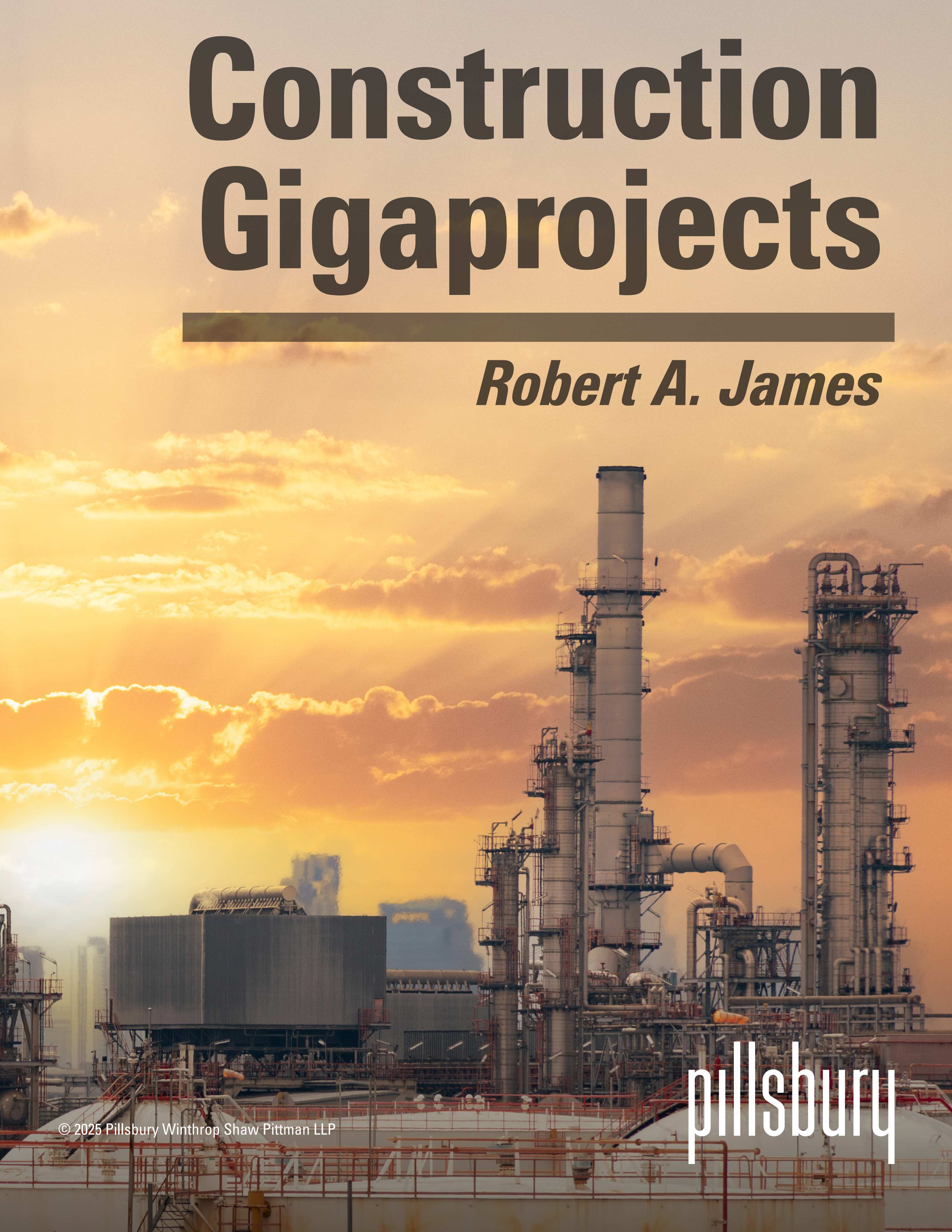
Construction Gigaprojects

Robert A. James



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INTRODUCTION

What is a construction "gigaproject," beyond an amped-up marketing term for the comparatively modest "megaprojects"?[1] Think initiatives with expenses of well over $1 billion and time periods of well over five years. Think engagements whose extraordinary size, duration and complexity might induce even the most seasoned of project professionals to rethink how they "do contracts."

The prospect of a gigaproject does not so much raise new questions as call for the careful reconsideration of otherwise established answers. What alternative forms of contracting might one use, how might they allocate economic and project risks, and what compensation might drive the parties' behavior? Here I address transfers of risk and schemes of compensation both as a static matter—for an entire engagement—and as a dynamic matter—morphing over different times or among different scopes of work. I also consider how good or poor execution can affect the success of a project, no matter what contract form is used.

