



NAC Executive Insights

Alternative Project Delivery Methods

Key Points

- Phases of a project and funding, financing, and project ownership are distinguished from project delivery methods.
- A range of project delivery methods are available and no single method best serves all projects in all sectors.
- Project delivery methods are briefly described and pros and cons summarized.
- Different terminology for the same contracting structures across market sectors is explained.

Introduction

The discussion of alternative project delivery systems is often complicated by a confusion between:

- Phases of a project
- Project funding and financing
- Project delivery method
- Project ownership

This Executive Insight focuses on alternatives, encompassing site selection, financial analysis, and project delivery methods while briefly addressing each of the other points of potential confusion. Terminology differences between various market sectors are highlighted.

Phases of a Project

One of the earliest and most important phases of a project often receives inadequate attention in later stages of project development and execution but can be the prime contributor to a project's ultimate success or failure. This phase begins with the project owner defining the strategic outcomes they are seeking to achieve and further sharpening these strategic outcomes into a series of strategic business objectives (SBOs) (private sector - industrial) or a defining master plan (government sector – infrastructure; private sector – development). Shortcomings arise when these strategic outcomes, whether memorialized by strategic business objectives or a master plan, are not clearly and sharply articulated, agreed to and, importantly, continuously communicated throughout the project lifecycle.

The next phase(s) of a project focus on the translation of these SBOs or master plans into tangible assets that deliver the performance outcomes necessary to achieve the defined and agreed to strategic outcomes. For purposes of this Executive Insight, these phases are defined to include:

- **Conceptual or feasibility phase**
- **Preliminary execution plan**, encompassing site selection; financial and alternative analysis, and related market and demand analysis; and preliminary determination of the project execution plan considering alternative project delivery methods as well as an interplay with funding, financing, and project ownership.
- **Preliminary engineering** or schematic design phase, where facility functional requirements are optimized and firmed up. At this stage, initial health and safety plans are defined. These plans often consider Failure Mode and Effect Analysis (FMEA). Quality management plans are also developed for both design and construction phases. Configuration management plans are put in place to assure continuous alignment with SBOs or master plan. Site and supply chain surveys are conducted, and the preliminary execution plan is refined to provide a detailed basis for the next stages in project execution.
- **Detailed engineering**, which is influenced by the project delivery model selected.
- **Procurement phase**, which is often conducted in parallel with both preliminary and detailed engineering when long lead procurement items are identified together with a material logistics plan. As with detailed engineering, this can be significantly influenced by the project delivery model selected.
- **Construction contracting phase**, which while influenced by the project delivery method chosen (which may move this time line forward), often receives inadequate attention from an overall project scheduling perspective.
- **Construction phase**, which may be further segregated to consider the all important mobilization phase among others
- **Commissioning and startup**
- **Final acceptance and construction/project closeout**

The next phase of the project is typically the longest in duration encompassing the operations and maintenance of the deployed facility. Considerations of this phase must be brought forward into the concept and feasibility phase to achieve desired levels of capital efficiency. It is here where strategic outcomes are realized.

Project Funding, Financing, and Project Ownership

Before turning to project delivery alternatives, it is important to state that the full range of delivery methods are generally available independent of the sources of project funding, financing, and ownership. Given that, risk appetites by the various parties to a project change as project funding, financing, and ownership change. This risk appetite also changes under the various project delivery models discussed in the next section.

Funding addresses how the money necessary to design, build, operate, and maintain the project will be provided over the entirety of a project's life. Financing addresses the sources of capital that will be used to deliver the initial asset so that the strategic outcomes may be achieved. Financing may come from a combination of sources, including equity and senior- and sub-ordinated debt (bank, private party, government; loan or bonds; taxable and tax-exempt).

Project ownership models become particularly important when public-private partnership models are considered. These apply not only to more traditional infrastructure assets, but may be relevant in some portions of the natural resources industry as well.

