Project Development and Strategies for Success

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I. Introduction

Businesses have to make important and timely decisions regarding capital investments needed to sustain a position in the market or to exploit new business opportunities. Getting the proper return on a firm’s investment is critical for long-term success. Unfortunately, many capital projects do not result in fulfillment of the firm’s business objectives due to misalignment of the business and project objectives. This can typically occur early during the project development phase if there is not a systematic approach to alignment that identifies and manages project risks. This process allows for thoughtful and robust project execution strategies to be developed that can mitigate identified risks. These systematic approaches are even more important today, since many owners’ capital program organizations have been downsized during the recent recession, and owners may find that they no longer have the internal management resources to properly plan and develop capital projects.

This paper details a proven project delivery system that provides key strategic information for timely go/no-go decision gates that effectively manage the risk-to-reward relationship during project development. The paper explores critical project execution strategies to mitigate risks and maintain alignment of the business and project objectives. We also discuss using third-party facilitators in augmenting the owner’s project management team as a valuable component of a well-rounded implementation process. Finally, to demonstrate the success of the concept, we provide two case studies in which Berkeley Research Group experts worked with industry owners to incorporate successful strategies and project controls for critical plant investment projects.

II. Project Delivery System and Front-End Loading

Capital projects contain a degree of uncertainty; there are no guarantees for project success. Many industrial owners have implemented sustainable processes for the creation of new capital assets based on a phased approach with carefully established decision points to define and manage project risks. A typical model for a capital project delivery system (PDS) has five phases (Figure 1). The first three phases are collectively known as front-end loading (FEL) and are devoted to project development, including identifying business opportunities, screening alternative solutions, and defining the optimum solution for implementation. The FEL phases are followed by project implementation and startup and operation.

Figure 1: PDS Project Model

The FEL process was developed by the Construction Industry Institute (CII) as part of its Best Practices Guide: Improving Project Performance.1 Front-end loading includes robust planning and design early in a project’s life cycle (i.e., the front end of a project), at a time when the ability to

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influence changes in design is relatively high and the cost to make those changes is relatively low. The effort and attention required in this phase is critical but often minimized in practice. Most delays, disruptions, disputes, and cost overruns can be traced back to this phase.

Owners typically use a stage-gate process during development, whereby a project must pass through formal gates with well-defined milestones to ensure that reliable information is developed for key go/no-go decisions and funding the next stage of work. The process involves developing sufficient strategic information so that decision makers can adequately address risk and commit resources in order to maximize potential success. The main objective during the FEL phases is to effectively manage risk when developing new capital assets. The investment decisions are considered and developed using an approach that creates control points that determine the level of the owner’s risk exposure and costs.

The five phases of this PDS model are summarized as follows:

1. **Business Planning (FEL 1)**: Strategic planning resulting in the identification of market opportunity or other business operational needs. The key outcome is to establish the business case identifying the need and expected outcome for pursuing an opportunity.

2. **Facility Planning (FEL 2)**: Focuses on defining the facility for the business objectives by examining alternative approaches that will ultimately result in identifying the optimum business and technical solution for the business case. The key deliverable is the selection of the technology and site for the proposed capital asset.

3. **Project Planning (FEL 3)**: Takes the FEL 2 selection and expands the level of engineering detail to achieve the business and project goals identified in FELs 1 and 2. Contracting and execution strategies are selected at this time. The key outcome is the definition of the project scope, cost, and schedule that forms the basis for the capital funding case. It also establishes the performance baseline for the subsequent evaluation of the implementation and operation phases. In order to improve project cost and schedule certainty, owners develop project scope adequately enough so that preliminary budgets and schedules can be relied upon.

4. **Implementation**: Covers the detailed engineering, procurement, and construction of the facility and represents the bulk of the project’s expenditures. The key deliverable is a facility “fit for intended use”—one that will provide the product quantity, quality, and technological and economic benefits defined in the FEL planning phases.

5. **Startup and Operation**: Represents the final acceptance of the new capital asset by the operations and manufacturing department, and comprises the evaluation of facility performance through sustained operation. The key outcome is the evaluation of how the asset achieved business goals and project objectives. Owners are well served during this phase to develop “lessons learned” for process improvement for future projects.

