CII BEST PRACTICES
FRONT END PLANNING AND ALIGNMENT

CREATING A FOUNDATION FOR PREDICTABLE & EFFICIENT PROJECT DELIVERY

Mike Murray – EPCM Global
Friday 26th June 2015
About the speaker

Mike Murray is a Senior Consultant working with EPCM Global, an Engineering, Project Management and Specialist Staffing solutions provider, providing innovative management and engineering consulting solutions for complex and high-risk operations and project types.

Mike was previously contracted to Eskom where he developed and managed the project life cycle model for new build capital projects. During his time at Eskom, he introduced and established the Construction Industry Institute (CII) Project Definition Readiness Index (PDRI) and Alignment best practices. Mike has worked with a number of management consultancies and various large corporate clients in the project and operations disciplines.
CII will add value to all capital projects

The Construction Industry Institute (CII) is.....

• A learning organisation with a wealth of knowledge and information
• Based at The University of Texas at Austin, USA
• Consortium of more than 130 leading owner, engineering-contractor, and supplier firms from both the public and private arenas
• Organisations have joined together to enhance the business effectiveness and sustainability of the capital facility life cycle

The South African Chapter of the CII was launched in May 2015 and is based at the Graduate School of Technology Management, University of Pretoria
The purpose of CII is to:

Measurably improve the delivery of capital facilities

By creating and implementing research-based knowledge that measurably improves the effectiveness and sustainability of capital facilities delivery.

It achieves this through its research-based, member-driven creation of knowledge and CII Best Practices.

By partnering of industry and academia to create forums for identifying the most significant opportunities for industry improvement.
CII – Four core processes

1. Knowledge Creation
   - Research to define best practices, breakthroughs, and industry norms.

2. Knowledge Dissemination
   - Dissemination through publications, implementation guides, educational materials, workshops, and conferences.

3. Knowledge Assessment
   - Assessment of the impact of CII practices through benchmarking.

4. Knowledge Management
   - Management, organisation, and assessment of the 600+ CII publications; oversight of Communities of Practice.

500+ CII publications; oversight of Communities of Practice.
CII Members develop best practices

As at 18th June 2015, the CII comprised 141 member companies, of which:

70 Owner companies

Examples:
- Abbott
- ArcelorMittal
- AstraZeneca
- Eskom Holdings SOC Ltd
- General Electric Company
- The Procter & Gamble Company
- Sasol Technology
- Shell

71 Contractor companies

Examples:
- Alstom Power Inc.
- Bechtel Group, Inc.
- Bentley Systems Inc.
- Black & Veatch
- Fluor Corporation
- POWER Engineers, Inc.
- SNC-Lavalin Inc.
- WorleyParsons
A CII Best Practice is a process or method that, when executed effectively, leads to enhanced project performance. CII Best Practices have been proven through extensive industry use, validation and peer reviewed research.

Best Practices

- Alignment
- Benchmarking & Metrics
- Change Management
- Constructability
- Disputes Prevention & Resolution
- Front End Planning
- Implementation of CII Research
- Lessons Learned
- Materials Management
- Partnering
- Planning for Startup
- Project Risk Assessment
- Quality Management
- Team Building
- Zero Accidents Techniques
CII Research is university-based

The CII advantage in research is its ability to combine credible, quantitative, university-based research with the expert guidance from personnel at the CII member organisations.

Examples of Research
- High Performance Work Teams
- Successful Delivery of Mega-projects
- Successful Delivery of Fast-track Projects
- Measuring Project Complexity and Its Impact
- Project Definition Rating Index Tool for Infrastructure Projects

Examples of Participating Universities
- University of Colorado
- University of Florida
- University of Kentucky
- Oregon State University
- University of Pennsylvania
- The University of Texas
CII Value-Added Benefits

• Measurable improvement in capital project delivery
  ✓ safety
  ✓ cost
  ✓ schedule
  ✓ quality
  ✓ change

• Predictable and sustainable capital project delivery performance
  ✓ reduced variability in project outcomes

• Improved capital facility life-cycle management
Only 25% of large construction projects finish on time, within budget – KPMG

“Every project owner wants predictability when it comes to large projects, and this is clearly not happening,”

“relationships between the contractors, and the owners and contractors, are mostly adversarial instead of collaborative, with little trust between the parties

KPMG’s Global Construction Project Owner’s Survey 2015
Increased complexity – failure risk

The growing complexity of global megaprojects is increasingly impacting on the ability of global engineering, procurement and construction management groups to meet projects’ original deliverables, with a recent survey suggesting that the bulk of these projects routinely fail to meet among the most fundamental project.