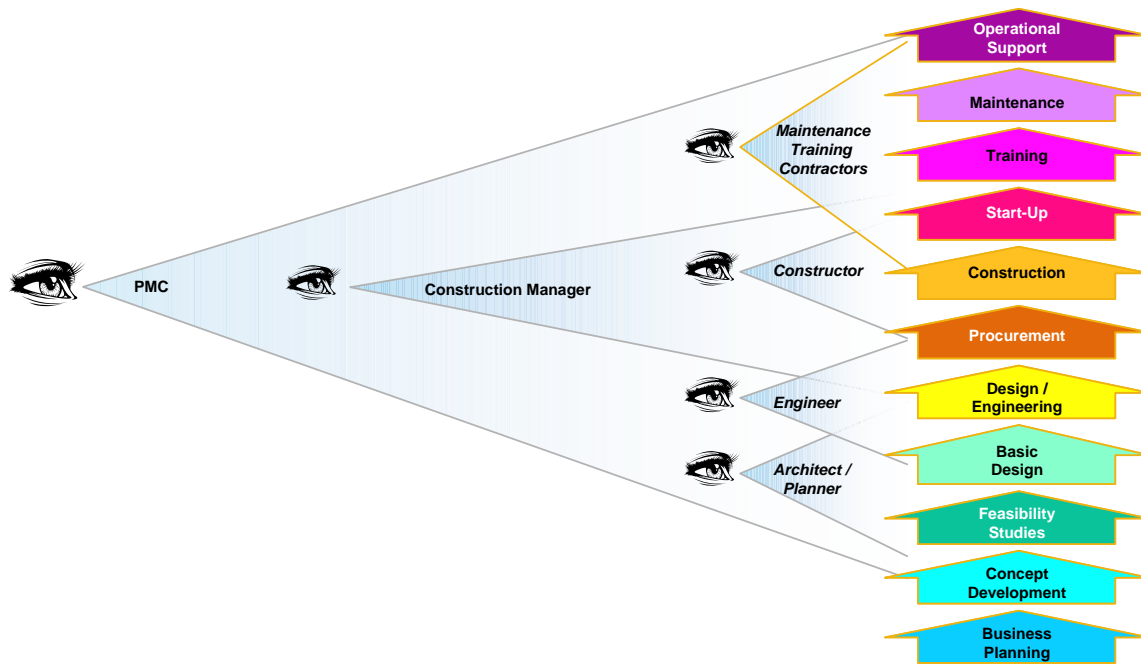
Project Delivery Method

A range of project delivery methods exists and many are described in this section. The principal difference across these various methods can be considered to be:

- The owner's role
- Who owns the various risks

No single project delivery method fits all projects and circumstances. Similarly, risk appetite varies across owners, designers, and contractors. That appetite changes over time and is driven by market conditions, project experiences, and availability of required risk transfer mechanisms (insurances) at affordable levels.

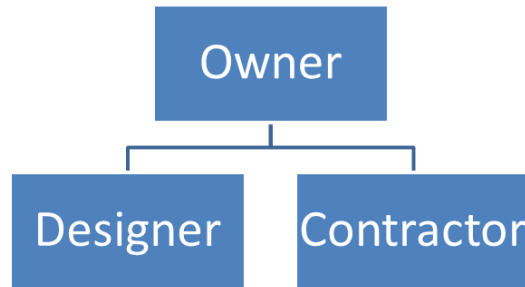
Program Management (PM) or Program Management Contractor or Consultant (PMC) — This method involves overall responsibility in a large project for planning, design, and construction management to be assigned by the owner to one company. Program management may also take a modified form, where one firm has responsibility for overall management of only the planning and design phases. This may be described as a general engineering consultant (GEC) or engineering management consultant (EMC). Such an approach may operate in parallel with a single construction manager or in parallel to the client providing construction management. The degree of owner involvement with the PMC may range from "arms length" oversight through a PMO (Program Management Office) function to a fully integrated "salt and pepper" organization. PMC approaches are increasingly prevalent across various industry segments. Traditional program management usually extends through the end of the capital expenditures (CAPEX) phase while Strategic Program Management can extend well into the operations and maintenance phase.



