is used to specify in-line piping items not covered by piping material specifications. It should identify all special items by tag number, in summary format. It should include items such as:

- ☐ Tag numbers
- ☐ Quantities
- ☐ Piping plans referenced
- ☐ Piping details
- ☐ Full purchase description
- ☐ Materials of construction
- ☐ P&IDs referenced
- ☐ Line/equipment numbers
- ☐ Other

G13. Instrument Index

This is a complete listing of all instruments by tag number. Evaluation criteria should include:

- | | |
|--|--|
| <input type="checkbox"/> Tag number | <input type="checkbox"/> Insulation, paint, heat tracing, winterization, etc. requirements |
| <input type="checkbox"/> Instrument type | |
| <input type="checkbox"/> Service | <input type="checkbox"/> Relieving devices (e.g., relief valves, rupture disks) |
| <input type="checkbox"/> P&ID number | <input type="checkbox"/> Other |
| <input type="checkbox"/> Line number | |

Additional items to consider for Renovation & Revamp projects

- ☐ Instrument status (e.g., new, existing, relocate, modify, refurbish, or dismantle)
- ☐ Existing instrumentation and valves (trim, functionality, leakage, closure, etc.)

H. EQUIPMENT SCOPE**H1. Equipment Status**

Has the equipment been defined, inquired, bid tabbed, or purchased?

This includes all engineered equipment such as:

- | | |
|--|--|
| <input type="checkbox"/> Process | <input type="checkbox"/> Security-related equipment |
| <input type="checkbox"/> Electrical | <input type="checkbox"/> Specialty items |
| <input type="checkbox"/> Mechanical | <input type="checkbox"/> Distributed control systems |
| <input type="checkbox"/> Heating, ventilation, air conditioning (HVAC) | <input type="checkbox"/> Other |
| <input type="checkbox"/> Instruments | |

Evaluation criteria should include:

- | | |
|---|--|
| <input type="checkbox"/> Equipment data sheets | <input type="checkbox"/> Number of items purchased |
| <input type="checkbox"/> Number of items inquired | |
| <input type="checkbox"/> Number of items with approved bid tabs | <input type="checkbox"/> Other |

Additional items to consider for Renovation & Revamp projects

- ☐ Modifications and refurbishment of existing equipment

H2. Equipment Location Drawings

Equipment location/arrangement drawings identify the specific location of each item of equipment in a project. These drawings should identify items such as:

- ☐ Elevation views of equipment and platforms
- ☐ Top of steel for platforms and pipe racks
- ☐ Paving and foundation elevations
- ☐ Coordinates of all equipment
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Clearly identify existing equipment to be removed or rearranged, or to remain in place

H3. Equipment Utility Requirements

A tabulated list of utility requirements for all equipment items should be developed. This list should identify requirements such as:

- | | |
|---|---|
| <input type="checkbox"/> Air | <input type="checkbox"/> Fuel |
| <input type="checkbox"/> Plant air | <input type="checkbox"/> Natural gas |
| <input type="checkbox"/> Instrument air | <input type="checkbox"/> Fuel oil |
| <input type="checkbox"/> Vacuum system | <input type="checkbox"/> Propane |
| | <input type="checkbox"/> Alternatives |
| <input type="checkbox"/> Water | <input type="checkbox"/> Ventilation |
| <input type="checkbox"/> Plant water | <input type="checkbox"/> HVAC |
| <input type="checkbox"/> Chilled water | <input type="checkbox"/> Refrigeration |
| <input type="checkbox"/> Hot water | |
| <input type="checkbox"/> Process water
(e.g., carbon filtered,
degasified, demineralized) | <input type="checkbox"/> Process |
| | <input type="checkbox"/> Carbon dioxide |
| <input type="checkbox"/> Steam | <input type="checkbox"/> Ammonia |
| <input type="checkbox"/> High pressure | <input type="checkbox"/> Nitrogen |
| <input type="checkbox"/> Condensate system | <input type="checkbox"/> Oxygen |
| | <input type="checkbox"/> Other |

I. CIVIL, STRUCTURAL, & ARCHITECTURAL

II. Civil/Structural Requirements

Civil/structural requirements should be developed and include the issues such as the following:

- ☐ Structural drawings
- ☐ Pipe racks/supports
- ☐ Elevation views
- ☐ Top of steel for platforms
- ☐ High point elevations for grade, paving, and foundations
- ☐ Location of equipment and offices
- ☐ Construction materials (e.g., concrete, steel, client standards)
- ☐ Physical requirements
- ☐ Seismic requirements
- ☐ Minimum clearances
- ☐ Fireproofing requirements
- ☐ Corrosion control requirements/required protective coatings
- ☐ Enclosure requirements (e.g., open, closed, covered)
- ☐ Secondary containment
- ☐ Environmental sustainability considerations
- ☐ Dikes
- ☐ Storm sewers
- ☐ Client specifications (e.g., basis for design loads, vulnerability and risk assessments)
- ☐ Future expansion considerations
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Existing structural conditions (e.g., foundations, building framing, pipe racks, harmonics/vibrations, etc)
- ☐ Potential affect of noise, vibration and restricted headroom in installation of piling and on existing operations
- ☐ Underground interference (utilize shallow depth designs)

I2. Architectural Requirements

The following checklist should be used in defining building requirements.

- ☐ Building use (e.g., activities, functions)
- ☐ Space use program indicating space types, areas required, and the functional relationships between spaces and number of occupants
- ☐ Service, storage, and parking requirements
- ☐ Special equipment requirements
- ☐ Requirements for building location/orientation
- ☐ Nature/character of building design (e.g., aesthetics, crime prevention through environmental design (CPTED))
- ☐ Construction materials
- ☐ Environmentally sustainable design
- ☐ Interior finishes
- ☐ Fire resistant requirements
- ☐ Explosion resistant requirements
- ☐ “Safe haven” requirements
- ☐ Acoustical considerations
- ☐ Safety, vulnerability assessment, and maintenance requirements
- ☐ Fire detection and/or suppression requirements
- ☐ Utility requirements (i.e., sources and tie-in locations)
- ☐ HVAC requirements
- ☐ Electrical requirements
- ☐ Power sources with available voltage and amperage
- ☐ Special lighting considerations
- ☐ Voice and data communications requirements
- ☐ Uninterruptible power source (UPS) and/or emergency power requirements
- ☐ Outdoor design conditions (e.g., minimum and maximum yearly temperatures)