A recent poll by benchmark specialists Independent Project Analysis (IPA), revealed that, of 300 global megaprojects with budgets of over $1-billion, 65% failed to meet the objectives established at final investment stage.

James Hughes, country head, Fluor Mozambique, Gas Africa conference, Sandton, June 2015
FEP – A proven solution to complexity

Process for developing sufficient strategic formation with which owners can address risk and decide to commit resources to maximize the chance for a successful project.

Construction Industry Institute CII . 1995 . “Pre-project planning handbook.”
Publication No. 39-2, Construction Industry Institute, Austin, Tex.

Front-End Loading (FEL) is the process by which a company develops a detailed definition of the scope of a capital project. It answers the fundamental questions about a project:

- Why?
- What?
- When?
- How?
- Who?
- Where?

IPA – Independent Project Analysis, Inc.
Front End Planning – Definition

Front-end planning in the project environment is defined as the period up to the point of official endorsement (project sanction) to proceed, when the appropriation for expenditure (AFE) for full budget funding occurs, and contract ratification with a major EPC/M contractor or multiple EPC contractors for project execution takes place. It is the period prior to commencing the detailed engineering, procurement, construction, and start-up / commissioning (EPCC) phases of the project.
The project delivery planning carried out prior to actually constructing the project deliverables goes by different names. But they all demand the same thing – proper up-front planning.

- Front End Planning (FEP)
- Front End Loading (FEL)
- Front End Engineering Design (FEED)
- Conceptual Engineering
- Feasibility Analysis
- Pre-Project Planning
Following the PMBOK Guide® elements may be sufficient to deliver projects properly in process and practice terms, but probably is not enough to ensure that the project is successful. To do the latter one needs to concentrate more on the managing of the front-end...

2005, Peter Morris, PMI Global Congress Proceedings – Edinburgh, Scotland
Managing project work deliverables

The process of managing the work of the project

Manage the project context

Managing the interface

The work activities and deliverables of the project

- Define, install and implement an IT system, or
- Scope, design, construct and commission a production line

The supporting organisation and processes

Providing routine enabling processes, knowledge and expertise
Project life span phases

The process of managing the work of the project

*The project life span governs project delivery*

- Pre-Project Planning
- Concept
- Definition
- Execution
- Finalisation
- Post Project

The work of the project

- Define, install and implement an IT system, or
- Scope, design, construct and commission a production line

The supporting organisation and processes

*Providing routine enabling processes, knowledge and expertise*
FEP / FEL and the project life span

Example of a project life span model

Front End Planning

<table>
<thead>
<tr>
<th>Establish the Need</th>
<th>Identify Alternatives</th>
<th>Develop the Alternatives</th>
<th>Select a Single Solution</th>
<th>Develop Solution</th>
<th>Detailed Solution Design</th>
<th>Execute the Design</th>
<th>Handover the Solution</th>
<th>Close the Project</th>
<th>Realise Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define and qualify the need for the project and the benefits to be achieved from doing the project.</td>
<td>Identify 3 or 4 alternative s which could satisfy the need</td>
<td>Investigate the competitive advantages of each potential alternative</td>
<td>Select the solution which has the best competitive advantage</td>
<td>Develop the different sub-components of the solution to fully define the solution.</td>
<td>Develop each component of the project to a sufficient level of detail to enable integration and scope finalisation.</td>
<td>Produce the deliverables defined by the project scope to achieve the required solution results.</td>
<td>Transfer and handover the project deliverables to the person or organisation which motivated the project.</td>
<td>Formally close-out the project once all deliverables have been completed and handed over.</td>
<td>The person or organisation which motivated the project evaluates the benefits obtained.</td>
</tr>
</tbody>
</table>
FEP essential for project success