The deliverables for each phase serve as inputs to subsequent phases. The quality of the effort and resulting deliverables determines the potential for success. If the project team errs in an early phase, the impact is magnified through successive phases, and even excellent team performance in subsequent phases may not be sufficient to overcome the error (e.g., the wrong plant perfectly built is still the wrong plant and will not meet business objectives).

The FEL planning phases are the heart of the PDS. These phases have the most influence in affecting the probability of project success in meeting the owner’s business objectives. The FEL planning phases minimize the likelihood of problems during the implementation and startup/operation phases. The *CII Best Practices Guide*, Section 1.01, Front End Planning, identifies a best practices survey completed in 2009 in which owners with high front-end planning usage on average spend 8 percent less than those with low usage.\(^2\)

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This paper will focus on these phases and the inherent strategies most critical in managing project uncertainties.

III. Conditions Driving the Need for Risk Management during Front-End Loading

The FEL process is designed to identify and address project uncertainties or risk and develop mitigation plans to maintain project objectives. Project risks are typically identified during the development of the project execution strategy or during further refinement of scope definition. As shown in Figure 2, the project execution strategy begins during FEL 2 and is refined in FEL 3.

Figure 2: Front-End Loading Phase Deliverables

The project execution strategy is driven in large part by the procurement strategy. The procurement strategy sets up the framework for the acquisition of services and goods and will form the basis for the major tasks to be addressed in the project plans, budget, and schedule. The two main elements in the preparation of the procurement strategy are:

1. The selection of the method for project delivery (i.e., EPC, EPCM, multiple primes, design-build, etc.)
2. The contract type (i.e., basis for compensation, such as lump sum, cost reimbursable, target price, etc.)

The development of the procurement strategies is affected by parameters such as the technology selection, market conditions, and owner’s project management capabilities. Each parameter poses risks that the owner will need to evaluate in determining its procurement strategy. The market conditions and technology selection may limit options for the type of desired project delivery method and form of contract. In general, the owner should attempt to assign risk with the party that is in the best position to control it. This may be accomplished by coordinating the packaging of the contractual scope of services with terms governing execution of those services. Once the procurement strategy is established, the contract packages for services and supply are incorporated into the project execution plan and schedule.

As was discussed earlier, the project is further defined through the FEL planning phases. During FEL 3, the project scope is defined with the technical design and site requirements. The diligence employed developing the preliminary designs, cost estimates, and schedules will improve the likelihood of cost and schedule certainty and should be considered when reflecting on commercial aspects of the capital expenditure (i.e., return on investment (ROI) objectives). Quantitative tools and best industry practices can be used to develop and refine cost and schedule risk-mitigation strate-
An effective approach is to conduct workshops with the project team to examine the assumptions and basis used to prepare the cost estimate and schedule. The workshop examines the validity of assumptions and identifies potential scenarios beyond the boundaries of the assumptions. The probability and impact of these occurrences are evaluated by the team, and a range of outcomes are identified for further analysis. A probabilistic analysis of the data using Monte Carlo simulation software is performed to indicate the probability of achieving the cost and schedule targets. The analysis will also identify the target cost and schedule completion associated with a desired percentage of certainty for the probable outcome. The results of such a simulation often are used as the basis to establish cost and schedule contingencies. Workshops also improve the team’s understanding of the overall project scope and respective responsibilities. The workshop also identifies risks that can be inputted and prioritized into a risk register from which risk mitigation solutions can be developed.

III. Value of Third-Party Facilitator

The recession impacted many capital programs. The good news is that the economy is improving. Business opportunities are appearing, but market forces are competitive. Windows for business opportunities are tight, and the timing for bringing new products to market or improving operational efficiencies is more critical than before.