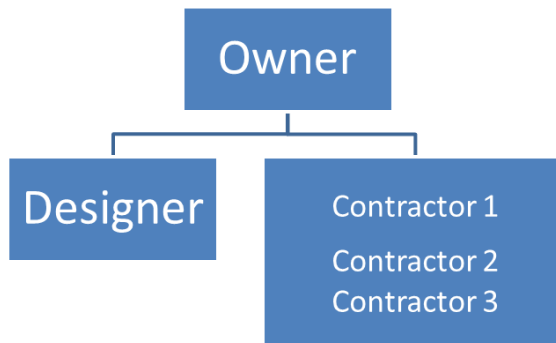
PMC+ — This method extends its traditional program management services, thus the moniker PMC+, by tasking the program manager to undertake certain project “verticals,” such as offsites and utilities, a long lead, critical process unit, or cross-cutting strategic procurement functions that may range from long lead equipment required by multiple contractors or materials sourcing or mod yard or logistics contracting. Assigned “verticals” are typically contracted on an engineer-procure-construction management (EPCM) basis. In some instances, however, this may be contracted on an engineer-procure-construct (EPC) basis. PMC+ changes both the risk profile of both the owner and PMC contractor.

Integrated Project Delivery (IPD) — IPD requires a multi-party agreement among the prime players in the design and construction process, at a minimum the owner, the designer, and the builder. This agreement, however, can include many of the important subconsultants and subcontractors as well. The intention of the multi-party contract, or the closely integrated family of contracts, is a team-based approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication, and construction.

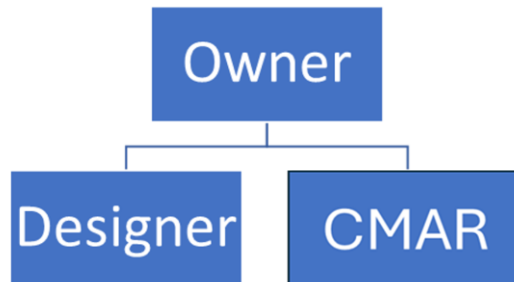
Design/Bid/Build (DBB) — This method involves two separate entities to be engaged for design and construction. A traditional method, engineering services for the U.S. infrastructure are often procured with DBB.



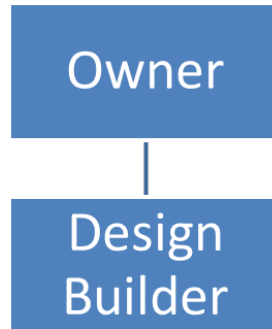
Multiple Primes (MP) — This is a variation of DBB. It uses multiple prime contracting, where the owner holds separate contracts for work disciplines: as general construction, earthwork, structural, mechanical, and electrical. In MP, the owner manages the overall schedule and budget.



Construction Manager (CM) and Construction Management at Risk (CMAR) — With CM or CMAR, the build portion of the project may involve multiple construction contractors with the owner supplementing their oversight capabilities with a dedicated construction manager (CM). The CM will have a range of responsibilities that are often determined by the owner’s capabilities and capacity. The use of a CMAR transfers owner responsibilities, authorities, and risks to the construction manager at risk, either in whole or in part. Both CM and CMAR represent variations to the DBB approach.



Design/Build (D/B) or Engineer-Procure-Construct (EPC) — Here, one contractor has the single responsibility for design and construction. D/B is also known as engineer-procure-construct (EPC). This approach may be taken for a segment of a larger project or for an entire project. This delivery system is sometimes referred to as “turnkey.”



Engineer-Procure-Construction Manage (EPCM) — With EPCM, one contractor has the responsibility for engineering and procurement and then acts in a role similar to the dedicated CM described above. While typically a reimbursable contract, portions may be undertaken at risk similar to a CMAR. An EPCM with total construction responsibilities at risk is referred to as an EPC contractor.

