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A Closer Look: An Overview of Construction Risk

What accounts for high volatility and relatively slim profit margins in the construction industry?

Introduction

In an average year, construction represents approximately 10 percent of the American gross national product, and because of its size and diversity one might conclude that the industry would be both stable and profitable. This is hardly the case, however, as the construction business instead is known for its high volatility yet relatively slender profit margins. The reasons for this are easy to understand: fierce competitive pricing exists at all tiers, sectors, and geographies of the industry while the technical, managerial, and administrative components that characterize today's construction process are growing more elaborate and expensive.

In spite of these challenging “macro-dynamics,” it is important to recognize that, from a “micro” perspective, all construction projects begin with the best of intentions. Unfortunately, in a highly competitive and complex climate that is fraught with risk, unfavorable outcomes can often plague these projects and their participants. Such outcomes might include cost overruns, budget shortfalls, compromised quality, schedule delays, third-party meddling, confusion about scope of work, smeared reputations, bruised relationships, severe financial hardship, and increased underwriting expenses. Troubling situations frequently surface because owners, contractors, designers, oversight agencies, and vendors cannot reliably predict the future, and so are rarely able to assess the true impacts of their decisions until late in the construction program. By then it is often difficult—if not too late—to recover.

In our experience, the extent to which these construction risks can be successfully identified and managed largely determines whether a project meets its schedule, budget, and quality assurance targets. The intent of this chapter is to discuss project risk once appropriately identified, we believe that project personnel can then better monitor and mitigate these risks, and thereby improve project performance.

The Construction Cycle

In most circumstances a project contains four distinct phases which together constitute the “construction cycle.” They can be classified in a number of ways, and are generally known as the (1) planning, (2) design, (3) construction, and (4) close-out phases. Although they may be considered as discrete components, these phases are in fact interdependent and often overlap. On “fast-track” or design/build projects, for example, the timing and degree of interdependence and overlap is much more pronounced than in traditional design-bid-build scenarios. Regardless of the type of project, it is critical that project personnel recognize these interdependencies so that salient risks in each phase can be identified, monitored, and mitigated in timely fashion. The following provides a synopsis of each phase and identifies selected risks associated with them.

The Planning (or Feasibility) Phase

The first phase of most construction projects concerns their technical and financial viability. This planning (or feasibility) phase includes performing a variety of preliminary studies and analyses, which are usually summarized and “packaged” for a variety of recipients. Typically, these summaries are distributed to interested parties such as owner groups, accreditation review boards, investors, financial institutions, third-party oversight groups, and political agencies. Because the planning phase serves as the very foundation and impetus for the project itself, it is critical that underlying assumptions be carefully considered and appropriately factored into these feasibility studies. It is equally important then to articulate the complex and abstract findings in a clear and concise manner, so to gain needed support, consensus, and approval. In our experience, the time horizon needed to adequately plan a project can be as long as—or perhaps even longer than—the time needed to construct the project.

During this phase issues will often surface that require further study, analysis, discussion, and resolution among the personnel involved. Issues that frequently lead to increased project risk during the planning phase include:

- Lack of firm decision deadlines
- Inappropriate or inaccurate baseline assumptions by any or all parties involved
- Inability to gain required support for the project
- Political indecision and/or pressures
- Inappropriate or ineffective communication of findings

The Design Phase

Once the preliminary analyses have been prepared and approved, a project typically enters the design phase. Here, the owner's abstract and conceptualized program is transformed into a tangible set of contract documents and specifications that will be used to physically construct the project. This phase entails a thorough and detailed examination of the project's technical requirements, rigorous coordination among all design disciplines as well as with external oversight agencies, and periodic meetings with the owner for directional concurrence. During this phase, constructibility and "value engineering" become key issues that should be addressed.

If the project is being designed under "fast-track" or design/build scenarios, it is important to recognize that just a portion of the total project design is completed before releasing contract documents for bid and/or construction. As a consequence, the designers do not always have the opportunity to revisit issues or revise calculations at a later date. This places enormous risk on the owner to provide adequate programmatic information in a timely fashion to the designers, and for the design professionals to "design it right the first time." The failure to do so, of course, exposes the project to expensive changes during construction and close-out.