In addition, owner’s capital programs and project management organizations have typically been downsized. Owners no longer have the internal project management resources to properly develop capital assets to seize business opportunities. The timing demands of market opportunities do not allow owners the luxury to redevelop internal project management staffs. Owners subcontract project management services or supplement their organizations with experienced third-party staff. Owners usually engage outside firms to assist with project management services for engineering and construction. Often the firms engaged are also responsible for performance of some portion of the work to be managed, which can present a conflict of interest over the supply of some of these services, impacting impartial risk assessment. The development and implementation of a risk management program and resultant strategies are core management processes that may be enhanced by the use of an independent third-party facilitator.

A third-party facilitator can be engaged early in the project planning cycle to augment and supplement the owner’s team to assess the project’s requirements with the organization’s project management capabilities. A gap analysis can be used to identify strengths, weaknesses, and omissions related to the project team, as well as its standards, policies, work practices, systems, and tools. The facilitator can also work with the owner’s project and legal teams to develop preferred contract terms that address the basis for compensation and assignment of risks. The preferred terms will provide a framework for the negotiation of future contracts for the procurement of project goods and services.

The facilitator also provides an objective view in the assessment of cost and schedule risks and can develop appropriate contingency plans. Facilitators can supplement the owner’s team with knowledge of best industry practices and lessons learned from unsuccessful projects. They can also ensure diligence throughout the stage processes with periodic checks and audits.

Figure 3 shows the relative timing of various risk management strategies and tools, along with the potential impact to the objectives.
Advantages of the use of a third-party facilitator include:

1. Can be engaged early in the project planning cycle
2. Unbiased to internal politics
3. Knowledgeable in industry best practices
4. Broad industry experience with executing projects under a variety of conditions and parameters
5. Can supplement owner’s staff on as-needed basis and perform analysis, make recommendations, and follow up with periodic checks and audits
IV. Case Studies

Case 1: Procurement Strategy and Negotiation

Situation
A Berkeley Research Group expert assisted a major North American industrial firm faced with an interesting problem. The company had chosen a technology and built a factory to serve a certain market. After a few years of production, it became clear that the initial technology choice had been incorrect, as the market had settled on a competing technology as the industry standard. The firm was desperate to convert the plant to the competing technology so as not to lose its customers. The conversion would require a lengthy shutdown and involve significant construction. There was already a fully trained workforce, infrastructure, and supporting equipment and processes that could be utilized for the new technology.

Actions Taken
In this industry, equipment suppliers provided technologies, and subsequent performance guarantees were usually granted with large equipment orders. Since much of the equipment could be reused (if designed properly), no typical “big” equipment order would offset the performance risk to the vendor. Upon reviewing the situation, it was determined that one suitable supplier had a significant sister engineering, procurement, and construction (EPC) company. BRG developed a strategy to enter into bilateral negotiations with that firm and leverage the size of the EPC contract to secure the performance guarantees for the new technology. Further complicating the issue due to the urgency of the market situation, a suitable scope definition, feasibility studies, and preliminary engineering work had not been performed. However, the business case had been defined, which set the appropriate investment for the conversion that would result in an acceptable business model.

With the above in mind, BRG crafted a reimbursable two-phase contract with the parent company, employing the EPC and equipment divisions to define an appropriations quality estimate with the associated definitive scope of work that would support the investment and production requirements in the business case. The first phase was called the target price phase, in which the target was the investment number determined by the business case. Three months was set aside for this phase, allowing front-end field construction work to proceed while the scope was refined, providing significant advantages to the project schedule. Once this phase was completed, the design was frozen and further changes were subject to a rigid change order process, which reinserted the scope discipline back into the now-integrated project team.

Commercially, the contract was set up as a bare-cost approach with significant incentives to achieve key business parameters on cost, schedule, ramp up, operability, and safety. The only disincentives were for lack of technical performance, as that was the key reason to choose the firm for the initial bilateral negotiations. There was a provision to convert the project to lump sum after the design freeze, with the incentive that the contractor could convert the unused contingency to profit, and the negotiated incentives would be added into the lump sum pricing and turned into disincentives as potential liquidated damages for not achieving the performance. The structure of the original reimbursable contract allowed the owner the flexibility to convert to lump sum. Sub-strategies employed due to the unique requirements included redeployment of the workforce to construction work. This avoided layoffs and improved union relations. There was an incentive built into the contract for the EPC firm to utilize this labor force, as it was provided “free” and anything it could perform contributed funds to the contingency pool, which was subject to a sharing arrangement. The goodwill gained from this approach also paved the way for the union workforce to accept the same startup incentives as the EPC contract, allowing for true alignment of stakeholders during that phase of the project.