- ☐ Indoor design conditions (e.g., temperature, humidity, pressure, air quality)
- ☐ Special outdoor conditions
- ☐ Special ventilation or exhaust requirements
- ☐ Equipment/space special requirements with respect to environmental conditions (e.g., air quality, special temperatures)
- ☐ Personnel accessibility standards (e.g., in the U. S., Americans with Disabilities Act requirements)
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Consider how renovation project alters existing architectural design assumptions
- ☐ Potential reuse of existing equipment, fixtures, materials and systems for renovation project
- ☐ Transition plan/ swing space for people, materials and processes

J. INFRASTRUCTURE

J1. Water Treatment Requirements

Water treatment requirements should be documented. Items for consideration should include:

- ☐ Wastewater treatment:
 - ☐ Process waste
 - ☐ Sanitary waste
- ☐ Waste disposal
- ☐ Storm water containment and treatment
- ☐ Other

J2. Loading/Unloading/Storage Facilities Requirements

A list of requirements identifying raw materials to be unloaded and stored, products to be loaded along with their specifications, and Material Safety Data Sheets. This list should include items such as:

- ☐ Instantaneous and overall loading/unloading rates
- ☐ Details on supply and/or receipt of containers and vessels
- ☐ Storage facilities to be provided and/or utilized
- ☐ Specification of any required special isolation provisions:
 - ☐ Double wall diking and drainage
 - ☐ Emergency detection (e.g., hydrocarbon detectors/alarms)
 - ☐ Leak detection devices or alarms
- ☐ Essential security considerations should include:
 - ☐ Inspection requirements
 - ☐ Secure storage
 - ☐ Authorized deliveries
 - ☐ Access/egress control
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Availability and access to secure storage for materials, laydown yards, etc. for R&R projects

J3. Transportation Requirements

Specifications identifying implementation of “in-plant” transportation (e.g., roadways, concrete, asphalt, rock) as well as methods for receiving/shipping/storage of materials (e.g., rail, truck, marine) should be documented. Specifically look at detailed traffic/routing plan for oversize loads.

Additional items to consider for Renovation & Revamp projects

- ☐ Coordinate equipment and material movement for renovation work with Operations to ensure no unplanned impacts
- ☐ Clearly identify delivery gates/ docks/ doors and receiving hours to be used by contractors for R&R work

K. INSTRUMENT & ELECTRICAL

K1. Control Philosophy

The control philosophy describes the general nature of the process and identifies overall control systems hardware, software, simulation, and testing requirements. It should outline items such as:

- ☐ Continuous
- ☐ Batch
- ☐ Redundancy requirements
- ☐ Classification of interlocks (e.g., process, safety)
- ☐ Software functional descriptions
- ☐ Manual or automatic controls
- ☐ Alarm conditions
- ☐ On/off controls
- ☐ Block diagrams
- ☐ Emergency shut down
- ☐ Controls startup
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Existing specifications, owner preferences and agreements, and compatibility

K2. Logic Diagrams

Logic diagrams should be developed and provide a method of depicting interlock and sequencing systems for the startup, operation, alarm, and shutdown of equipment and processes.

Additional items to consider for Renovation & Revamp projects

- ☐ Field verify logic diagrams to ensure they are functional and have not been altered

K3. Electrical Area Classifications

The electrical area classification plot plan is provided to show the environment in which electrical and instrument equipment is to be installed. This area classification will follow the guidelines as set forth in the latest code requirements (for example, the National Electric Code in the U.S.). Installation locations should include the following:

- ☐ General purpose
- ☐ Hazardous
 - ☐ Class I: Gasses and vapors
 - ☐ Class II: Combustible dusts
 - ☐ Class III: Easily ignitable fibers
- ☐ Corrosive locations
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Reclassification impact on existing access and operating areas

K4. Substation Requirements/Power Sources Identified

Substation requirements should be documented and may include the following:

- ☐ Number of substations required
- ☐ Electrical equipment rating required for each substation
- ☐ Specifications for all major electrical substation equipment
- ☐ Infrastructure required for each substation considering building type and environment, fencing, access, lighting and barriers, and substation yard materials

Clearly define power sources for the project in relation to:

- ☐ Location, voltage level, available power
- ☐ Electrical equipment available
- ☐ Electrical ratings and routes of power feeds from their sources to the project substations

- ☐ Specifications for special power sources should be described and provided (e.g., emergency generators or in-plant generation)
- ☐ Temporary construction power sources
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Impact on existing equipment and new equipment selection (e.g. short circuit ratings)
- ☐ Field verify condition of isolation points
- ☐ Sequencing of tie-ins with production planning requirements to ensure safety and on-going operations
- ☐ Tie-in points approved by Operations
- ☐ Ensure and conduct a structured process to validate tie-ins and tie-in strategy.
- ☐ Ensure that new electrical systems or equipment are compatible with industrial environment (e.g., uninterrupted power supplies, inverters, etc.)

K5. Electric Single Line Diagrams

A single line diagram indicates the components, devices, or parts of an electrical power distribution system. Single line diagrams are intended to portray the major system layout from the public utility's incoming transmission line to the motor starter bus. Depending on the size of the electrical system, the single line diagrams should include several levels of distribution such as:

- ☐ Incoming utility with owner substation/distribution to high and medium voltage motors and substations
- ☐ Unit substations and switchgear
- ☐ Motor control centers with distribution to motors, lighting panels
- ☐ Other

K6. Instrument & Electrical Specifications

Specifications for instrument and electrical systems should be developed and should include items such as:

- ☐ Distributed Control System (DCS)
- ☐ Instrument data sheets
- ☐ Motor control and transformers
- ☐ Power and control components
- ☐ Power and control wiring (splicing requirements)
- ☐ Cathodic protection
- ☐ Lightning protection
- ☐ Security systems
- ☐ Grounding
- ☐ Electrical trace
- ☐ Installation standards
- ☐ Lighting standards
- ☐ Civil requirements for electrical installation:
 - ☐ Protection/warning for underground cabling
 - ☐ Special slabs or foundations for electrical equipment
 - ☐ Concrete-embedded conduit
- ☐ Other

SECTION III – EXECUTION APPROACH

L. PROCUREMENT STRATEGY

L1. Identify Long Lead/Critical Equipment and Materials

Identify engineered equipment and material items with lead times that will impact the detailed engineering for receipt of vendor information or impact the construction schedule with long delivery times.