Why should the fact that a project is *big* make you think an agreement might be *different*? Why should the contract for a project that takes a decade be different from the contract that might be over in 10 months? And if you do think anew about contract types, which types should you be thinking about? There are the conventional structures that we regularly see for normal jobs. For gigaprojects, variations that are rarely encountered in day-to-day contracting have emerged, particularly for engagements entailing unusual exposures or limited competition.

These traditional and alternative structures can address distinctive risks—call them "gigarisks"—contingencies that may not loom on smaller-scale jobs, but that can almost be represented and warranted to show up in endeavors that are big enough and that last long enough. Different compensation methods can be injected into each of these structures. The goal of this discussion of structures, risk allocations and compensation incentives is to aid in the selection and design of a structure appropriate for a particular gigaproject.

But selection and design are only part of the distinctive task—there is also implementation. The best contract structure in the world won't do well if you don't execute properly. If you don't enforce the terms, if you don't process the information being made available to you, if you don't muster sufficient owner-side resources to meet the skill set of the sophisticated service provider community, then any form is likely to fall short of expectations.

Two overarching insights became apparent in compiling these observations. The first is that you don't have to pass all the risks at once, and you don't have to use a single form of compensation throughout a project. You can divide a job into time phases or scope segments, or both. Both time and scope can be associated with different allocations of risk, and with different compensation schemes. While a simple project contract may feature a fixed initial dollar amount and a single risk allocation, a gigaproject might lead you to mix and match different arrangements for different phases or segments.

The second insight is the complicating relevance of independent funding sources. The owner and the contractor may identify the most efficient particular contract type, risk allocation and compensation scheme to use, as between themselves. But if an outside financing source is involved, a challenge appears that resembles the three-body problem in physics. It becomes very difficult to assure the financer that its interest is adequately protected without depriving the owner and contractor of the very benefits they sought to achieve. The disconnect between financing conditions and commercial requirements, particularly at early stages where costs and risks cannot be reasonably evaluated and borne, may prevent the gigaproject from advancing at all.

WHAT IS A GIGAPROJECT, AND SO WHAT?

The definition of a gigaproject begins of course with gigabucks, the expenditure of big money. The "giga" concept connotes expenses literally in the billions. But why should that make a difference for our purposes? Why should the number of digits make a distinction in your contracting?

For some projects, a lot of money may *not* make a difference. If you are procuring an item at very high expense, but it's a single piece of equipment that gets bolted into an existing factory and connected to existing utilities, input sources and output destinations, all accomplished in turnkey fashion by a vendor or contractor, maybe the contract won't differ from the one you used last Tuesday to buy and install a factory air conditioner.

But most of the jobs we talk about as gigaprojects also get gnarly in one way or another. Take, for example, a carbon capture and sequestration development, sometimes shorthanded as a unitary CCS "project."

- The CO2 is captured inside an industrial facility like an electric power or hydrogen production facility. An amine scrubber or some other chemical process extracts CO2 from the waste stream, the fuel stream or the combustion stream. That is a petrochemical project, and you would expect a petrochemical contractor to be involved.
- The captured CO2 is transported on a pipeline across linear rights of way, using sealed pipe unlike conventional oilpatch pipes. That requires sophisticated technology associated with a different and limited set of pipeline owners and contractors.
- The transported CO2 is injected into pore space in the deep subsurface. That is the province of oil and gas or geothermal companies and the contractors that support those firms.
- Finally, there is a monitoring and verification process that goes on for decades. You need an entity with financial as well as operational capabilities, and the willingness to deploy them for the long term. Such an outfit is distinct from the construction contractor community, which likes to finish one job, get its security released, recharge its bonding capacity, and go on to the next job.

Thus, even something called a single “project” might itself consist of very disparate technologies, contractor pools, risks and time horizons.[2]

A gigaproject may be associated with new technologies, or with new applications of old technologies. One of my current projects involves wastewater treatment using technology employed for years in several countries, for many kinds of effluent. But it has never been used for our specific agricultural product stream, and it has never been used in a country in our geographic region. The design-builder and the prospective operation and maintenance contractor have both advised us that this is therefore a new application, and requires different risk allocations than what they clearly agreed to bear in precedent transactions elsewhere.