Outcomes
The resulting project was one of the most successful ever done by the owner. The project finished at the appropriated budget and on its accelerated schedule, but it had an almost vertical ramp up to full and on-quality production. The project was a success for the contracting firm as well.
Case 2: Scope Definition

Project Overview and History
The client was a North American firm specializing in the mining and beneficiation of raw materials for steel manufacturing. The project was the centerpiece of a business plan to penetrate a new growth market segment and consisted of the installation of a new iron-making facility on a greenfield site near an existing mine. The project was to be financed and operated under a new joint venture between the owner and technology supplier partner that held the patent for an innovative but unproven process technology.

The owner had initially participated in a group that built a demonstration plant but had withdrawn due to an economic downturn. After the economy had improved, the owner revived the project, taking data from an earlier feasibility study and other marketing information to prepare an appropriation request to its board for $320 million with a 24-month construction schedule. The board approved the appropriation contingent on the feasibility study and associated appropriation request documentation passing a third-party audit for compliance with the client’s newly adopted, revised capital improvement standards.

The owner’s project team updated the appropriation request materials to reflect the new standards and scheduled an independent peer review (IPR). An outside firm conducted the review and determined that notable deficiencies existed in the capital estimate, project execution plan, and scope definition. Deficiencies included:

Estimate Related
• Scope of supply and basis of estimate not documented or integrated
• Contingency not included or analyzed
• Estimate not aligned with the work breakdown structure (WBS)

Project Execution
• Project execution plan incomplete
• No contracting/procurement plan identified

Engineering Definition
• Engineering definition for planned plant enhancements not developed
• Basic design not frozen and not under strict change control

The IPR recommended that the feasibility study be completed, a draft project execution plan be prepared, and a new project readiness review be conducted before major commitments were made. The client engaged BRG to assist in managing the revised efforts.

BRG’s Engagement and Actions
BRG worked with the owner, technology supplier, and engineering, procurement, and construction management (EPCM) contractor to develop a plan to complete the feasibility study to address the IPR recommendations, comply with the client’s internal requirements, and utilize project control practices. BRG’s activities are summarized below.

Corporate Capital Improvement System Compliance
• Planned and facilitated project development review meetings.
• Reviewed draft sections of the feasibility study report and provided recommendations to project team for revisions to comply with requirements for executive management approval.
• Assisted project team with preparation for further peer review audits for project readiness and procedural compliance.

Project Execution Strategy
• Assisted owner with contracting strategies to better allocate risk between the process equipment supplier and EPCM contractor.
• Developed work packages for equipment purchasing and construction contracting to maximize purchasing leverage and facilitate project planning.

Project Control
• Developed a WBS for use in preparation of the project estimate and schedule. This would also serve as the eventual basis for monitoring progress.
• Developed integrated overall project master schedule reflecting major work packages and tasks. Defined necessary interfaces between process engineering, equipment supply, installation engineering, construction, and commissioning/startup.

Budget Estimate Risk and Contingency Assessment
• Reviewed project estimate to assure all elements of the project scope and owner’s costs were adequately addressed. Reviewed EPCM basis of estimate to assure coordination with basis of schedule assumptions.
• Facilitated risk assessment effort. Recast estimate into a model for cost risk evaluation. Facilitated discussion for possible ranges and probability of outcome. Led discussion of interpretation of Monte Carlo simulation results to identify contingency for estimate accuracy.

Procurement Risk Mitigation Strategies
• Implemented the program to identify, evaluate, and mitigate risks to procurement strategy. Organized and facilitated a risk workshop with project stakeholders in which risks were identified and ranked, and mitigation actions were developed.
• Prepared risk register report by procurement package.

Contract Advisory Services
• Reviewed owner’s standard contracts for engineering, equipment procurement, and construction, and recommended revisions to mitigate risks identified with the procurement strategy.