Additional items to consider for Renovation & Revamp projects

Identification and delivery of long lead/critical equipment and materials are especially important for shutdowns/turnarounds.

- ☐ Delivery dates must be identified in advance of shutdown/turnarounds to support preparations for pre-outage activities

L2. Procurement Procedures and Plans

Specific guidelines, special requirements, or methodologies for accomplishing the purchasing, expediting, delivery, and security of equipment and materials required for the project. Evaluation criteria should include:

- ☐ Listing of approved vendors
- ☐ Client or contractor paper
- ☐ Reimbursement terms and conditions
- ☐ Guidelines for supplier alliances, single source, or competitive bids
- ☐ Guidelines for engineered/field contracts
- ☐ Responsibility for owner-purchased items:
 - ☐ Financial
 - ☐ Shop inspection
 - ☐ Expediting
- ☐ Tax strategy:
 - ☐ Engineered equipment
 - ☐ Field materials
 - ☐ Labor
 - ☐ Write-offs of existing facilities and equipment

- ☐ Definition of source inspection requirements and responsibilities
- ☐ Definition of traffic/insurance responsibilities
- ☐ Definition of procurement status reporting requirements
- ☐ Additional/special owner accounting requirements
- ☐ Definition of spare parts requirements, including consideration to match existing
- ☐ Local regulations (e.g., tax restrictions, tax advantages)
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Procedures for repair, refurbishment, and relocation of existing equipment
- ☐ Retrofit kits (e.g., non-standard connections and obsolete equipment may require adaptors)

L3. Procurement Responsibility Matrix

A procurement responsibility matrix has been developed showing authority and responsibility for procurement. This matrix should outline responsibilities for:

- | | |
|---|--|
| <input type="checkbox"/> Engineering and design | <input type="checkbox"/> Consulting services |
| <input type="checkbox"/> Engineered equipment | <input type="checkbox"/> Commissioning and startup materials |
| <input type="checkbox"/> Construction | <input type="checkbox"/> Source inspection |
| <input type="checkbox"/> Bulk materials | <input type="checkbox"/> Other |
| <input type="checkbox"/> Fabrication/modularization | |

Additional items to consider for Renovation & Revamp projects

- ☐ Utilization of reused and existing equipment, materials, lines, electrical and instrumentation, etc.
- ☐ Availability of procurement support during time-constrained R&R work, especially where expedited material services are required

M. DELIVERABLES

M1. CADD/Model Requirements

Computer Aided Drafting and Design (CADD) requirements should be defined. Evaluation criteria should include:

- ☐ Application software preference (e.g., 2D or 3D CADD, application service provider (ASP)), including licensing requirements
- ☐ Configuration and administration of servers and systems documentation defined
- ☐ For 3D CADD, go/no-go on walk-through simulation for operations checks, interference checks, and construction planning and scheduling
- ☐ Owner/contractor standard symbols and details
- ☐ Handling of life cycle facility data including asset information, models, and electronic documents
- ☐ Information technology infrastructure to support electronic modeling systems, including uninterruptible power systems (UPS) and disaster recovery
- ☐ Security and auditing requirements defined
- ☐ Physical model requirements
- ☐ Other

M2. Deliverables Defined

The following items should be included in a list of deliverables:

- ☐ Drawings
- ☐ Project correspondence
- ☐ Project Process Safety Management (PSM) documents
- ☐ Permits
- ☐ Project data books (quantity, format, contents, and completion date)
- ☐ Equipment folders (quantity, format, contents, and completion date)
- ☐ Design calculations (quantity, format, contents, and completion date)
- ☐ Spare parts special forms

- ☐ Loop folder (quantity, format, contents, and completion date)
- ☐ Procuring documents
- ☐ Isometrics/field erection details
- ☐ As-built documents
- ☐ Quality assurance documents
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Requirements to update existing (legacy) documentation/ models and as-built drawings, including equipment folders/ asset management systems
- ☐ Procedures for retiring an asset including the documentation requirements, spare parts inventory, and accounting requirements

M3. Distribution Matrix

A distribution matrix (document control system) should be developed that identifies most correspondence and all deliverables. It denotes who is required to receive copies of all documents at the various stages of the project, and ensures the proper distribution of documentation. Some documents may be restricted due to proprietary nature.

N. PROJECT CONTROL

N1. Project Control Requirements

A method for measuring and reporting progress should be established and documented. Evaluation criteria should include:

- ☐ Change management procedures, including interface with information systems
- ☐ Cost control procedures
- ☐ Schedule/percent complete control procedures
- ☐ Cash flow projections
- ☐ Report requirements
- ☐ Other

Additional items to consider for Renovation & Revamp projects

Shutdowns/Turnarounds/Outages may require a much more detailed project control system, including issues such as

- ☐ Detailed hourly schedule
- ☐ Additional communication to coordinate contractor activities with existing owner maintenance and plant operations
- ☐ Clearly defined outage dates and constraints
- ☐ Integration of multiple projects
- ☐ Change management procedures

N2. Project Accounting Requirements

Project specific accounting requirements have been identified and documented. These requirements include items such as:

- ☐ Financial (client/regulatory)
- ☐ Report requirements
- ☐ Phasing or area sub-accounting
- ☐ Payment schedules
- ☐ Capital vs. non-capital
- ☐ Other

N3. Risk Analysis

A risk analysis focusing on cost and schedule has been performed and a process is in place to ensure periodic risk analysis is conducted. Major project risks need to be identified, quantified, and management actions taken to mitigate problems. Pertinent issues may include risks in terms of:

- ☐ Design
- ☐ Business
- ☐ Construction
- ☐ Operational impact
- ☐ Management
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Unforeseen issues related to the unique characteristics of renovation projects (i.e., hazardous materials, unknown underground structures or utilities, or other)
- ☐ Security clearance/ access control in operating areas during project execution
- ☐ Safety of occupants during emergency conditions related to renovation activities

P. PROJECT EXECUTION PLAN

P1. Owner Approval Requirements

Owner approval requirements have been developed. This document clearly defines all documents that require owner approval such as:

- ☐ Milestones for drawing approval:
 - ☐ Comment
 - ☐ Approval
 - ☐ Bid issued
 - ☐ Construction
- ☐ Electronic model reviews
- ☐ Durations of approval cycle compatible with schedule
- ☐ Individual(s) responsible for reconciling comments before return
- ☐ Types of drawings that require formal approval
- ☐ Purchase documents:
 - ☐ Data sheets
 - ☐ Inquiries
 - ☐ Bid tabs
 - ☐ Purchase orders
- ☐ Change management approval authority
- ☐ Vendor information
- ☐ Other