Bridging or Progressive Design/Build (Progressive D/B) — Bridging is often used in design/build projects to help the owner refine project requirements in order to assure compliance with programmatic needs and to prepare a solicitation for a design/build. The owner hires an architect/engineer to develop 10 to 15 percent design documents (plans or BIM model), and outline specifications and programmatic requirements. The design/build team works collaboratively with the owner’s staff to prepare final plans, specifications, and designs and carry out the construction phase.

Design/Build/Operate/Maintain (DBOM) — Here, one contractor has responsibility for design, construction, and operation and maintenance of the project for a fixed period of time.

Design/Build/Finance or Finance/Design/Build (DBF or FDB) — This delivery method involves one contractor with the single responsibility for design, construction, and financing of the project.

Design/Build/Operate/Maintain/Finance (DBOMF) or Build/Operate/Transfer (BOT) — This method uses one contractor for responsibility for design and construction and to operate the project for a period of time. The contractor will then transfer the facility to the client’s organization. Financing is typically involved, although ownership through this period of time is maintained by the client.

Build/Own/Operate/Transfer (BOOT) — Here, one contractor has responsibility for design, construction, ownership, and operation for a period of time, after which ownership and operation are transferred to the client’s organization.

Build/Own/Operate (BOO) — This is really the privatization of a project—namely, the complete transfer of responsibility for designing, building, owning, and operating a facility, typically but not exclusively, in the public sector.

Public Private Partnerships (PPP) — These type arrangements may encompass DBOMF, BOT, and BOOT but exclude BOO, which is privatization of an asset.

While each of the delivery systems above refers to a singular contractor, it is common for these contractors to be joint ventures of two or more firms.

Comparison of Project Delivery Systems

The following table presents several characteristics of the various project delivery systems. This comparison is not comprehensive. Rather, it provides an initial understanding of the similarities and differences between them.

Comparison of Project Delivery Systems			
Project Delivery System	Pros	Cons	Contract Form
PM or PMC (Program Management or Program Management Consultant/ Contractor)	<ol style="list-style-type: none"> 1. Advantages when applied in a multiple project environment. 2. Comprehensive and clear overview of all the active projects. 3. Early identification, escalation and resolution of issues. 3. Change authorization coupled with impact assessment and control. 4. Early identification and forecasting of resource conflicts or competition. 5. All project documents held in one central data base. 6. Consistency of approach, management and reporting. 	<ol style="list-style-type: none"> 1. Potential to become too bureaucratic. 2. May impose too many constraints on the project process. 3. Inadequate attention to articulating, obtaining agreement on and continuously communicating the programs strategic business objectives (SBOs). 4. Interfaces (offsites and utilities) receive inadequate attention at scale. 	Cost reimbursable

	<ul style="list-style-type: none"> 7. Clear responsibility and authorities. 8. Knowledge sharing aids continuous improvement and innovation. 9. Constraint coupling more easily identified. 		
PMC+ (Program Management Contractor +)	<ul style="list-style-type: none"> 1. PMC advantages as described above. 2. Sharpened focus on interfacing works, such as offsites and utilities. 3. Mobilization of significant contractor resources in differentiating areas. 4. Ready capability to augment or replace underperforming contractors managed as part of the PMC role. 	<ul style="list-style-type: none"> 1. "Plus (+)" works best executed on a lump sum. EPC basis requires sophisticated owner capabilities in scope and contract negotiation. 2. Segregation of costs between PMC and "plus (+)" elements of work is required. Added audit required by owner. 	Cost reimbursable (PMC) and either EPC/DB (preferred) or EPCM.
IPD (Integrated Project Delivery)	<ul style="list-style-type: none"> 1. Alignment of goals. 2. Team based approach. 3. Multi-party agreement such that all stakeholders work as one. 4. Collective management. 5. Contractually required collaboration. 6. Shared risk. 7. Optimizes use of technology (BIM, EPM, LEAN) in project development. 	<ul style="list-style-type: none"> 1. Extensive planning required. 2. Potential for forced integration of project team members. 3. Long procurement. 4. No buy in by team members. 5. Lack of education. 6. Lack of legal precedents. 7. Still new to the industry. 8. Not an apples-to-apples supplier base. 9. Difficult to apply to public sector contracting. 	Cost plus incentives.

