

IPA Research Studies

IPA has conducted over 300 research studies whose findings are aimed at raising the level of understanding of the drivers of capital effectiveness in the process industries. All IPA research studies are quantitatively based, linking capital project performance with a set of practices. The practices and learnings that result from IPA's empirical approach have been implemented by numerous organizations to make measurable improvements in their capital project systems. The practices identified in IPA's research have been used by some of the best projects to achieve costs 25 percent less than competitive projects completed 20 percent faster and operate 15 percent better. Such results have been shown to improve the expected return on these investments by 22 percent.

IPA research is unique in that it is empirically based. Studies conducted by IPA are based on the learnings from over 10,000 capital investments ranging in size from less than \$100,000 US to over \$1 billion US. All phases of the capital cycle have been studied from the early phases when investment opportunities are selected to the operation of the asset. Various types of projects have been covered in IPA studies from Greenfield facilities in new locations to maintenance projects in operating plants. IPA has the only data of its kind, collected by trained analysts, in a methodical fashion.

The research conducted by IPA is also different from other project management research in that it is interdisciplinary. All participants in the capital project process are represented, including business, engineering disciplines, research and development, operations, maintenance, cost engineering, controls, in addition to project management. The interdisciplinary nature of IPA studies allows the research to encompass all aspects of capital effectiveness.

IPA research is focused on the practices that can be used early and during the capital investment process. Changing these practices can improve the project outcomes and so improve capital effectiveness.

Studies have been conducted to address questions from major companies around the world. Some of the issues addressed are:

- How competitive are the cost and schedule of this investment?
- What are the key functions needed to be represented on the project team?
- What information is needed prior to authorizing a project?
- How can risks from commercializing new technology be identified and mitigated?
- How does the contracting approach affect project outcomes?
- What are some important practices to improve the value of projects?
- Why do mega projects fail to meet their objectives?
- What are the important activities needed for controlling a project through execution?
- What are the elements of an effective plant project system?

IPA maintains an active research program to explore the most current issues affecting capital investment. Working closely with its clients and those involved in capital projects, the IPA research program is structured to identify new trends and practices to best meet the most current needs. Some areas currently explored are: core competencies to be maintained in project organizations, the business/engineering interface, how to best implement a gated process for various size projects, factors affecting operation of facilities, and risk identification and mitigation.

The extensive databases allow IPA to address issues that impede capital project effectiveness. Studies can be structured to address the concerns of a single organization or a consortium of companies. Studies have been done in the following areas:

- The capital investment decision
- Measuring project competitiveness
- Project planning and definition
- Resourcing for effective capital investments
- Successful commercialization of new technology
- Contracting strategies
- Project Execution Practices
- Implementing Best Practices
- Maintaining assets through effective plant projects
- The drivers of mega projects

The Capital Investment Decision

Effective use of capital is an important element of an organization's profitability. IPA's research focuses on identifying the critical factors that shape investment decisions. Work in this area includes studies into the interface between project professionals and the business function and the role of these functions in the capital project process. IPA's research has identified the critical elements that need to be defined at given stages in the project process relating these and other critical practices to capital effectiveness.

Some of the issues that research in this area address are:

- The business role in capital projects
- Understanding cost/schedule trade offs
- The important elements of the business/engineering interface
- Critical activities needed to pass through project gates
- Elements of the gated project process
- Portfolio management
- Guidelines for writing project objectives
- The business stake in effective project systems

Measuring Project Competitiveness

Cost, schedule and operability are important components of project performance. IPA research has produced methodologies to determine the cost and schedule effectiveness of capital investments. This allows for the measurement of the project's competitiveness relative to other comparable projects. The effect of practices on effectiveness can then be measured. This has allowed IPA to research the drivers of cost effectiveness, cycle time acceleration, operability outcomes, and shorter startups.

A second measure of performance is predictability, or how a project performed compared to the expectations that were established in authorizing the investment. As with the effectiveness measure, IPA has conducted research to establish the practices that relate to predictability.