Gigaprojects often entail larger numbers of entities. I once worked on a large groundwater replenishment project for a water district and a sanitation district. But this client was not a joint venture—our contractor client faced two owners. Both owners had to lift their paddles up to approve things that our contract called for to be decided by a single “owner.” Each of the districts had an engineer, and it sometimes seemed one was trying to one-up the other at our expense, thinking of new things for their contractor to do.

Even in the absence of multiple owners or contractors a gigaproject often involves joint ventures, on either the owner side or the contractor side, where those governance issues are still present but must be thrashed out inside the venture. Gigaprojects also frequently are governed by multiple agencies, and have to withstand discrete, overlapping or conflicting reviews by all the jurisdictions to which a project is subject.

Then there are the risks distinctively raised by a long duration. If you are doing a project expected to last 12 months, you can pretty safely consider that the world is going to stay pretty much the same. But if you launch a project that will run for a decade or longer, it is time to prepare for assured dramatic change—whether in the confines of the project itself or in global factors.

Within the bounds of the project itself, one must accommodate changes in owner and construction-manager competencies and contractor staffing. Institutional memory is not guaranteed over 10 years, during which time people will definitely come and go. Contract structures have to build the discipline needed to establish processes that can be replicated with new people, as teams inevitably begin to turn over. Gigaprojects will be finished by people who were not present at their creation.

Outside the bounds of the project, the project professional must anticipate things like changes in financing, changes in interest, inflation and currency exchange rates, changes in political parties, potential pandemics, and changes in macroeconomics, politics and technologies. And the participants must also tolerate *unanticipatable* surprises along the way that can (and, over a sufficiently long duration, will) challenge the project.

Front-end loading (FEL), planning efforts prior to commencement of the principal contract or contracts, may be shortened or omitted in small-scale projects. But FEL is essential to manage the length and breadth of a gigaproject. The teams responsible for putting the contracts together need and deserve at the outset a clear picture of what it is that all are aiming for in the end. FEL processes can produce reliable reference documents that can be used in the course of later design and construction.

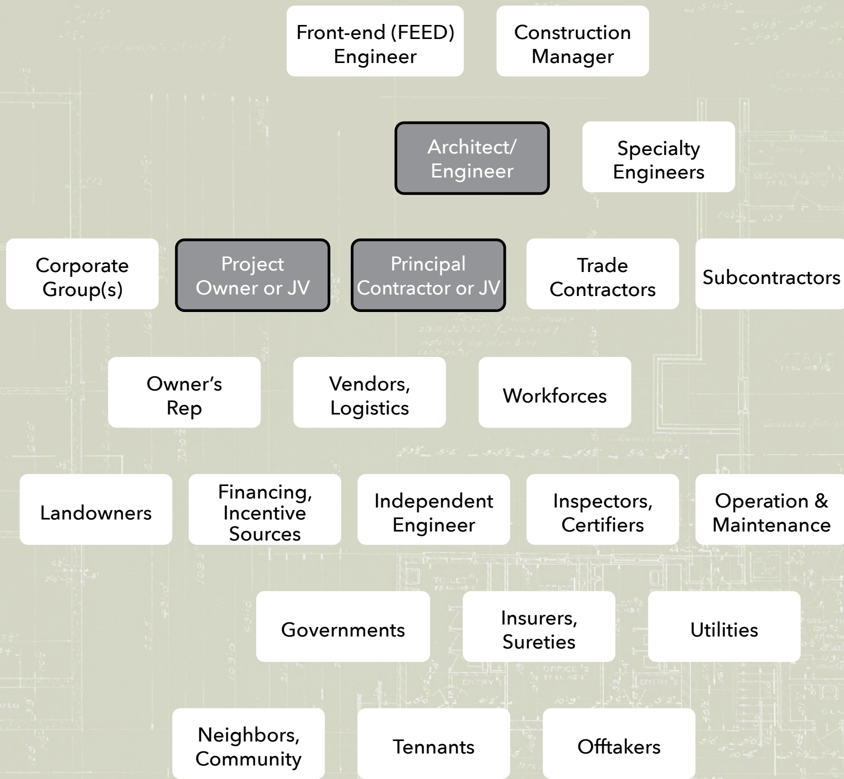
Supply chains are an *X* factor in gigaprojects. For short-term projects, "supply chain" may simply be the inventory on hand of the vendor in question. Over a medium term, the chain may be focused on inventory kept in the jurisdiction where the project is located. But over a "gigaterm," the chain is often founded on overseas inventories, and on inventories that have not yet been manufactured. New models of equipment may just be conceptual at present, and are to be designed, fabricated and delivered toward the end of your project.