### Project Development and Delivery Life Span Model

<table>
<thead>
<tr>
<th>PHASE</th>
<th>Front-End Planning</th>
<th>Business Planning</th>
<th>Front End Loading</th>
<th>Implementation</th>
<th>Close-Out</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGE</td>
<td>Define Need</td>
<td>Identify Alternatives</td>
<td>Develop Alternatives</td>
<td>Select Single Solution</td>
<td>Develop Solution</td>
<td>Finalise Solution</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>Need Statement</td>
<td>Business Case</td>
<td>Establish Core Project Team</td>
<td>Select Preferred Alternatives</td>
<td>Definitive Scope</td>
<td>Finalise Solution Detail</td>
</tr>
<tr>
<td>PURPOSE</td>
<td>Business opportunity and economic study</td>
<td>Two or more alternatives selected for development</td>
<td>Option Study Alternatives identified</td>
<td>Conceptual Study Qualification of need / opportunity and development of the concept</td>
<td>Pre-Feasibility Study Development and evaluation of options Selection of optimal scope</td>
<td>Feasibility Study Perform detailed scopeing and front-end engineering design (FEED)</td>
</tr>
<tr>
<td>ESTIMATE MATURITY</td>
<td>Class 5 0% to 2%</td>
<td>Class 4 1% to 15%</td>
<td>Class 3 10% to 40%</td>
<td>Class 2 30% to 75%</td>
<td>Class 1 65% to 100%</td>
<td></td>
</tr>
<tr>
<td>ACCURACY RANGE</td>
<td>L -20% to -50% H +30% to +100%</td>
<td>L -15% to -30% H +20% to +50%</td>
<td>L -10% to -20% H +10% to +30%</td>
<td>L -5% to -15% H +5% to +20%</td>
<td>L -3% to -10% H +3% to +15%</td>
<td></td>
</tr>
<tr>
<td>COST EXPENDITURE GATES</td>
<td>0.5% 1% to 2%</td>
<td>3% to 5%</td>
<td>6% to 9%</td>
<td>10% to 14%</td>
<td>15% to 94%</td>
<td>95% to 98%</td>
</tr>
</tbody>
</table>
Break – Leg Stretch
08:45 – 09:00
Front End Planning – Approach and Research
Front End Planning – Managing risk

- Total Cost Established
- Front End Planning (FEP)
- Procurement
- Final Design
- Construction
- Acceptance Criteria
- Commissioning
- Start up
- Operations & Maintenance

ABILITY TO INFLUENCE COST

CASH FLOW
Front End Planning – FEP

FEP 1
DEVELOP OPTIONS
Conceptual Study

FEP 2
OPTION SELECTION AND VIABILITY
Pre Feasibility Study

FEP 3
PROJECT DEFINITION AND PLANNING PHASE
Feasibility Study

FEP 4
PROJECT IMPLEMENTATION PHASE
Execution

Start Up & Commissioning

Intensive Focus Here
For Success Here

Client Business Case
The analysis of the performance of the design phase in thirty one fast track projects revealed a statistically significant correlation between performance of the design phase and front end planning, alignment, constructability, change management.

Primary drivers of project failure

Cause of cost and schedule overruns...

1. Unrealistic or overly optimistic original cost to complete cost estimate and schedules.
2. Incomplete scope definition or inadequate front-end loading and poorly completed front-end deliverables including milestone schedule slippage in front end.
3. Inappropriate project strategies for the project (mega oil sands) environment.
4. Mismanagement of the construction phase.

Pre-project planning data collected from 62 industrial projects and 78 building projects, representing approximately $5 billion in total construction cost.

Pre-project planning was identified as having a direct impact on the project success (cost and schedule performance).

The research results prove better planning in the early stage of the project life cycle have a positive impact on the final project outcome.

FEP impact on cost and schedule

### Significant difference in performance

<table>
<thead>
<tr>
<th>Performance</th>
<th>PDRI Score</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 200</td>
<td>&gt; 200</td>
<td></td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3% below budget</td>
<td></td>
<td>9% over budget</td>
</tr>
<tr>
<td>5% behind schedule</td>
<td></td>
<td>21% behind schedule</td>
</tr>
<tr>
<td>8% of budget</td>
<td>11% of budget</td>
<td>3 points</td>
</tr>
<tr>
<td><strong>Schedule</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4% below budget</td>
<td></td>
<td>4% over budget</td>
</tr>
<tr>
<td>4% behind schedule</td>
<td></td>
<td>10% behind schedule</td>
</tr>
<tr>
<td>7% of budget</td>
<td>8% of budget</td>
<td>1 point</td>
</tr>
<tr>
<td><strong>Change Orders</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5% below budget</td>
<td></td>
<td>25% over budget</td>
</tr>
<tr>
<td>13% behind schedule</td>
<td></td>
<td>30% behind schedule</td>
</tr>
<tr>
<td>3% of budget</td>
<td>10% of budget</td>
<td>7 points</td>
</tr>
</tbody>
</table>

*N = 25, N = 83, N = 75, N = 54, N = 12, N = 9*

Five critical drivers of success

1. Pre-project planning is a process that will “positively impact capital project performance”.
2. Pre-project planning is a critical project process that must be “performed consistently” on each project.
3. The project manager and project team must ensure it is “performing the right project”.
4. The project manager and project team must ensure it is developing the “right work product” during pre-project planning.
5. The project manager and project team must choose the “right approach to project design” and construction execution.