A few of the areas explored by IPA research in this area include:

- Trends in outcomes and practices for excellent projects
- Elements of cost effectiveness
- Practices to minimize cycle time
- Labor productivity throughout the world
- Estimating practices
- Engineering costs and their effects on overall costs
- Minimizing startup time
- Factors affecting plant operability

Project Planning and Definition

Project Definition, or Front-End Loading has been shown by IPA research to be one of the most critical drivers of capital effectiveness. IPA research in this area has identified the elements needed for good project definition for a wide range of project types and sizes. IPA research has also identified a set of Value Improving Practices that have been quantitatively linked to good project results. Some best practices that have been identified by IPA research include the following:

- Establishing a well-defined project execution plan for large and small projects
- Best Practices for the FEL 2/Project Selection Stage
- Use of Value Improving Practices
- Effective FEL strategies
- Best Practices in Front-End Loading for all types of projects

Resources for Effective Capital Investments

Effectively resourcing projects has been an area of continued interest for those seeking to execute capital projects effectively. IPA special studies in this area have identified key factors that contribute to effective teams. Research has also quantified the resources needed to do good Front-End Loading. Core competencies for project organizations have been identified. IPA has also conducted work in how technical specialists can be effectively used. New work in this area concerns organizational effectiveness and how project organization structure might influence capital effectiveness.

IPA research has addressed this area of project effectiveness by investigating some of the following issues:

- What are the appropriate staffing levels for various types of projects?
- What resources are needed for good project definition?
- How does organizational structure effect project outcomes?
- Elements of team effectiveness
- Key roles in a gated system
- The impact of turnover of team members
- The role of cost professional
- Resourcing projects in times of low unemployment

Commercializing New Technology

IPA has an extensive database of projects that commercialize new technologies. These projects are often difficult to execute. Research in this area has identified a set of practices and strategies shown to address the risks associated with innovative capital projects.

Minimizing the risks associated with implementation of new technologies have been studied through research efforts and include the following:

- Best practices for effective commercialization of new technology
- Measuring new technology and the uncertainties associated with it
- Technology commercializing strategies
- The need for technical specialists
- Understanding the difficulties with solids processing

Contracting Strategies

Contractor involvement in projects has increased dramatically in the last decade, as owner resources have shrunk. IPA research has kept up with this trend by investigating how owner organizations can effectively leverage their resources with contractors. The effect of contract type, use of alliances, and the impact of incentives have been quantitatively related to project outcomes. The important factors in making contract strategy choices have been investigated by IPA. A sample of issues addressed by IPA research in this area include the following:

- Leveraging contracting capabilities
- Contracting strategies for large and small projects
- Alliances and project results
- Project performance and contract incentives
- Contractor claims
- Contracting practices around the world

Project Execution

IPA's research in the area of project execution explores the practices important for maintaining the value of the investment as a project proceeds through the execution phases. The drivers of changes that increase cost and slow execution duration have been identified and linked to project performance. Other areas of investigation include control practices and resource needs for effective project execution.

Practices for executing projects with minimum changes and disruptions have been explored in some of the following research:

- Measuring and minimizing changes
- Practices for project control
- Obtaining cost information from contractors
- Work progressing practices
- Rework and cost effective projects
- Execution metrics

Implementation

Research into drivers of capital effectiveness are only valuable if changes can be implemented that result in measurable improvements. Therefore, IPA has conducted studies into how organizations have implemented changes in their practices. Approaches to using lessons learned, learnings from the best and worst of projects, and practices that break organizational paradigms have all been subjects for IPA research. Some of the questions concerning implementing Best Practices investigated by IPA research include the following:

- Implementing Best Practices in organizations
- Making lessons learned work
- Investigating factors driving the best and worst projects
- Breaking paradigms: Understanding success when new practices are used

Maintaining Assets through Effective Plant and Small Projects

Projects executed at plant sites, important in maintaining asset effectiveness, are influenced by some practices different for more standard capital projects. IPA has studied the drivers, quantitatively linking the drivers to the outcomes of plant projects. Plant project specific practices, resource needs, and contracting strategies to improve plant project performance have been identified.

IPA has also conducted research into turnaround effectiveness. Turnaround practices drivers of turnaround duration, resource needs, and integrating turnaround and plant projects are all topics covered in IPA special studies. Some issues explored include the following:

- Best Practices for small and plant projects
- Integrating turnarounds and capital projects
- Organization structure and plant projects
- The impact of turnaround date changes
- Scheduling practices for turnarounds and plant projects
- Important elements of defining revamp projects

Understanding the Drivers of Mega Projects

The performance of mega projects, those estimated to cost over \$1 billion US, is of critical importance to business success. However, IPA investigations have shown that the majority of these large, complex projects are failures. IPA has conducted research into the drivers, resource needs, and contracting strategies which, when implemented, result in success in this important set of capital investments. Some areas investigated by IPA research include the following:

- Identifying risks for large, complex projects
- Elements of team effectiveness
- Lessons learned from mega projects
- Contracting strategies for large projects
- Drivers of failure