P2. Engineering/Construction Plan & Approach

This documented plan identifying the methodology to be used in engineering and constructing the project should include items such as:

- ☐ Responsibility matrix
- ☐ Selected methods (e.g., design/build, CM at risk, competitive sealed proposal, bridging, design-bid-build, CM as agent, parallel prime contractors)

- ☐ Contracting strategies (e.g., lump sum, cost-plus)
- ☐ Subcontracting strategy
- ☐ Work week plan/schedule
- ☐ Organizational structure
- ☐ Work Breakdown Structure (WBS)
- ☐ Construction sequencing of events
- ☐ Safety requirements/program
- ☐ Environmental program
- ☐ Security requirements/program (e.g., access to site, inspection, background checks)
- ☐ Identification of critical lifts and their potential impact on operating units
- ☐ Quality assurance (QA)/quality control (QC) plan
- ☐ Information and communication technology infrastructure to support field operations, including licensing requirements
- ☐ Other

Additional items to consider for Renovation & Revamp projects

- ☐ Flexible contracting arrangements for renovation projects such as a combination of unit price, cost reimbursable, and lump sum
- ☐ Contingency for unforeseen conditions
- ☐ Specialized contractors for R&R activities, such as hazardous abatement or heavy haulers
- ☐ Responsibility for critical maintenance activities in the existing facility (i.e., routine maintenance during construction)
- ☐ Permits and approvals when working in or near continuing operations (i.e. hot work permitting, confined space, lift plans, environmental remediation, etc.)
- ☐ Coordination between multiple contractors and/or maintenance activities

P3. Shut Down/Turn-Around Requirements

Required shut downs or turn-arounds have been identified and documented. Special effort should be made to contact the Shutdown/Turnaround Manager for “customer” requirements relative to the unique issues surrounding a Shutdown/Turnaround. Typical issues to consider include but not limited to:

- ☐ Definitions of the scope of work to be accomplished during such down times
- ☐ Scheduled instructions for the down time
- ☐ Timing of outages
- ☐ Interface with other ongoing projects and operations
- ☐ Work force scale up and training and staff movement logistics
- ☐ Work protection considerations for the shutdown/turn-around
- ☐ Accuracy of information regarding the facility is known
- ☐ Standard reporting for progressing, forecasting, and frequency required by the Turnaround Manager.
- ☐ Identification of who approves emergent work-scopes during Turnaround and any “hurdle” criteria it must meet to be approved.
- ☐ Identification of unique risks as a result of multiple projects working concurrently
- ☐ Identification of any “must do” requirements leading up to the Shutdown/Turnaround.
- ☐ Required emergency purchase/rental plans for materials, subcontractors, equipment, facilities, etc.
- ☐ Standard software required for integrating the master schedules (e.g., Primavera)
- ☐ The “triage” process for establishing priorities when resources are not available or there is a conflict/interference in space, equipment, etc.
- ☐ Manage conflicting contractual arrangements which may inhibit timely completion

- ☐ A functional accountability matrix has been established that will enable communication across multiple projects
- ☐ Safety
- ☐ Other

P4. Pre-Commissioning Turnover Sequence Requirements

The owner's required sequence for turnover of the project for pre-commissioning and startup activation has been developed. It should include items such as:

- ☐ Sequence of turnover, including system identification and priority
- ☐ Contractor's and owner's required level of involvement in:
 - ☐ Pre-commissioning
 - ☐ Training
 - ☐ Testing
- ☐ Clear definition of mechanical/electrical acceptance/ approval requirements
- ☐ Other

P5. Startup Requirements

Startup requirements have been defined and responsibility established. A process is in place to ensure that startup planning will be performed. Issues include:

- ☐ Startup goals
- ☐ Leadership responsibility
- ☐ Sequencing of startup
- ☐ Technology start-up support on-site, including information technology
- ☐ Feedstock/raw materials
- ☐ Off-grade waste disposal
- ☐ Quality assurance/quality control
- ☐ Work force requirements
- ☐ Other

P6. Training Requirements

Training requirements have been defined and responsibility established.

Training has been identified in areas such as:

- ☐ Control systems
- ☐ Information systems and technology
- ☐ Equipment operation
- ☐ Maintenance of systems
- ☐ Training materials and equipment (e.g., manuals, simulations)
- ☐ Safety
- ☐ Other

Appendix D:

Sample of a Completed PDRI

Type of facility: Diesel Power Plant	Project site: Grassroots
Primary product: Electricity	Estimated project duration: 12 months
Design capacity: 108 MW	Estimated project cost: \$112 million

SECTION I – BASIS OF PROJECT DECISION								
CATEGORY Element	Definition Level						Score	
	0	1	2	3	4	5		
A. MANUFACTURING OBJECTIVES CRITERIA (Maximum Score = 45)								
A1. Reliability Philosophy	0	1	5	9	(14)	20	14	
A2. Maintenance Philosophy	0	1	3	5	(7)	9	7	
A3. Operating Philosophy	0	1	4	7	(12)	16	12	
CATEGORY A TOTAL							33	
B. BUSINESS OBJECTIVES (Maximum Score = 213)								
B1. Products	0	(1)	11	22	33	56	1	
B2. Market Strategy	0	2	(5)	10	16	26	5	
B3. Project Strategy	0	1	5	(9)	14	23	9	
B4. Affordability/Feasibility	0	1	3	6	(9)	16	9	
B5. Capacities	0	2	(11)	21	33	55	11	
B6. Future Expansion Considerations	0	2	(3)	6	10	17	3	
B7. Expected Project Life Cycle	0	1	(2)	3	5	8	2	
B8. Social Issues	0	1	2	5	7	(12)	12	
CATEGORY B TOTAL							52	
C. BASIC DATA RESEARCH & DEVELOPMENT (Maximum Score = 94)								
C1. Technology	0	2	10	(21)	39	54	21	
C2. Processes	0	2	8	(17)	28	40	17	
CATEGORY C TOTAL							38	
D. PROJECT SCOPE (Maximum Score = 120)								
D1. Project Objectives Statement	0	2	8	14	19	(25)	25	
D2. Project Design Criteria	0	2	6	11	16	(22)	22	
D3. Site Characteristics Available vs. Req'd	0	2	9	16	22	(29)	29	
D4. Dismantling and Demolition Req'mts	0	2	(5)	8	12	15	5	
D5. Lead/Discipline Scope of Work	0	1	(4)	7	10	13	4	
D6. Project Schedule	0	(2)	6	9	13	16	2	
CATEGORY D TOTAL							87	
E. VALUE ENGINEERING (Maximum Score = 27)								
E1. Process Simplification	0	0	2	4	6	(8)	8	
E2. Design & Material Alts. Considered/Rejected	0	0	2	4	5	(7)	7	
E3. Design for Constructability Analysis	0	0	3	5	(8)	12	8	
CATEGORY E TOTAL							23	
Section I Maximum Score = 499				SECTION I TOTAL			233	