Outcome
The feasibility study was completed in accordance with the client’s requirements and addressed the deficiencies noted in the earlier IPR report. Another review was performed, and the IPR firm identified the following improvements:
• The engineering definition and documentation was completed sufficiently to allow a Class II estimate to be prepared with an accuracy range of +/-15 percent.
• The WBS was structured to allow the estimate and schedule to be organized by process area and work package.
• The project execution plan was properly prepared, identifying the project execution strategy and the roles and responsibilities of the project team.
• The procurement and contracting strategy was properly prepared.
• The basis of estimate documented the methodology, data sources, assumptions, and exclusions in the preparation of the scope of supply.
• The contingency analysis was prepared from the identified risks, ranges of outcome, and probability of occurrence using a Monte Carlo simulation to identify the probable outcomes.

Once the scope of supply definition and the project execution plan had been completed, the estimate and schedule was properly defined and coordinated with the project execution strategies. This resulted in an increase of the project estimate to $447.5 million with a 36-month schedule. Through the risk analysis and scope definition efforts, continuing problems with the innovative technology were exposed. While engineering solutions to these problems were identified and included in the feasibility study, the owner’s management determined it would not be a prudent business decision to proceed until the technology issues could be proven. The project is currently on hold pending this proof.
V. Conclusions

The FEL planning phases are the heart of the project delivery system and have the most influence in affecting the probability of project success in meeting the owner’s business objectives. The phases minimize problems during the implementation and startup/operation phases. The FEL planning process is designed to identify project uncertainties or risk and develop mitigation plans to maintain project objectives. During the FEL process, project risks are typically identified during the development of the project execution strategy or during further refinement of scope definition.

It is essential for project success that contracting strategies and associated procurement risks are properly matched with the owner’s project management capabilities. The identification and evaluation of risks that can impact the business ROI objectives can be managed utilizing cost and schedule risk workshops in conjunction with tools such as Monte Carlo simulation. The results of the simulation are used as the basis for cost and schedule contingencies. The workshops also often improve team members’ understanding of the overall project scope and their respective responsibilities.

Owners find they do not have the internal project management resources to develop capital assets to seize business opportunities. The implementation of a risk management program and resultant strategies are core management processes that may be better served by the use of a third-party facilitator. A facilitator can be engaged early in the project planning cycle to work with the owner’s team to identify the preferred project delivery option and contracting strategies to be employed. A facilitator is also unbiased to internal politics and knowledgeable in industry best practices, has broad industry experience with executing projects under a variety of conditions and parameters, and supplements staff on an as-needed basis.

VI. About the Authors and BRG

Lawrence A. Bastianelli, PMP, CCE

Larry Bastianelli is a senior managing consultant with BRG in Pittsburgh, Pennsylvania. Mr. Bastianelli has over 35 years of experience in project management/project controls in the engineering, procurement, and construction phases of capital improvement programs. His areas of expertise include planning and scheduling, cost control, project execution procedures, contract administration, change management, and claims prevention/analysis. Mr. Bastianelli has extensive experience in the preparation of engineering studies for capital expansion projects in the industrial and manufacturing industries. He has specialized expertise with industry practices established for project development utilizing the FEL process for capital program stage gate development. He is fully versed in CPM scheduling and Primavera scheduling software. Mr. Bastianelli graduated from the University of Michigan with a B.S. in civil engineering. He is a CCE, Certified Cost Engineer, and a PMP, Certified Project Management.

Brad Wolf is a director with BRG in Pittsburgh, Pennsylvania. Mr. Wolf has over 30 years of heavy industrial project and construction experience as an owner, supplier, and contractor. He has held construction positions dealing with marketing, design, project management, process improvements, quality control, and startup in the oil, chemical, power generation, metals, mining, automotive, water, and wastewater industries. Mr. Wolf specializes in providing consulting and expert services to companies in the areas of capital project processes, risk management and mitigation, claim and damage analysis, schedule recovery, various forms of business assistance, contract interpretation, and planning. Mr. Wolf is fully familiar with the various construction contract types including turnkey, design-build, EPC, lump sum, and reimbursable. He has led due diligence efforts in restructuring, turnarounds, joint ventures, mergers, and acquisitions. He has extensive international contracting experience. He is a past member of the Construction Industry Institute’s Re-
search Committee. He received his B.S. in materials engineering from Lehigh University. Mr. Wolf is a Registered Professional Engineer.