The contracting pool is shallow for gigaprojects. As my CCS example indicates, there may only be a few contractors that are available for a particular element, much less the entire combination of elements. The shallow-pool problem is compounded because *when you want to do a gigaproject, so does everyone else on your block*. If you feel market conditions justify expanding your production facility, guess what? That's also the case for brand *X* and brand *Y* that you're competing with. Thus, the relatively small number of potential bidders is further constrained right when you want them.

Contractors are additionally limited in how many projects they can take on by their own business capacity. They only have so many project managers, engineers and other professionals to draw on; the human element can never be underestimated in the construction industry (or any other). There are also financial limitations, notably in security for performance. Surety bonds, letters of credit or other products may not be available for a gigaproject either because of a contractor's own challenges, or because of conditions in the broader credit market.

It is one thing to find a contractor that is capable of *managing* gigarisk. It is quite another to induce one with those skills to be willing to *assume* that risk. The paradox, of course, is that those who are best able to manage risk may be the most reluctant to expose their balance sheets to gigaprojects in the robust manner they might for smaller jobs.

Gigaprojects thus have features distinct from lesser undertakings. That distinction suggests using a clean whiteboard to visualize contract relationships and obligations.



GIGAPROJECT CONTRACT STRUCTURES

There are a multitude of entities involved in even a modest construction project, and the numbers and types of companies increase dramatically for a gigaproject. Above is a sample chart. It's very simple—to form your contracts for a job, all you need to do is connect the boxes!

The focus of my observations is on the shaded boxes, which represent the project owner, the principal contractor, and the architecture or engineering firm. But the contract drafter should have in mind how the other boxes will ultimately connect with the inner trio.

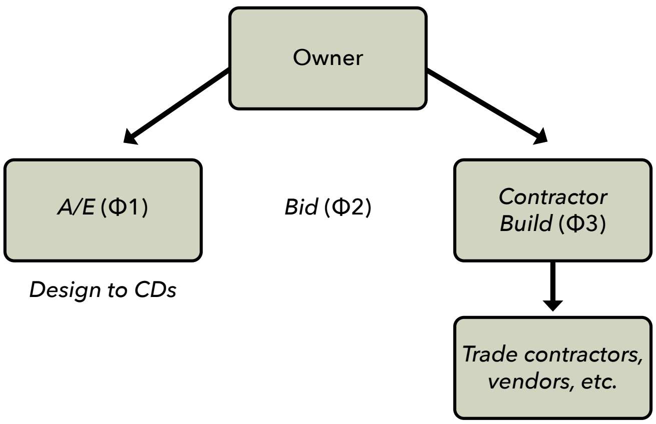
The process of crafting a gigaproject, if not the result of that process, is roughly the same as for smaller quarry. The first step is determining which companies are parties to any given contract. Integral to that decision is defining the scope of each of those parties' obligations. In delineating those responsibilities, the agreement will allocate a variety of economic and project risks. Those allocations may be intentional and explicit, in the terms of the contract or buried in some exhibit, or they may be unintentional or implicit, according to the vagaries of the background governing law. For gigaprojects, that choice of law may not be obvious, and there may be multiple jurisdictions and forums to take into account.

A further fundamental issue is what kind of compensation scheme is to be used—usually a fixed price; a reimbursable-cost model with or without a guaranteed maximum price (GMP); a price per unit of input or output; carrots and sticks like bonuses and liquidated damages; or some combination thereof. The compensation scheme will, for better or worse, incentivize the party's behaviors—whether you intended those behaviors or not.

In this review of contract structures, I begin with forms that have been traditionally used in construction—design-bid-build (DBB) and engineering, procurement and construction (EPC).[3] I then move on to the most frequently encountered structures for gigaprojects, engineering-procurement-construction management (EPCM) and formal front-end loading (FEL). Finally, I turn to variations on these themes, including separation of risk and compensation schemes for time phases and scope segments, repeat supply chains, and alliance or integrated project delivery (IPD).

DESIGN-BID-BUILD (DBB)

The most common structure in the United States remains DBB. In construction law, we are refreshingly direct—we tend to say what things really are. Design-bid-build is "design, bid, build"—there's someone who's designing, there's a bid process, and there's someone who's building.