SECTION II – BASIS OF DESIGN								
CATEGORY		Definition Level						Score
Element	0	1	2	3	4	5		
F. SITE INFORMATION (Maximum Score = 104)								
F1. Site Location	0	(2)	10	18	26	32	2	
F2. Surveys & Soil Tests	0	1	4	(7)	10	13	7	
F3. Environmental Assessment	0	2	5	10	(15)	21	15	
F4. Permit Requirements	0	1	3	5	(9)	12	9	
F5. Utility Sources with Supply Conditions	0	1	4	8	(12)	18	12	
F6. Fire Protection & Safety Considerations	0	1	2	4	(5)	8	5	
CATEGORY F TOTAL							50	
G. PROCESS/MECHANICAL (Maximum Score = 196)								
G1. Process Flow Sheets	0	(2)	8	17	26	36	2	
G2. Heat & Material Balances	0	(1)	5	10	17	23	1	
G3. Piping & Instrumentation Diagrams (P&IDs)	0	2	(8)	15	23	31	8	
G4. Process Safety Management (PSM)	0	1	2	4	(6)	8	6	
G5. Utility Flow Diagrams	0	1	(3)	6	9	12	3	
G6. Specifications	0	(1)	4	8	12	17	1	
G7. Piping System Requirements	0	1	(2)	4	6	8	2	
G8. Plot Plan	0	1	4	(8)	13	17	8	
G9. Mechanical Equipment List	0	1	(4)	9	13	18	4	
G10. Line List	0	1	2	(4)	6	8	4	
G11. Tie-in List	0	1	2	(3)	4	6	3	
G12. Piping Specialty Items List	0	1	1	(2)	3	4	2	
G13. Instrument Index	0	1	2	(4)	5	8	4	
CATEGORY G TOTAL							48	
H. EQUIPMENT SCOPE (Maximum Score = 33)								
H1. Equipment Status	0	1	(4)	8	12	16	4	
H2. Equipment Location Drawings	0	1	2	(5)	7	10	5	
H3. Equipment Utility Requirements	0	1	2	3	(5)	7	5	
CATEGORY H TOTAL							14	
I. CIVIL, STRUCTURAL, & ARCHITECTURAL (Maximum Score = 19)								
I1. Civil/Structural Requirements	0	1	(3)	6	9	12	3	
I2. Architectural Requirements	0	1	(2)	4	5	7	2	
CATEGORY I TOTAL							5	

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

SECTION II – BASIS OF DESIGN (continued)							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	3	(5)	7	10	5
J2. Loading/Unloading/Storage Facilities Req'mts	0	1	3	5	(7)	10	7
J3. Transportation Requirements	0	(1)	2	3	4	5	1
CATEGORY J TOTAL							13
K. INSTRUMENT & ELECTRICAL (Maximum Score = 46)							
K1. Control Philosophy	0	1	(3)	5	7	10	3
K2. Logic Diagrams	0	(1)	2	3	3	4	1
K3. Electrical Area Classifications	0	(0)	2	4	7	9	0
K4. Substation Req'mts Power Sources Ident.	0	1	3	5	(7)	9	7
K5. Electric Single Line Diagrams	0	1	(2)	4	6	8	2
K6. Instrument & Electrical Specifications	0	1	(2)	3	5	6	2
CATEGORY K TOTAL							15
Section II Maximum Score = 423							
SECTION II TOTAL							145

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

SECTION III – EXECUTION APPROACH								
CATEGORY Element	Definition Level						Score	
	0	1	2	3	4	5		
L. PROCUREMENT STRATEGY (Maximum Score = 16)								
L1. Identify Long Lead/Critical Equip. & Mat'ls	0	(1)	2	4	6	8	1	
L2. Procurement Procedures and Plans	0	(0)	1	2	4	5	0	
L3. Procurement Responsibility Matrix	0	(0)	1	2	2	3	0	
CATEGORY L TOTAL							1	
M. DELIVERABLES (Maximum Score = 9)								
M1. CADD/Model Requirements	0	0	(1)	1	2	4	1	
M2. Deliverables Defined	0	0	(1)	2	3	4	1	
M3. Distribution Matrix	0	(0)	0	1	1	1	0	
CATEGORY M TOTAL							2	
N. PROJECT CONTROL (Maximum Score = 17)								
N1. Project Control Requirements	0	(0)	2	4	6	8	0	
N2. Project Accounting Requirements	0	(0)	1	2	2	4	0	
N3. Risk Analysis	0	1	2	3	4	(5)	5	
CATEGORY N TOTAL							5	
P. PROJECT EXECUTION PLAN (Maximum Score = 36)								
P1. Owner Approval Requirements	0	0	2	3	(5)	6	5	
P2. Engineering/Construction Plan & Approach	0	1	(3)	5	8	11	3	
P3. Shut Down/Turn-Around Requirements	(0)	1	3	4	6	7	0	
P4. Pre-Commiss. Turnover Sequence Req'mts	0	1	(1)	2	4	5	1	
P5. Startup Requirements	0	0	(1)	2	3	4	1	
P6. Training Requirements	0	0	(1)	1	2	3	1	
CATEGORY P TOTAL							11	
Section III Maximum Score = 78		SECTION III TOTAL					19	

PDRI TOTAL SCORE

Maximum Score = 1000

397

Definition Levels

0 = Not Applicable

2 = Minor Deficiencies

4 = Major Deficiencies

1 = Complete Definition

3 = Some Deficiencies

5 = Incomplete or Poor Definition

Appendix E:

Logic Flow Diagrams

Section Diagram

499 Points

Section I: Basis of Project Decision

Categories A thru E

423 Points

Section II: Basis of Design

Categories F thru K

78 Points

Section III: Execution Approach

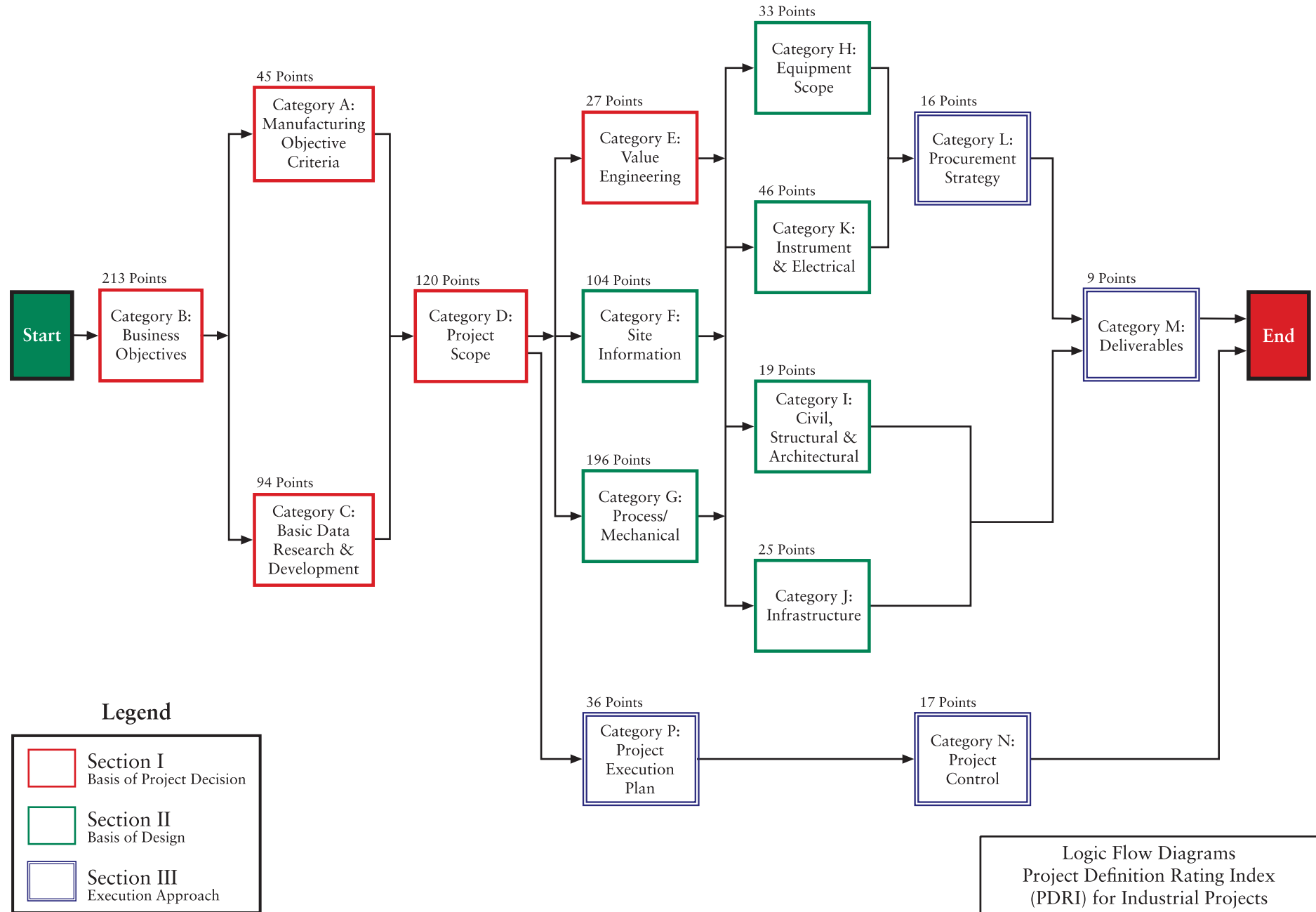
Categories L thru P

Logic Flow Diagrams
Project Definition Rating Index
(PDRI) for Industrial Projects

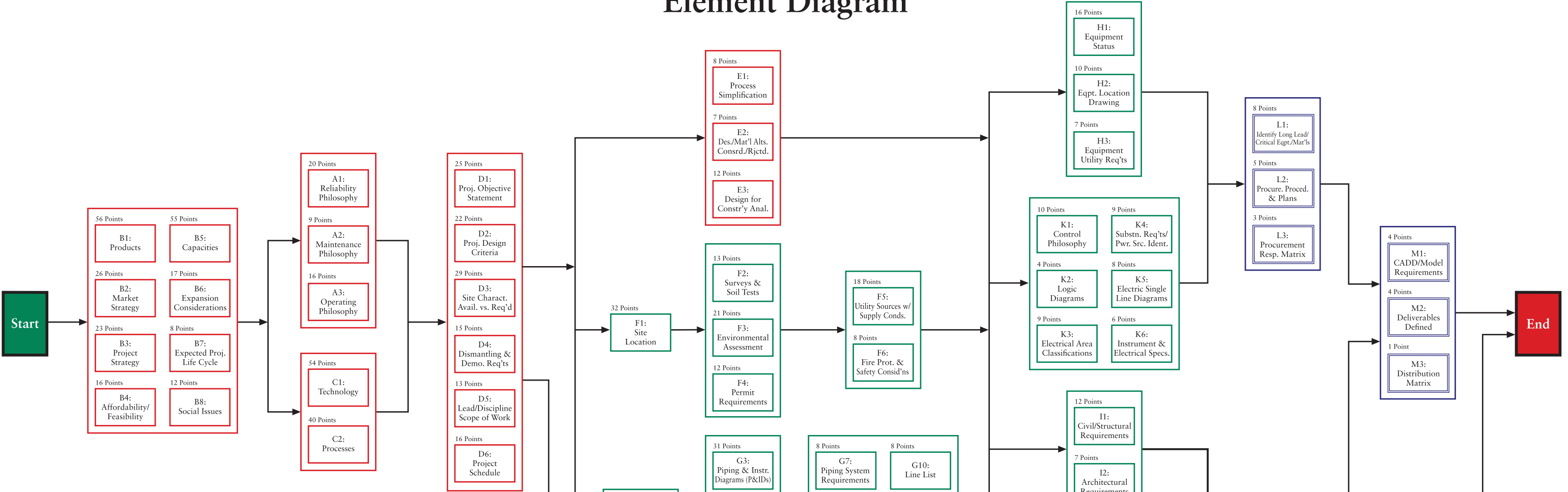
November 2014

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Category Diagram

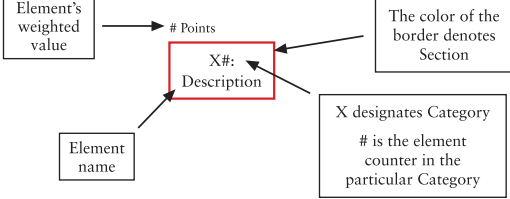


Element Diagram



LEGEND

Example Element



Section Guide

- Section I** (Red border)
Basis of Project Decision
- Section II** (Green border)
Basis of Design
- Section III** (Blue border)
Execution Approach