Issues that can lead to increased project risk that are particularly apparent in the design phase include:

- Inappropriate selection and procurement of the design team
- Ambiguous and/or incomplete programmatic input and design requirements
- Inaccurate baseline assumptions made by design team
- Incomplete and/or untimely inter-disciplinary coordination
- Budgetary constraints
- "Last-minute" changes

The Construction Phase

Upon completion of the contract drawings and specifications, the project enters into the construction phase. At this point in the "cycle" bids for the project are solicited the construction contract is awarded and the necessary materials, equipment, and labor can be procured. It must be emphasized that these activities are highly dependent on the quality of the design documents.

Once the contract has been awarded, the project can be built. In today's electronic culture of "real time" reporting, anticipated construction schedules and project cash flows should always be carefully analyzed in advance, and continually monitored and refreshed on a weekly, if not daily, basis. The many risks that must be addressed by a construction contractor include:

- Availability and procurement of anticipated skilled labor, material, and equipment
- Staff turnover, productivity, experience, and training

- Adequate project supervision and controls
- Quality and caliber of the design documents
- Mitigation of design errors, omissions, and ambiguities on the contract drawings and specifications
- Owner-directed changes
- Uncovering differing site conditions
- Less than favorable weather conditions

Close-Out Phase

The construction phase flows directly into the close-out phase. This phase occurs just prior to the project being considered 100 percent complete. It is during this period that a series of administrative and managerial issues must be addressed to satisfactorily bring closure to the contract. These issues include:

- Preparation and completion of “punchlist” items
- Obtaining all necessary permits for occupancy
- Facility testing and building commissioning
- Transmittal of extra materials and spare parts to the owner
- Transference of completed manufacturer warranties
- Start-up of all major equipment
- Preparation of as-built drawings
- Release of lien documentation
- Processing of outstanding invoices for payment

Issues that affect final completion of the project and that often result in increased risk during the close-out phase include:

- Obtaining consensus and closure on outstanding “punchlist” items, which includes concerns related to workmanship, quality, and overly stringent owner expectations
- Obtaining satisfactory inspection and approvals from building department officials related to life safety issues such as fire alarms, evacuation procedures, and handicap accessibility
- Scheduling of testing to coincide with calendars of building inspectors or other authority having jurisdiction
- Preparation, coordination, and delivery of operation and maintenance manuals; as-built drawings; manufacturer warranties; and extra materials and spare parts
- Providing system operation training to owner’s personnel

Types of Construction Risk

A myriad of issues often prevents construction projects from achieving their schedule, quality and financial objectives. Although not exhaustive by any means, the risks affecting a favorable project outcome can be categorized by the subsections below.

Country and Political Risks

Many of the same management skills that are necessary for successful project execution apply to construction projects in all corners of the world. But at the same time, it is important to recognize that there are special differences associated with working in countries other than the United States, and particularly in emerging market countries. These include political and economic risks. For example, a nation's economic performance and political stability exerts considerable impact on construction investment and activity. Issues to consider include a government's:

- Fiscal responsibility
- Monetary policies
- Ability to adjust to internal and external "shocks"
- Terms-of-trade with trading partners
- Availability of resources
- Infrastructure and access conditions
- Shifts in political leadership
- Changes to administrative agendas

Financial Risks

A project's economic viability largely depends on its capital structuring and its ability to attract reliable sources of funding at reasonable terms. These issues are typically quite complex and require rigorous study by financial analysts and accountants during the project's planning phase. Moreover, these issues are compounded when working in countries other than the United States, where tax structures, project equity and ownership laws, and credit availability may be dramatically different. In particular these include:

- Tax structures and incentives
- Availability and ability to obtain adequate credit
- Ability to pay down project debt
- Allocation of project equity among project owners
- Fluctuations in currency exchange rates

Weather and Natural Disasters

Construction sites are highly susceptible to the vagaries of weather and natural disasters. Obviously, such adverse conditions can impact any project schedule. Examples include snowstorms, earthquakes, hurricanes, prolonged high temperatures, and extended periods of rainfall. These types of conditions suggest that special care be taken while planning, designing, and constructing any project. Issues to consider include:

- Proper adherence to earthquake and hurricane building code requirements
- Ensuring that provisions for inclement weather protection is included in the baseline construction bids
- Verification that project schedules anticipate weather that may occur during the performance period
- Assurance that the manpower selected for the project is properly trained, adequately equipped and outfitted, and mentally prepared to work under these potentially adverse conditions
- Consideration of granting non-compensable time extensions owing to adverse weather conditions or natural disasters

Technical Risks

During the planning and design phases it is particularly important that interdisciplinary communication occur in timely, routine, and regimented fashion. The designer should regularly review progress and confirm that adequate attention has been given to quality assurance, coordination of various design disciplines, and manufacturer's specifications. Once construction begins, attention should shift to ensuring quality workmanship and technical contract compliance. Also, alterations in design, changes in scope, and differing site conditions must be monitored. Specific issues to address include:

- Assurance that complete, coordinated contract documents have been produced and distributed to all involved parties
- Use of the most technologically-appropriate building products and processes
- Constructibility of the design
- Design changes during construction
- Differing site conditions
- Availability of materials, labor and equipment from manufacturers and suppliers

Note that if these issues require revisions to the contract drawings and specifications, the resubmittal of shop drawings may be necessary, which usually costs time and money.

Managerial Risks

The success of construction projects hinges largely on the decision-making capabilities of the management team and the professional interaction within this group. We have observed on many occasions how personal attitudes and interaction of the management team can affect this decision-making process, frequently with adverse consequences for the project. While it is impossible to ensure that these interpersonal issues do not permeate through the entire management team, controls can be installed to help all team members appropriately deal with these situations should they occur. Furthermore, it is imperative that skilled, seasoned personnel are placed into positions of management and oversight. In our experience, key issues to consider include:

- Ensuring skilled project supervision is in place
- Making sure project oversight roles are known
- Establishing appropriate project document controls and reporting procedures
- Procuring of adequate labor, materials, and equipment
- Developing and promoting effective working relationships between team members
- Assuring quality assurance/quality control (QA/QC) programs are in place and are followed

Administrative Risks

Construction projects are document-intensive, and administered in a variety of ways that are frequently dictated by owner requirements or by governmental policy. As a consequence, contract administration and compliance is a process-intensive, detail-oriented, and often tedious exercise whose importance cannot be overlooked. When considering administrative-related risk, the following items should be considered:

- The team selection process, particularly for publicly-funded projects that typically mandate a formalized advertisement policy as well as minority-owned participation
- Project correspondence and document distribution procedures
- Timely negotiation and approval of contract changes
- Recognition and distribution of project status reports
- Timely processing of applications for payment
- Thorough documentation leading to substantial completion
- Completion of all close-out procedural requirements

Despite the industry's increasing migration to electronic forms of communication and record keeping, construction projects remain enmeshed in "paper." As a consequence it is imperative, particularly during the construction phase, for timely execution of contract administrative matters using either conventional or electronic (or both) formats. Conversely, untimely administrative actions can delay work in potentially

critical and time-sensitive areas. Regular reporting of project status enables the project team to assess overall project needs and staffing requirements, as well as to anticipate substantial completion and predict future financial obligations.

Environmental Risks

Ideally, every project should address environmental issues during the planning and design phases of the project. These issues typically revolve around special regulations, permits, and approvals required by local, state or federal entities, and can take significant amounts of time and manpower to finalize. It is not uncommon, however, for unforeseen situations to surface during the construction and close-out phases that require prompt attention and swift resolution. When these types of issues are “surprises,” their impact on project schedule and budget can be exponential. As a consequence, special attention should be given to:

- Early identification of hazardous site conditions
- Early identification of archaeological and/or historical site conditions
- Conducting public hearings as required, and compliance with special notification procedures
- Coordination and concurrence from involved governmental entities and interested third parties
- Resolution of easement and/or boundary conditions
- Negotiations with utility companies
- Obtaining required permits (including any special permits)
- Pending legislative initiatives
- Compliance with special notification procedures