<p>DBB (Design/Bid/Build)</p>	<ol style="list-style-type: none"> 1. Familiar process that promotes competition. 2. Owner maintains significant control. 3. Maximizes risk transfer to contractor. 4. Less costly to administer. 	<ol style="list-style-type: none"> 1. Longer time to market. 2. Owner responsible for design errors and omissions (Spearin risk). 3. Potential adversarial relationships. 4. Limited or no early contractor involvement. 	<p>Cost reimbursable (design); (may be lump sum or fixed price design for all or portion of design in select instances; fixed price/lump sum (construction); unit rate or adjustment factors may also apply.</p>
<p>MP (Multiple Primes)</p>	<ol style="list-style-type: none"> 1. Greater subcontractor control. 2. Greater price visibility. 3. Savings on general contractor's fees. 4. Supports phased or fast-track construction. 	<ol style="list-style-type: none"> 1. Contracts with multiple entities. 2. Owner assumes coordination role of the GC. 3. Owner responsible for schedule, cost, quality control in addition to design errors and omissions. 	<p>Cost reimbursable (design, similar to design in DBB); fixed price/lump sum (multiple construction primes); (select reimbursable or force account work on unit rates may be included as a separate contract or in one or more of the construction primes).</p>
<p>CM (Construction Manager)</p>	<ol style="list-style-type: none"> 1. Supplements owner's CM capabilities and resources. 2. Provides owner with maximum flexibility and control throughout project. 	<ol style="list-style-type: none"> 1. Full project risk retained by owner until all construction packages bought out. 2. CM is not responsible for the faults of the contractors. 3. Firm project cost not established until later in the project timeline. 	<p>Cost reimbursable.</p>
<p>CMAR (Construction Manager at Risk)</p>	<ol style="list-style-type: none"> 1. Similar to D/B/B. 2. Greater visibility to subcontractor pricing. 3. Construction input during design phase. 	<ol style="list-style-type: none"> 1. Similar to D/B/B during construction. 2. Owner involvement in contractor selection may create performance challenges for the CMAR. 	<p>Cost reimbursable (to upset limit or with gain/pain provisions).</p>

<p>D/B; EPC (Design/Build or Engineer- Procure- Construct)</p>	<ol style="list-style-type: none"> 1. Greater speed to market. 2. Owner not responsible for designer errors and omissions. 3. Early contractor involvement. 4. Greater potential for offsite fabrication. 5. Increased opportunities for optimization and innovation. 	<ol style="list-style-type: none"> 1. Some loss of control over design. 2. Greater sophistication needed to administer the contract. 3. Speed of decision making required. 4. Competitively bid D/B may focus on lowest capital cost vs. lowest life cycle cost/performance. 	<ol style="list-style-type: none"> 1. Many variations, fixed price, guaranteed maximum price (GMP), cost reimbursable, and other.
<p>Bridging</p>	<ol style="list-style-type: none"> 1. Greater owner control of preliminary or schematic design phase. 2. D/B contractors all bid against the same schematic design. 3. Greater control on life cycle costs and performance. <p>Owner’s exposure to construction claims reduced.</p>	<ol style="list-style-type: none"> 1. Early contractor involvement reduced. 2. Overall project schedule extended. 3. Owner changes after award of D/B contract potentially even more expensive than in traditional D/B. 	<p>Cost reimbursable (preliminary design); lump sum D/B contract.</p>
<p>EPCM (Engineer- Procure- Construction Manage)</p>	<ol style="list-style-type: none"> 1. Lower overall cost, no mark-up due to contract risk; owner retains competitive pricing advantage. 2. Owner staff sense of ownership strengthened. 3. More control over process. 4. More transparency on project costs. 5. Well-suited for less defined projects with anticipated changes to scope of the contract/supply chain. 6. Less litigation—teams can identify issues early and remedy situation before larger problems arise. 7. Owner’s financing flexibility. 	<ol style="list-style-type: none"> 1. Owners carry most of the risks. 2. Increased effort of the owners is required because of the heavy involvement in day-to-day operations. 3. Potential for gap in scope coverage between the contractor and vendors/suppliers. 	<p>Cost reimbursable (may include certain negotiated fixed overheads).</p>

