Lessons on Process for Evaluation

Presented at Evaluation 2010, San Antonio, TX

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Why Are We Here?
Purpose

• To:
  – Provide the audience with a process for planning evaluation

• By:
  – Demonstrating the capital project planning process
  – Discussing the drivers for successful capital projects

• For the purpose of:
  – Enabling you to apply these processes to evaluations
Outline

- *Independent Project Analysis*
- Capital Projects and Goals
- Developing a Process
- Front-End Loading
- Team Development
- Practices in Execution
- Challenges
- Conclusions
Origins of Independent Project Analysis (IPA)

• For almost 25 years, IPA has been benchmarking capital projects in the process industries

• IPA grew out of research at The Rand Corporation on the sources of success and failure in capital projects, especially new technology projects

• Dupont was our first important customer and is still an important customer two decades later
IPA’s Purpose

IPA improves the competitiveness of our customers through more effective use of capital in their businesses.

It is our mission and unique competence to conduct research into the functioning of capital project systems, and to apply the results of that research to help our customers create and use capital assets more efficiently.

Above all else, however, IPA is in the business of generating positive change!
IPA’s Customers

- IPA works for the extractive and manufacturing industries
  - Extractive: oil, gas, iron, copper, zinc, diamonds, etc.
  - Manufacturing: chemicals, fuels, pharmaceuticals, paper, food processing, consumer products

- Our primary focus is on companies that must invest large amounts of capital in facilities to meet their customers’ needs

- We do very little work for governments, although we have done and will continue to do some
  - Environmental projects (USEPA, USDOE, COE)
  - Facilities construction (Navy, USDOE, State Dept.)
  - Alternatives fuels commercialization (USDOE, NREL)
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<th>Clients Represented in the IPA Databases</th>
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What Is a Capital Project?

A project that involves expenditure of an organization's monetary resources for the purpose of creating capacity for production.

Much can be learned from capital projects in terms of practices that can be applied to an evaluation as a “project”

Planning and process matter
When Are Capital Projects Benchmarked?

**Business Planning (FEL 1)**

**Scope Development (FEL 2)**

**Project Planning (FEL 3)**

**Execution Phase**

**Operations Phase**

**BFEL:** Review soundness of business case

**Prospective:** Establish practices and targets at authorization

**Pacesetter:** Understand early drivers of project performance

**Closeout:** Collect actual project data

**Operability:** Collect operability data
IPA Data

• 12,000+ global projects
• Information obtained directly from the project teams
• 2,000+ variables per project

Data

• How practices drive outcomes
• Industry and sector trends
• Time trends

Research

• Benchmarking of individual projects
• Company performance

Metrics
IPA Works at Several Levels

- *Individual projects* form the foundation of our work
- *Workshops* provide a roadmap for best project practices
- Diagnosing (benchmarking) *project systems* provides companies with the basis for improvement
- *Benchmarking Conferences* bring companies together to share practices and metrics
IPA’s Research and Methodology Is Based on Proprietary Databases

**PROCESS PLANTS PES®**
- >6,500 projects
- Detailed histories of process plant projects > US$6 million

* PES is a registered trademark of IPA

**PES SMALL PROJECTS**
- 6,000+ projects
- Projects < US$6 million from process industries

**MEGAPROJECTS**
- 300+ projects
- US$Billion class projects, all types

**HAZRISK**
- 400+ projects
- Environmental assessments and cleanups

**ELECTRIC POWER PROJECTS**
- >150 projects
- Single or combined cycle plants,

**PLANNED SHUTDOWNS /TURNAROUNDS**
- 250+ turnarounds
- Facility turnarounds

**INFORMATION TECHNOLOGY**
- 270+ projects; including Applications Development, Telecommunication, etc.

**INSTRUMENTATION & CONTROL**
- 450+ projects
- Automation, DCS, SCADA, etc.

**PETROLEUM E&P**
- 1,000+ projects
- Petroleum production platforms worldwide

**PIPELINES**
- 800+ projects
- Pipelines, terminals, booster stations, etc.
Outline

• Independent Project Analysis
• **Capital Projects and Goals**
• Developing a Process
• Front-End Loading
• Team Development
• Practices in Execution
• Challenges
• Conclusions
Elements of Capital Effectiveness