This graphic illustrates what might be called a pure DBB regime. The owner has a direct contract with the designer (either an architect or engineer) for preparation and delivery of completed designs. The owner takes the completely finished designs and uses them to solicit bids for construction according to those plans. Then the owner enters into a contract with the selected builder for the construction of the work.

DBB is rarely as simple as this picture would suggest. Often designs for specialty systems like mechanical, electrical, plumbing and fire safety are generated by a "design-build" subcontractor working for the contractor. Specialty designers and consultants may be hired by the owner in addition to the main engineer. Sometimes the engineering firm that prepares the design is intended or at least invited to bid on the construction. Those nuances aside, the key attribute of DBB is that the owner sits in the middle of the process, having separate contracts with different entities responsible for overall design and for construction.

Some aspects of that separation are helpful to many of the participants. The owner can instill competition among potential service providers at each of the different phases. Finished plans in principle can reduce uncertainties and disputes and ensure alignment with the owner's programmatic intent. The owner enjoys a direct and exclusive relationship with the designer of its precious vision, rather than having the designer and contractor both across the table. Public works laws frequently require DBB because of the competition aspect; indeed, in many states, one must hunt for an exception allowing the consideration of other contract types.[4]

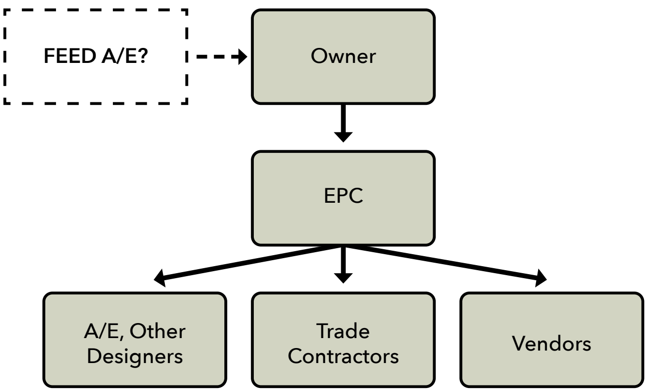
DBB also has drawbacks. The very separateness of the owner's connections to the designer and contractor means that people will be able to point fingers at one another: "It's not my fault that the work is [behind/defective], it's the [other person]." Since DBB depends on having completed designs available to solicit bids to begin construction, the owner loses the benefit of having the construction company at the table in the early planning process. It complicates efforts to achieve efficiencies through "fast track" construction, in which early elements of the improvement are built or procured before the interior designs are completed.

DBB still makes sense for some; the benefits of competition and owner control over the designers sometimes make up for the lack of what is reverently called a "single point of responsibility." It is nonetheless instructive that private entities that have a choice in contracting methods, unconstrained by public works laws, regularly prefer the other structure types. That preference is augmented in the realm of gigaprojects.

ENGINEERING, PROCUREMENT & CONSTRUCTION (EPC)

EPC is a tried-and-true form of contract, used broadly across many types of industrial projects. It has been around for a good long while. Indeed, when construction projects lawyers shorthand their entire practice specialty when talking to other lawyers, they usually just say "EPC."

A common variant, particularly in commercial improvements, is design-build. D-B has a similar structure to EPC but often omits industry-specific scopes like commissioning and achievement of performance guaranties. Here, I use the term EPC for these alternates.[5]



As you can see from this diagram, the key distinction from DBB is that in EPC the owner contracts with an entity as a "single point of responsibility," or more brutishly and colloquially, "one throat to choke."

The EPC entity on paper is responsible for designing, procuring and building the project in a complete manner, turning over the keys (hence "turnkey") when the work is complete. It's a great tool for an owner who doesn't mind being less involved in the details of its project. Unlike DBB, the owner does not stand in a direct relationship with the designer. The designer now works for, or with, or as the contractor. It thus approaches design intent questions from the standpoint of the contractor, mindful of the risks and cost exposures that have been allocated to the EPC entity. An owner that really wants to be heavily involved in all the design and constructability decisions may not be well served by a form EPC contract.

In the DBB world, designers were often joined at the hip with their owners. They were the owners' greatest advocates. They were often assigned in standard contract forms the role of initial decision makers for interpretations of designs, and even for owner-contractor disputes. EPC deconstructs those traditional designer roles.