Terry Yeager

Terry Yeager is a principal with BRG in Atlanta, Georgia. Mr. Yeager has more than 20 years of experience in general contracting, construction management, and business management to complement the nine years he has provided construction consulting services. He has developed highly specialized skills in estimating, scheduling, project management, and business management. Mr. Yeager has had extensive involvement in design-build business development and execution. His experience, along with his ability to simplify and effectively communicate complex issues, has proven to be an asset to premier owners, contractors and sureties in the United States and Canada. Mr. Yeager provides numerous litigation support, claim mitigation, and project risk management services including master scheduling, estimating, constructability review, schedule analysis, progress analysis, claim preparation–analysis, evaluation of project delay, analysis of resources and productivity, quantification of damages, and training. Mr. Yeager graduated from the University of Arkansas with a B.S. in civil engineering and holds an MBA.

Richard Fultineer

Rick Fultineer is a director with BRG in Pittsburgh, Pennsylvania. Mr. Fultineer is nationally recognized for assisting owners, contractors, designers, sureties, and their counsel with complex construction projects involved in litigation or distress. Mr. Fultineer has over 25 years of industry experience in providing testimony and consulting services in the areas of claims and damages analysis, construction management, mechanical engineering design, and information management. He has participated in the evaluation of a wide range of commercial, institutional, power, oil and gas, and industrial projects, including steel plants, oil refineries, road and bridge work, utility plants, wastewater treatment plants, manufacturing plants, hospitals, airports, jails, stadiums, arenas, commercial developments, and environmental clean-up projects, both in the United States and internationally. Mr. Fultineer received his B.S. in mechanical engineering from Northeastern University and his MBA from the University of Pittsburgh.

About BRG and its Construction Practice

BRG is a leading global expert services and management consulting firm that provides management consulting services, strategic advice, authoritative studies, litigation and regulatory support, and independent expert testimony to Fortune 500 corporations, major law firms, and government agencies around the world. BRG experts and consultants specialize in the provision of sophisticated economic, financial, and analytical advice across a wide range of disciplines including antitrust and competition policy, complex damages, finance, healthcare, intellectual property, valuation, and work force issues. BRG’s experts and professionals are aligned across a broad range of industry sectors such as high technology, financial services, healthcare, energy, transportation, government policy, and construction.

BRG’s Construction practice possesses one of the world’s most respected teams of construction consulting professionals. We provide our clients with a “best-in-class” multidisciplined team. Our construction experts feature consultants with significant practical design and construction experience and a 20-year history of project management advisory services, as well as construction dispute resolution experience spanning all major industry sectors. We bring our knowledge and experience to assist owners in improving their project development and design and construction administration processes. BRG also helps clients solve challenging issues to deliver “troubled projects,” provide claims avoidance and mitigation services, and provide dispute resolution services, including expert testimony.
BRG is headquartered in Emeryville, California, and has 21 offices worldwide featuring construction professionals in Atlanta, Calgary, Detroit, Houston, London, New York, Pensacola, Phoenix, Pittsburgh, San Francisco Bay Area, Tampa, and Washington, DC. BRG offers experienced personnel in each construction discipline including civil, structural, mechanical/HVAC/plumbing, and electrical, and offers specific experience on airport projects. Our personnel have had significant industrial contracting experience prior to their current roles as project management consultants, risk management professionals, and expert witnesses. BRG’s Construction practice consists of professional engineers, certified public accountants, estimators, schedulers, construction management professionals, forensic accountants, financial analysts, and project risk management professionals.

Our senior professionals are internationally recognized construction experts who are frequently called upon to provide expert testimony in federal and state courts, domestic and international arbitration, and before special administrative panels on subject matters that include generally accepted construction accounting/auditing practices, project controls, CPM scheduling methodology, design and construction management practices, and claims.