Business Strategy
Technology Strategy

Intermediate Goals

Alignment of Functions
Front-End Loading
Use of Value Improving Practices
Leading Technology

Discipline & Continuity
Optimal Scope for Business Needs
Executed With Minimum Change
Timely Involvement of Contractors/Vendors

Project Goals

SAFETY

Low Cost
Fast Cycle Time
Functionality

BETTER IRR

Key Leading Indicators

Key Performance Indicators
Project Goals – In Evaluation Terms

- Fast Cycle
- Low Cost
- BETTER
- IRR
- Functionality
- SAFETY

Low Cost
Fast Cycle
Functionality

SAFETY
BETTER
IRR
Project Goals – In Evaluation Terms

- Cost
- Schedule
- Efficacy
- Low Cost
- Fast Cycle Time
- Functionality
- SAFETY
- BETTER IRR
- Do No Harm
- Cost/Benefit Analysis
Predictability Indices

- Project outcomes vs. targets established at authorization

  \[(\text{Project Actual} / \text{Project Estimate}) - 1\]
  
  (0 percent means no deviation)

- Can collect for evaluations as well –
  
  - Cost → \($90K / $100K\) – 1 = -0.10
  
  - Schedule → (4 months / 3 month) – 1 = 0.25
Competitiveness

- Project effectiveness vs. Industry

Project Actual / Industry Benchmark

(1.00 is Industry)
Industry Benchmarks: Based on Statistical Models

- IPA models are based on historical performance of past projects (i.e., projects in IPA’s database)
- Generate an industry average prediction for projects with similar characteristics
- Provide a statistical range around the industry average
- We do this using multivariate regression
Elements of Capital Effectiveness

Key Leading Indicators
- Alignment of Functions
- Front-End Loading
- Use of Value Improving Practices
- Leading Technology

Key Performance Indicators
- Discipline & Continuity
- Optimal Scope for Business Needs
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Intermediate Goals

SAFETY

- Low Cost

BETTER IRR

- Fast Cycle Time
- Functionality

Key Leading Indicators

Key Performance Indicators
How Do We Measure FEL?

Front-End Loading (FEL) Index

Site Factors
- Plot plans
- Soils data
- Environmental permitting
- Health & safety requirements

Engineering Definition
- Engineering tasks
  - Detailed scope
  - PFDs, H&MBs, P&IDs
  - One-line electrical diagrams
  - Equipment specs
- Cost estimate
- Sign-off from:
  - Operations
  - Maintenance
  - Business

Project Execution Plan
- Contracting strategy
- Team participants & roles
- Integrated schedule
  - Detailed
  - Critical path
  - Resource loading
- Plans
  - Procurement
  - Commissioning/startup
  - Etc.
Outline

• Independent Project Analysis
• Capital Projects and Goals
• *Developing a Process*
• Front-End Loading
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• Conclusions
Gatekeeping in Capital Projects

- Gates are meetings where a “gatekeeper” (an independent reviewer) decides whether the project -
  - Should move to the next phase,
  - Should recycle, or
  - Should be terminated

- Gatekeeping meetings have specific deliverables that the project team or project manager is expected to prepare and distribute in advance of the meeting.
At authorization, IPA provides clients with an FEL rating for each capital projects

Can an FEL rating for evaluation be developed?
Business Planning
FEL 1

- Questions addressed at gate:
  - Is it revenue generating?
  - Is it strategically important to our business?
  - Who are the stakeholders?
Questions addressed at gate:

- What is the research question?
- What is the problem we are trying to address?
- Is it feasible?
- What is the rough level of effort expected?
Scoping