Using the PDRI improves performance

Results from usage of the PDRI's (Project Definition Readiness Index) have indicated an increase in project budget predictability of almost 20 percent on average versus authorisation estimate, with similar results for schedule, change orders, and operability. Included in these results are real cost savings of greater than 10 percent per project.

*Development of the Project Definition Rating Index (PDRI) For Infrastructure Projects Auth: Evan Bingham. Thesis Presented in Partial Fulfillment of the Requirements for the Degree Master of Science - ARIZONA STATE UNIVERSITY December 2010*
The goal of the Project Definition Readiness Index (PDRI) is to determine how well the project scope of work has been defined, and therefore the schedule and cost estimate, and how well equipped and prepared the project is to commence with either detail design or construction.
There are 4 different PDRI tools relevant to different project types

<table>
<thead>
<tr>
<th>CII PDRI Tools</th>
<th>Examples of projects showing which tool they would use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial PDRI</strong></td>
<td>• Bottling plant  • Pharmaceutical process plant  • Server farm</td>
</tr>
<tr>
<td><strong>Infrastructure PDRI</strong></td>
<td>• Railway line  • Highway / Toll road  • Water pipeline</td>
</tr>
<tr>
<td><strong>Building PDRI</strong></td>
<td>• Office building  • Server farm</td>
</tr>
<tr>
<td><strong>STAR PDRI</strong></td>
<td>• Renovation, refurbishment of process plant</td>
</tr>
</tbody>
</table>

Each tool is used to assess the project against 3 broad scope definition sections

- **Basis for Project Decision**: How well defined is the justification and supporting information for the project. And how well have the options and alternatives been determined and evaluated, to ensure alignment with the business’s objectives.
- **Basis of Design**: How comprehensively have all the design parameters and specifications been defined to ensure the scope of the project is fully understood and defined.
- **Execution Approach**: How well have the requirements of the owner’s execution been identified and defined, to ensure the project can be implemented and delivered effectively.
Example of CII PDRI

Project Definition Rating Index

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:

- Chemical composition
- Physical form/properties
- Raw materials
- Packaging
- Intermediate/final product form
- Allowable impurities
- By-products
- Wastes
- Hazards associated with products
- 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.


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

Industrial Projects
PDRI sections cover all aspects
The completeness of the project scope definition is reviewed to a quantifiable level of detail.

Is this the right project and have all alternatives been considered and assessed including alternative technologies and the most optimal solution identified?

There is a well documented strategy which clearly defines the need and purpose for the project.

The Need and Purpose includes sufficient data on the improvement to capacity and analysis of the profitability or benefits.

Has there been an analysis of the profitability or benefits of undertaking the selected project option? What methodology was employed? Who reviewed and approved it?

There is a structured method used for determining the profitability or benefits analysis and this has been completed, reviewed and signed-off.

* The number of ‘Elements’ ranges between 64 and 70 dependent on the PDRI tool employed.
Each element assessed by the team

The emphasis is on identifying and evaluating the impact of the risks and the mitigation actions.

- The high scoring elements which require attention are clearly identified.
- The gaps and associated risks and mitigation actions are described.
- The next actions to close the gaps are assigned to named individuals responsible for correcting them.
How to interpret the Summary Report Sheet

1. **PDRI Score**
   - The PDRI score is the sum of the scores for each Element [scored between 1 – 5], for (a) the Section and (b) the Category.

2. **Min Score**
   - This is the minimum attainable score for the sum of all the Elements within the applicable Section and Category. This is the eventual score the project team should be aiming for.

3. **Max Score**
   - This is the maximum weighted score attributable to the applicable Section and Category.

4. **Def (%)**
   - The Definition percentage is the level of completeness of the respective Section and Category based on the score for the current PDRI assessment.