Category Guide

- A** Manufacturing Objectives Criteria
- B** Business Objectives
- C** Basic Data Research & Development
- D** Project Scope
- E** Value Engineering
- F** Site Information
- G** Process/Mechanical
- H** Equipment Scope
- I** Civil, Structural, & Architectural
- J** Infrastructure
- K** Instrument & Electrical
- L** Procurement Strategy
- M** Deliverables Strategy
- N** Project Control
- P** Project Execution Plan

Appendix F:

Facilitation Instructions

From observation, an external facilitator (a person who is not directly involved with the project), has proven to be an essential ingredient in ensuring that the PDRI assessment session is effective. The facilitator, who may be internal to the organization or an outside consultant, should be experienced in front end planning of the type of facility under consideration and have excellent facilitation skills. The following issues should be addressed by the facilitator for to prepare for and conduct the PDRI assessment.

Pre-meeting Activities

The facilitator should establish a meeting with the project manager/engineer to receive a briefing on the nature and purpose of the project to be evaluated. The objective of this meeting is to learn enough about the project to ask intelligent/probing questions of the project team members while conducting the session. Many times, the “open ended” discussions concerning key elements provides the most value when conducting a PDRI assessment. Therefore, it is the responsibility of the facilitator to ask the types of questions that will result in an open discussion. Gaining some insight prior to the assessment helps in this regard.

This meeting also serves as a good time to preview the PDRI elements to see if some of them do not apply to the project at hand. This is especially true for smaller renovation projects. In some cases, it is obvious that some of the elements do not apply and these can be removed in advance to save the team some time in the assessment.

The facilitator should inform the project manager that this is her/his opportunity to listen to the team members to see how well they understand the scope of work. The project manager should work with the facilitator to probe the planning team and the owner to ensure clear two-way understanding of scope requirements and expectations. If the project manager dominates the discussion, and subsequent scoring, the rest of the design team will quickly “clam up” and fall in line. This will result in a PDRI assessment that reflects the understanding of the project manager, not the team members.

The facilitator should remind the project manager that the PDRI assessment session is an opportunity to team build and align the team members on the critical requirements for the project. Experience has shown that serving food (perhaps lunch or breakfast) can help to increase participation as well as interaction between team members.

The facilitator and project manager should discuss the key stakeholders who should attend the session. Ensure that all key stakeholders are in attendance. Reducing the number of attendees will make the session go more efficiently, but this may compromise the true value of the PDRI assessment. Work with the project manager to send out meeting notices in time for the major stakeholders to be able to attend.

Logistics

The facilitator should ensure that the facilities are large enough to accommodate the key project stakeholders in comfort. One method of assessment is to utilize a computer projector to keep score as assessment progresses. Therefore, a room with a screen, computer, and projector is a plus. The PDRI can be conducted manually as well. When conducting manually, each participant will require a copy of the score sheet and Element Definitions so they can follow along.

The assessment session takes approximately two to four hours per project. An inexperienced team, or a very complex project, may well take the full four hours. As teams within an organization get accustomed to the PDRI sessions, the time will drop to around two hours. However, it is the discussion occurring during the assessment session that is perhaps its most important benefit. Do not allow an artificial time limit to restrain the open communications between team members.

Some organizations conduct the sessions over an extended lunch period. In these situations, it is best to start with a short lunch period as an ice breaker, then conduct the session. The facilitator should ensure that the room is set up in advance.

- ☐ Make sure the computer, projector, and programs are functioning.
- ☐ Make sure a flip chart is available.

- ☐ Set up the notes and Action Items pages.
- ☐ Make sure all participants have the proper handouts.
- ☐ When using the automated PDRI scoring programs, make sure the operator is skilled. Lack of computer skills and preparation can lead to ineffectiveness.
- ☐ Ensure the programs are loaded and working prior to the session.
- ☐ Identify a scribe to capture actions on a flip chart as the session progresses.

Participants

Suggested attendees of the assessment session may include:

- ☐ Engineering Team Discipline Leads and Support Services as required
- ☐ Project Manager/Project Engineer(s)
- ☐ Owner Engineering Project Representatives
- ☐ Owner Business Sponsor
- ☐ Owner Operations – Key Personnel
- ☐ Owner Support Services – Maintenance, Construction, Safety, Environmental, Logistics, QA/QC, Procurement
- ☐ Contractors if possible

It is important that all assessment session participants come prepared to actively engage in the assessment. Typically this can be facilitated by sending the PDRI assessment sheets and element descriptions out ahead of time with a pre-reading assignment. Expectations of participants include:

- ☐ All should be prepared to discuss their understanding and concerns of the elements that apply to them.
- ☐ Design/engineering should be prepared to explain what they are doing in regards to each PDRI element.
- ☐ Owner representatives should voice their expectations, and question the design team to ensure understanding.

Roles and responsibilities during the assessment session should include:

- ☐ The project manager should assist the facilitator to probe the team members for answers and insight.
- ☐ The facilitator will ensure that everyone has an opportunity to voice their opinions and concerns.

Conducting the session:

- ☐ The facilitator should provide the team members with a short overview of the PDRI.
- ☐ The facilitator or project manager should define the purpose of the assessment session.
- ☐ The project manager should give a quick update of the project and its status, including progress supporting the estimate and plan.
- ☐ The facilitator should explain the scoring mechanism (definition levels 0, 1, 2, 3, 4, and 5), and explain that the evaluation is not a democratic exercise, rather it is a consensus activity.
- ☐ The facilitator should explain that certain elements may apply more to certain team members or stakeholders. Make sure that these key stakeholders have the greatest say in deciding on level of definition.
- ☐ The facilitator should keep the session moving and not allowing the participants to “bog down.” Many times the participants want to “solve the problem” during the assessment session. Do not allow this to happen. Remember, the session is to perform a detailed assessment only, and actions can be performed later.
- ☐ The facilitator should always challenge assumptions and continue to ask the question, “Is the material in writing?”