When dealing with these issues, the project team should realistically assess the process involved and the time required for resolution and should incorporate it into the project schedule as early as possible

Other Risks

During the construction cycle of any project, many other issues to surface – and in various combinations—that can introduce substantial project risk. Because each project is different, to provide a single, comprehensive list of all these risks would be impossible. Additional factors to consider, however, include:

- Siting of the project vis-à-vis an urban (i.e. accessible) context versus a rural (i.e. remote) context. An urban site often entails logistical challenges in terms of staging areas and traffic detours while a more remote site often contains difficulties related to procurement of equipment, as well as mobilizing and retaining an adequate workforce

- Presence and participation of union labor, which carries potential schedule impacts due to number of available working hours per day, and hourly trade wages for example
- Potential for work stoppage due to labor strikes
- Availability of labor, materials, and equipment, shortages of which can introduce significant schedule disruptions and cost overruns
- Public relations, and the extent of media coverage and media image, all of which play significant roles as to how the project is characterized and perceived by non-participants
- Experience and track record of the project team, using more experienced personnel will increase the potential to offset whatever project-specific issues and risks surfaced
- Provisions for medical emergencies and evacuations
- Proper safety training of all superintendents and workers
- Potential large-scale and petty theft of materials and equipment from the job site

Mitigating the Risks

While it is difficult, if not impossible, to accurately predict the vagaries of politics, weather, and economics, following these straightforward guidelines can mitigate many of the risks that may affect performance on a construction project:

Control Expectations. All participants must have a common and realistic understanding of project schedules, costs, and scope of work. Written and oral commitments must be clear, and optimism must be appropriately tempered. Expectations should be openly discussed prior to the commencement of work.

Use Third-Party Reviews. Benefit from the knowledge and experience of others. Implement periodic peer reviews, independent QA/QC checks, and constructibility reviews early in the process. Use the resultant findings from these reviews to address any identified problems or inconsistencies. Approach the project as a knowledge sharing experience—be ready to accept ideas and suggestions of others.

Monitor Progress on a Routine Basis and Develop Recovery Plans. Evaluating and isolating the root causes of troubling issues can be a complex exercise. This is best accomplished by using a well-defined management structure and systematic cost control system. Once the root causes of trouble have been isolated, project participants should develop methods to effectively resolve these issues. Implementation must proceed rapidly and changes in progress must be monitored continually. Be diligent insist on regular reviews of “the process” as well as “project progress”. Make changes as necessary.

Encourage a Total-Team Approach Among all Participants. Seek input from all of the impacted participants during development of the recovery plan. The extent to which participants "buy-in" to the plan will largely determine its success. Consider implementing a "partnering" program in which all parties actively participate. Incentive programs can also reduce potential project risk.

Avoid Changes. (Particularly during the construction phase.) Although the recovery plan must include room for contingencies, it must also be recognized that contract changes always introduce the potential for schedule delays and cost overruns. At the same time, it must also be acknowledged that changes are a fact of life on any construction project, and when they occur, change directives and negotiated change orders must immediately follow. Periodically review the change order process to ensure that signatures and approvals are being secured and adequate direction is being provided.

Consider the Interests of Others. Recognize that the definition of a successful project can vary among its participants. To some, "success" may mean financial profit to others it may be preservation of a client relationship to a third, it may entail enhancement of a professional reputation. This affects each participant's approach to the risk mitigation process.

Summary

The evolution of an abstract idea into a fully built project can take years, sometimes decades. The process is complex, and requires the creative efforts of dozens of skilled and experienced construction professionals, who along the way are charged with addressing and resolving thousands of difficult decisions. With each decision comes risk, and how this risk is mitigated largely determines the success of the project.

The issues raised in this chapter have highlighted selected issues and scenarios where project risk has been known to develop. While recognizing that (1) each project is unique, and is therefore exposed to varying combinations of these risks and (2) there are no panaceas or "magic wands" that make risks disappear, there are nevertheless effective techniques and strategies that can mitigate these risks. In our experience, learning to identify these issues proactively is half the battle. After that, project personnel can collaborate to reduce the adverse impacts of these risks.

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