**FEL 2b**

- Deliverables at gate:
  - Draft execution plan
    - Major tasks identified
    - Milestone schedule that identifies specific calendar dates for the major tasks
  - Cost estimate
Execution Planning

**FEL 3**

- **Deliverables at gate:**
  - Finalize Project Execution Plan (PEP)
    - Specifically identify how the work will be accomplished
  - Document roles and responsibilities for the team members
  - Resource-loaded schedule

- **Identify specific calendar dates and who is responsible for executing the tasks**
Execution

- For capital projects, execution involves engineering, construction, and installation

- For evaluation – Execution A
  - Instrument design
  - Data collection
  - Data cleaning

- Gate: Dataset completed
• For evaluation – Execution B
  – Analysis
  – Reporting
• Capital Projects End: Mechanical Completion
• Evaluation End: Final Delivered
Business Planning

- For capital projects, the last phase is “Startup phase”
- For evaluation:
  - Document the study
  - Maintain the final dataset
  - Secure any final deliverables
  - Dissemination
  - Goal is “replicability”
Outline

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Elements of Capital Effectiveness

Key Leading Indicators

- Business Strategy
- Technology Strategy
- Alignment of Functions
- Front-End Loading
- Use of Value Improving Practices
- Leading Technology
- Discipline & Continuity
- Optimal Scope for Business Needs
- Executed With Minimum Change
- Timely Involvement of Contractors/Vendors

Key Performance Indicators

- Low Cost
- Fast Cycle Time
- Functionality

SAFETY

BETTER IRR
Capital Projects FEL

= Site Factors + Engineering Definition + Project Execution Plan

- Plot plans
- Soils data
- Environmental permitting
- Health & safety requirements

- Engineering tasks
  - Detailed scope
  - PFDs, H&MBs, P&IDs
  - One-line electrical diagrams
  - Equipment specs
- Cost estimate
- Sign-off from:
  - Operations
  - Maintenance
  - Business
  - Operations
  - Maintenance
  - Business

- Contracting strategy
- Team participants & roles
- Integrated schedule
  - Detailed
  - Critical path
  - Resource loading
- Plans
  - Procurement
  - Commissioning/startup
  - Etc.
Calculating the Front-End Loading Index: 
*Prospective Evaluation*

- **Site Factors**
- **Engineering Definition**
- **Project Execution Plan**

**FEL INDEX**

- Definitive
  - Best Practical at Authorization
- Preliminary
  - Full Spec.
  - Advanced
  - Limited
- Assumed
  - Screening
  - Definitive
  - Assumed

**Screening Study**

- Over Defined
  - Best
  - Good
  - Fair
  - Poor
Site Factors for Evaluation
“Subject Factors”

Site Factors

- Plot plans
- Soils data
- Environmental permitting
- Health & safety requirements

Subject Factors

- Sample size
- Sample characteristics
- Government requirements (OMB clearance)
- Protection of human research subject requirements
Engineering Definition for Evaluation

“Methodology”

- Engineering tasks
  - Detailed scope
  - PFDs, H&MBs, P&IDs
  - One-line electrical diagrams
  - Equipment specs
- Cost estimate
- Sign-off from:
  - Operations
  - Maintenance
  - Business

- Hypothesis – identify dependent and independent variables in writing
- Articulation of problem
- Methodology for:
  - Sampling
  - Data collection
  - Analysis
  - Reporting
- Cost estimate
- Sign-off from external stakeholders
Project Execution Planning for Evaluation

- Contracting strategy
- Team participants & roles
- Integrated schedule
  - Detailed
  - Critical path
  - Resource loading
- Plans
  - Procurement
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  - Etc.