Assessment Session Objectives:

1. Capture the degree of definition for each element.
2. Capture significant comments from open discussions.
3. Capture Action Items, assign responsibility and due dates (either at the end of the session, or shortly thereafter).
4. Ensure that the team understands the notes captured and agrees with the path forward.
5. Create alignment among the session attendees.

Roles and responsibilities/expectations:

- ☐ Post-session activities: The facilitator should ensure that the PDRI notes, action items, and score card are published within 48 hours of the sessions. The ideal target is 24 hours.
- ☐ The facilitator should stay engaged with the team if possible to ensure that all Action Items are completed as required to support the scope definition process.
- ☐ The project manager should ensure that the actions are addressed.

Small Project Considerations:

- ☐ Small retro-fit projects or single discipline projects may have several elements that do not apply.
- ☐ As previously mentioned, the facilitator and project manager can meet ahead of time to identify some of these elements.
- ☐ Assigning a zero to a significant number of PDRI elements can greatly affect the score. It is best to use the normalized score in this case. In these cases, less significant elements can have a more significant impact on the overall score. Be careful in interpretation of this score.

The PDRI was originally designed to evaluate the definition of an entire unit, building, or facility. On smaller retro-fit projects, the facilitator may have to “make the leap” from an entire facility to a small component of an existing facility. For example, a project to install a new substation, may not have a product, technology, or require process simplification. It does, however, have a design capacity that it is expected by the owner/operators.

Experience has shown that the smaller retro-fit projects do not get the same level of attention from owner operations that a larger project might receive. In many cases, the PDRI may be the very first time the design team has met with the owner operations personnel to discuss the expectations of the project. The facilitator must be fully aware of these situations before conducting the session and make a special effort to ensure:

1. The owner’s operation personnel attend the session.
2. Open discussions take place to ensure understanding.

Alliance-Planned Projects

Many of the smaller projects may be conducted by an alliance design firm. These firms act as the design/engineering capability for the facility owner and may execute numerous small projects per year. Many of the PDRI elements refer to location, standards, stress requirements, hazard analysis, deliverables, accounting, and other repetitive requirements. In these types of projects, the facilitator will merely have to question, “Is there anything different or unusual about this project for this element?” It is also a good time to ask if there is any opportunity for improvement in any of these areas that would improve this project and other projects to follow.

Appendix G:
Example Action List

Project title/date:						
(Sorted in order of PDRI element)						
Item #	PDRI Element(s)	Level of Definition	PDRI Element Score	Item Description	Date Completed	Responsible

Project Assessment Session Action Items, June 22, 200x						
(Sorted in order of PDRI element)						
Item #	PDRI Element(s)	Level of Definition	PDRI Element Score	Item Description	Date Completed	Responsible
1	A2	2	3	Resolve recycle maintenance philosophy issues	July 1, 200x	John Ramos
2	B4	1	1	Issue affordability/feasibility report to the team	July 1, 200x	Jake Blinn
3	B5	1	2	Confirm distribution for finished product	July 1, 200x	Sue Howard
4	F2	2	4	Complete soil testing for duct work	July 15, 200x	Jose Garcia
5	F4	1	1	Monitor all open permits	Ongoing	Jake Blinn
6	G9	3	9	Waste gas, water treatment, HVAC, and misc. balance of plant mechanical equipment list	July 31, 200x	Tina Towne
				<i>And so on.....</i>		

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International Paper
Irving Oil Limited
Kaiser Permanente
Koch Industries
Eli Lilly and Company
Linde North America
LyondellBasell
Marathon Petroleum Corporation
National Aeronautics & Space Administration
NOVA Chemicals Corporation
Occidental Petroleum Corporation
Ontario Power Generation
Petroleo Brasileiro S/A - Petrobras
Petroleos Mexicanos
Petronas
Phillips 66
Pioneer Natural Resources
Praxair
The Procter & Gamble Company
Public Service Electric & Gas Company
Reliance Industries Limited (RIL)
SABIC - Saudi Basic Industries Corporation
Sasol Technology
Shell Global Solutions US
Smithsonian Institution
Southern Company
Statoil ASA
SunCoke Energy
Tennessee Valley Authority
TransCanada Corporation
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST/
Engineering Laboratory
U.S. Department of Defense/
Tricare Management Activity
U.S. Department of Energy
U.S. Department of Health & Human Services
U.S. Department of State
U.S. Department of Veterans Affairs
U.S. General Services Administration
Vale
The Williams Companies

AMEC
AZCO
Aecon Group
Affiliated Construction Services
Alstom Power
Audubon Engineering Company
Baker Concrete Construction
Barton Malow Company
Bechtel Group
Bentley Systems
Bilfinger Industrial Services
Black & Veatch
Burns & McDonnell
CB&I
CCC Group
CDI Engineering Solutions
CH2M HILL
CSA Central
Cannon Design
Coreworx
Day & Zimmermann
Dresser-Rand Company
eProject Management
Emerson Process Management
Faithful+Gould
Fluor Corporation
Foster Wheeler USA Corporation
Gross Mechanical Contractors
Hargrove Engineers + Constructors
Hilti Corporation
Honeywell International
IHI E&C International Corporation
IHS
International Rivers Consulting
JMJ Associates
JV Driver Projects
Jacobs
KBR
Kiewit Corporation
Kvaerner North American Construction
Lauren Engineers & Constructors
Leidos Constructors
Matrix Service Company
McCarthy Building Companies
McDermott International
Midwest Steel
Parsons
Pathfinder
POWER Engineers
PTAG
Quality Execution
Richard Industrial Group
The Robins & Morton Group
S&B Engineers and Constructors
SBM Offshore
SNC-Lavalin
Skanska USA
Supreme Group
Technip
Tenova
TOYO-SETAL Engenharia
URS Corporation
Victaulic
WESCO International, Inc.
Walbridge
Wanzek Construction
The Weitz Company
Wilhelm Construction
Willbros United States Holdings
Wood Group Mustang
WorleyParsons
Yates Construction
Zachry Holdings
Zurich