(As an aside, one should not be tied to a particular risk allocation simply because of a label like "DBB" or "EPC." Calling something or someone an "EPC" is no excuse for not examining the facts and the objectives to see what type of contract is in order. We do a disservice if we feel that we're confined to the structures of a form. If you do start with a form, embrace the possibility of substantial changes.)

Conversely, the EPC is a great favorite of financing entities. Banks adore that single point of responsibility feature. It's easier for their payment source, the owner-borrower, to point its finger at one party, the EPC contractor, because any given problem involves performance or design or both, and with EPC both performance and design risks are broadly assigned to that entity. If there is one opinion that is universally shared by financers, it is they don't want their borrower to be on the hook for project mistakes. They want assurance that their borrower has the cash flow (whether from plant operation or receipt of liquidated damages) to service payments of principal and interest, not to settle claims for delays and extras on top of the budget and completion schedule. They pressure owners in order to have a much clearer line of responsibility, and owners feel correspondingly compelled to move those risks to an EPC contractor.

What's not to like about EPC? Several things. The separation of owner from designer is one downside. The designer is no longer in complete alignment with the owner's interest. If risks are transferred to an EPC at an early state of planning, that can lead to higher prices and to schedules full of contingency padding.

Contractors, designers and subcontractors typically do not carry assets on their books sufficient to absorb large losses. For them to shoulder project risks at all, they need to build in compensation and schedule float as an initial safeguard, while transferring—for a price—some quantum of risks to subcontractors, insurers, sureties and others. They

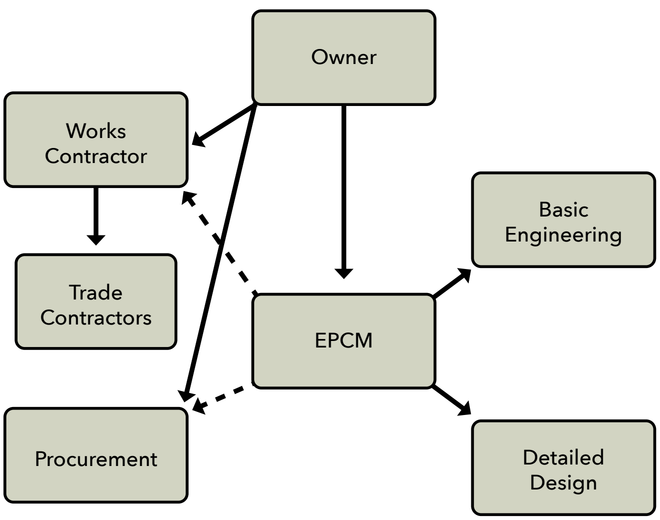
must then build the accumulated cost of bearing those exposures into the price charged to the owner. As the project size mounts, even those strategies become insufficient to induce the services provider to take on the risks.

The owner of a gigaproject sees it as part of a decades-long business plan. That company may have the ability to absorb a much larger range of cost and schedule impacts. This owner-contractor distinction is not always present; the abilities of a small or thinly capitalized owner, and those of a large, sophisticated contractor to withstand project risks, may in fact be reversed. But either way, there is often an asymmetry in the ability of the two parties to absorb, transfer or mitigate gigarisks.

All of this discussion of the benefits and detriments of EPC on an ordinary project—a megaproject or kiloproject, if you will—is frequently moot in a discussion of viable options for gigaprojects. The storm cloud on the horizon is that there are major firms that are not doing EPC anymore precisely because of the risk they are being asked to take.[6] That reluctance increases as the project size, duration and complications mount. That is why we are talking about alternative structures for gigaprojects.

ENGINEERING, PROCUREMENT & CONSTRUCTION MANAGEMENT (EPCM)

We now move to alternative structures for gigaprojects. Foremost among the alternatives is EPCM, or “engineering, procurement and construction *management*.” EPC*M* instead of EPC. Oh, what a difference that one letter “M” makes![7] The EPC agreement is a *tool-belt contract* whose scope includes the undertaking to perform (whether by the prime contractor or through subcontractors) physical improvements to real property. The EPCM agreement is a *white-collar contract* whose scope consists of managerial and engineering services.



This graphic resembles a schematic for a poorly conceived backyard football play. The EPCM relationships are much more complex than those in an EPC. On the diagram, the solid lines show contractual responsibilities, while the dotted lines show administrative or supervisory responsibilities. The owner may hold the principal “works contract” or the subsidiary “trade contracts,” but it is the principal contractor, the EPCM, whose responsibility it is to manage those contracts on the owner’s behalf.