- Team participants & roles
- Integrated schedule
  - Detailed
  - Critical path
  - Resource loading
- Plans for:
  - Instrument development
  - Data collection & cleaning
  - Analysis
  - Reporting
  - Documentation
Elements of an Integrated Schedule

• Detailed
  – Provides specifics on what will happen when

• Critical Path
  – This is the longest path in your schedule
  – Activities on the critical path have zero total float
  – If any activity on the critical path is late, it can delay your project end date

• Resource Loaded
  – People required to do the work
  – Equipment needed to do the work
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**Key Performance Indicators**

- SAFETY
- BETTER IRR

- Low Cost
- Fast Cycle Time
- Functionality

**Elements of Capital Effectiveness**

- Business Strategy
- Technology Strategy

- Functionality
- Business Strategy
- Technology Strategy
How Do We Measure Team Development?

Team Development Index (TDI)

= Project Objectives + Team Composition + Roles & Responsibilities + Project Implementation Process

- Project objectives: Documented, Communicated, Agreed to, Trade-offs clear
- Integrated team
- Key functions represented: Business, Ops/Maintenance, Engineering, Construction, Etc.
- Team member roles & responsibilities: Defined, Agreed to
- Tasks identified
- Risks identified, analyzed, & mitigated
- Project implementation process in place
- Applied consistently on all projects
- Process understood & followed by team
Project Objectives for Evaluation

- Project objectives:
  - Documented
  - Communicated
  - Agreed to
  - Trade-offs clear

- Project objectives:
  - Documented
  - Communicated
  - Agreed to
Team Composition for Evaluation

- Integrated team
- Key functions represented:
  - Business
  - Ops/Maintenance
  - Engineering
  - Construction
  - Etc.

- Integrated team
- Key functions represented:
  - Stakeholders
  - Principal Investigator
  - Etc.
An integrated project team includes (but is not limited to) a team of full- or part-time representatives from the following areas:

- Business
- Engineering
- Construction
- Maintenance
- Operations/Production
- Health and Safety
- Environmental (if needed)
- Contractor (if appropriate)

These representatives are identified prior to project authorization and have specific responsibilities that are defined and understood by all team members.

These representatives have authority to make decisions for function they are representing and provide functional input to project manager.
What is an Integrated Team in Evaluation?

• Who should be involved?
  – A representative from each key element of the evaluation should be involved early on
  – For example:
    > Sampling statistician
    > Instrument designer
    > Etc.
Roles and Responsibilities for Evaluation

- Team member roles & responsibilities:
  - Defined
  - Agreed to
- Tasks identified
- Risks identified, analyzed, & mitigated

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Project Implementation Process for Evaluation

- Project implementation process in place
- Applied consistently on all projects
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- Applied consistently on all evaluations
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SAFETY

BETTER IRR
Discipline and Continuity

• Discipline:
  - Following the PEP
    > Are the hours expended as planned?
    > Are calendar dates as planned?
    > Are tasks getting done as planned?

• Continuity
  - Retaining the Principal Investigator and other key personnel
Defining Changes

- **Change** in projects is defined as a deviation from the planned (authorized) kit or configuration of kit in a project.

  - **Design Changes**
    - Modifications to the intended configuration that do not involve a change in functionality or objectives.

  - **Scope Changes**
    - Modifications caused by change in objectives or desired functionality:
      - Scope additions
      - Scope deletions

- A change is **major** if the estimated cost is greater than 0.5 percent of estimated total cost or is expected to cause a change of 1 month or more to schedule.
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Challenges to Implementation

- Scalability
- Human resistance to following a process
- Assumption that there are too many unknowns – that it is not worth it to plan in depth
- Challenges to resource loading
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- Use of Value Improving Practices
- Leading Technology

Key Performance Indicators
- Optimal Scope for Business Needs
- Executed With Minimum Change
- Timely Involvement of Contractors/Vendors
- Discipline & Continuity

Key Indicators
- Safety
- Better IRR

Elements include:
- Low Cost
- Fast Cycle Time
- Functionality

SAFETY

BETTER IRR
Conclusions

- Do proper Front-End Loading – it pays
- Ensure you have a complete team that is familiar with the evaluation goals and the plan for implementing it
- Avoid changes in Principal Investigator
- Monitor progress
- Avoid scope and/or design changes
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