Progressive D/B	<ol style="list-style-type: none"> 1. Simple, inexpensive, quick procurement process. 2. Potential for increased owner participation. 3. Flexibility to complete work based on funding. 4. Owner can reject lump sum or GMP without significant project delays. 5. Better chance of designing to budget. 	<ol style="list-style-type: none"> 1. Construction cost is not known at the time of initial contract signing. 2. Cost determined through negotiated and competitive processes. 	Cost reimbursable converting to progressive lump sums.
DBOM (Design/Build/ Operate/ Maintain)	<ol style="list-style-type: none"> 1. Single point of responsibility for performance of the facility. 	<ol style="list-style-type: none"> 1. Owner has limited involvement in decision making until the project is transferred in operations. 	Lump sum (D/B) and either lump sum or performance based compensation (output, availability) during O&M phase.
DBF; FDB (Design/Build/ Finance or Finance/Design /Build)	<ol style="list-style-type: none"> 1. Owner does not assume financial responsibility for the project until it is fully commissioned and meeting performance specifications. 	<ol style="list-style-type: none"> 1. Owner has limited influence on the details of engineering or construction. 	Lump sum (may include output/ performance and schedule penalty/ incentives.)
DBOMF; BOT (Design/Build/ Operate/ Maintain/ Finance or Build/Operate/ Transfer)	<ol style="list-style-type: none"> 1. Owner retains project ownership, but does not carry cost of project on balance sheet until transfer. 2. Transfer occurs after a defined period or when the project has reached a defined level of financial performance. 3. One entity responsible for performance of the facility. 	<ol style="list-style-type: none"> 1. Owner has limited influence on the details of engineering or construction. 	Concession type contract.
BOOT (Build/Own/ Operate/ Transfer)	<ol style="list-style-type: none"> 1. Owner does not carry cost of project on their balance sheet. 2. Ownership transferred after a defined period of time. 	<ol style="list-style-type: none"> 1. Owner has limited influence on the details of engineering or construction. 	Concession type contract.

<p>BOO (Build/Own/Operate)</p>	<p>1. Owner completely transfers responsibility of the project to a private party and pays for services, outputs, or benefits it receives, if any.</p>	<p>1. Owner has limited influence on the details of engineering or construction. 2. Owner’s ability to adjust facility focus diminished or non-existent. 3. Owner may be precluded from developing a competing facility.</p>	<p>Sale contract.</p>
<p>PPP (Public Private Partnership)</p>	<p>1. Funds public projects through private finance. 2. Variety of models available (for profit/not-for-profit; revenue/availability; fixed/variable tenor). 3. Sharpens outcomes focus of owner. 4. Private finance leverages private sector performance. 5. Focus on maintaining a state of good repair sharpened, defined, and funded.</p>	<p>1. Owner-driven changes often prohibitively expensive. 2. Removal of non-performing developer/contractor may be difficult.</p>	<p>Concession type contract.</p>

Summary

This Executive Insight provides an overview of some of the various alternative project delivery systems available to owners. Additional delivery systems and variations on each may be found in numerous countries around the world, where different capabilities and legal and contractual frameworks are available. Key for any project is selection of the most appropriate delivery method for the challenge at hand. Owners may find that a combination of delivery methods may provide the best solution on large complex projects.

About the Author

Bob Prieto was elected to the National Academy of Construction in 2011. He is a senior executive who is effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering, and construction industries.

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