5. **Top Elements**
   - These are the top 10 Elements having the highest weightings in the PDRI. These are the Elements which should be focussed on first in terms of level of completeness of the definition.
**FEP critical for definition completeness**

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</tr>
<tr>
<td></td>
<td>Concept FEL 1</td>
</tr>
<tr>
<td></td>
<td>Define Need</td>
</tr>
<tr>
<td>ENGINEERING</td>
<td>Stakeholder Requirements (URS)</td>
</tr>
<tr>
<td></td>
<td>Finalise Solution</td>
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FEP critical for cost accuracy

AACE International Recommended Practice No. 18R-97: Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries. AACE® International – The Association for the Advancement of Cost Engineering
The front end planning effort is typically identified with two to five percent of the project Total Installed Cost (TIC), depending on the type and complexity of the project.

Typical activities and products of front end planning may include the following:

- Options analysis
- Life-cycle cost analysis
- Cost and schedule estimates
- Site investigation and selection
- Environmental analysis
- Process design basis
- Initial engineering design
- Space planning
- Site layout
- Project execution approach
- Project control plan
- Contracting strategy
If we position project management as an execution-only discipline, we will be seen as just that and cut-off from the really important parts of the project: those where value can most be created: the front-end.

We need to be voicing a view of programme and project management which provides a holistic approach to managing projects, and programs, from their earliest stages to their last in order to deliver business benefit.

2005, Peter Morris, PMI Global Congress Proceedings – Edinburgh, Scotland
Research and consistently apply a defined front end planning process
• Ensure adequate scope definition before moving forward with design
• Use front end planning tools
• Define existing conditions thoroughly
• Select the correct contracting strategy early
• Align the project team, including key stakeholders
• Build the project team, including owner stakeholders and consultants
• Include involvement from both owners and contractors
• Staff critical project scoping and design areas with capable and experienced personnel
• Identify and understand risks of new project types, technologies or locations
• Address labour force skill and availability

FEP usage owners spend 8% less

Value of Best Practices Survey completed in 2010; owners with high front end planning usage on average spend 8% less than those with low usage
If airline pilots use checklists...

The segmented checklist enhances ability to manage the cockpit and comply with standard operating procedures. Many a pilot has avoided embarrassment, not to mention a possible accident, because he or she used the written checklist properly.

...Then why do programme and project managers not do the same to improve project performance?

Proven methods such as front end planning and tools such as the project definition readiness index provide this capability.
1. Managing the Front-End: how project managers shape business strategy and manage project definition, 2005, Peter Morris Originally published as a part of 2005 PMI Global Congress Proceedings – Edinburgh, Scotland

2. Front End Planning In The Modern Construction Industry By Roberta Patrice Bosfield, ARIZONA STATE UNIVERSITY May 2012

3. Development of the Project Definition Rating Index (PDRI) For Infrastructure Projects by Evan Bingham. ARIZONA STATE UNIVERSITY December 2010


7. CII South Africa Launch. CII's Impact on Capital Projects, May 21, 2015 University of Pretoria Stephen P. Mulva, Ph.D. Associate Director, CII
Q&A, Networking and Event Close
09:30 – 10:00
EPCM Global is a management consulting services firm for public and private sector clients. We provide specialist solutions and competitive insights within our three core offerings:

• Consulting solutions for business, project and engineering management
  • Business architecture – review the integration of your business strategy, systems architecture, sustainability principles and operations.
  • Business process development and re-engineering – develop, re-engineer and standardise processes for sustainability.
  • Plant lifecycle and performance improvement – develop processes and tools to address shortcomings within your company’s asset lifecycle management.
  • Operational optimisation – develop and implement operational improvement solutions.
  • Project readiness assessments – facilitate project definition readiness.
  • Project lifecycle methodology – assess, develop and standardise project lifecycle models.
  • PMO establishment – Establish the strategy, architect, structure, organise and establish programme and/or project management office

• Project delivery solutions
  • Full Engineering, Procurement and Construction Management (EPCM) capability assistance.
  • Specialised assistance in project development, project execution and project integration.
  • Our project management services include Greenfield projects, Brownfield (refurbishment and replacement) projects and project recovery.

• Specialist staffing solutions
  • Recruitment of skilled staff on a permanent, contractual or temporary basis with training and technical, specialised support from EPCM Global.
  • Service focussed on the Project Management, Engineering Management, Procurement and Construction Management industries.

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