The primary conceptual difference from EPC is that the EPCM contract is not primarily founded on risk shifting. This agreement is an instrument that allocates relatively modest liability exposure. To be sure, the EPCM bears a duty of professional care for its own performance of construction management activity and its engineering and procurement roles. But its exposure is usually confined to its own oversight responsibility; the EPCM is not fully responsible for the ultimate success of the project.

In fact, it is not easy to describe in an objectively measurable and enforceable way what *is* the EPCM’s duty. It is even more difficult to separate failures of the trade contractors from those of the EPCM. Who failed? Was it the trade contractor because the trade contractor didn’t get it right, or was it the EPCM because the EPCM failed to manage the overall job appropriately? Moreover, the EPCM is also acting at the behest of the owner. The owner might itself have been engaged in interference, delays or variance from the contract terms. The owner will always have some voice and some role, and therefore some limitation in its ability to transfer exposures or enforce that transfer.

The same is true for procurement and for issues with vendors. Although the name is E*P*CM, the “P” often refers only to procurement *management*, that is, buying equipment in the name of the owner using the owner’s purchase orders. That puts the owner, not the EPCM, in the line of contracting with the vendors and the logistics firms. Here, the EPCM’s duties may be focused on helping the owner enforce the owner’s warranty and other rights against the suppliers and transporters (a so-called “pass-through” procurement). The other performance risk that such EPCMs carry is with the basic engineering, and perhaps more so with the detailed engineering.

Given all that, why would owners use an EPCM? The relative attractiveness of this structure is that EPCM may help to put the project first. The most important object of a contracting exercise is to give the project the greatest chance of success. That starts with an efficient allocation of risk and responsibility. The EPCM contracting arrangement can help keep costs where they should be—no party is charging greater amounts because it is being forced to take risk that it cannot efficiently manage. The kind of contractors with gigaproject management skills who will not enter into EPC contracts often will work on an EPCM basis for major projects.

To be candid, this does mean that the owner in an EPCM scheme ends up retaining more risk than it would back in the day when it could shift almost all exposures to an EPC. Conversely, that puts owners to some degree at odds with their friendly financing sources. The bank will ask, "Well, whose neck am I going to wring if something goes wrong?"

The retention of owner risk is thus not lightly undertaken. Client and counsel need to analyze and justify *which* risks are assumed or transferred, borne or passed along, mitigated or tolerated, and *when*. But if the participants focus on project success, the EPCM methodology makes considerable sense.

The incentive of choice in an EPCM relationship is the carrot, not the stick. The shift of major contractors to EPCM is largely driven by the desire to avoid liability for cost and schedule overruns and for claims for defective performance of underlying work by works and trade contractors. The focus therefore turns to target pricing, where the EPCM can share in underruns below aspirational price and time goals; contractual bonuses for a variety of metrics, from underruns to early completion to safe operation to exceeding the baseline performance and efficiency criteria; and discretionary awards made by the owner, or in some cases by a panel including the owner and contractor to recognize superior subcontractor performance.

A key consequence of using an EPCM delivery method is that the owner needs a greater array of core competencies. After all, at the heart of this delivery method is an entity that is supremely experienced, highly motivated, and well educated in the ways and means of contracting and getting well paid and protected. It is a company whose reason for being in existence, after all, is being expert in managing project risk. Compare such a creature to an owner that has a modest administrative team, that does not do many projects in the course of a year, and that relies ordinarily on a turnkey EPC for the projects that it does pursue. If an owner handles one "gigagig" every 20 years, a pretty common frequency for mission-defining improvements, it is likely not equipped to manage as well as an EPCM that does these jobs all the time.

The owner's human resources are important to the success of a project, even one where the owner hires the best EPCM in the business. Indeed, for each construction participant, staff is destiny. No matter how great your team members may be on matters within your enterprise's scope, if they don't have experience on a big construction project, they will drown in the flood of information and requests for decision that come the owner's way. Many owners are frankly not equipped to do that even if they are expertly conducting their normal business. An EPCM acts as a much sharper, more experienced, and probably more expensive adjunct to typical owner teams. It nonetheless is not a complete substitute for all core owner competencies.

How does an owner keep track to ensure that the EPCM is doing what it's supposed to be doing? The owner needs to monitor the performance of the EPCM, as opposed to making design and construction decisions. Appendix A1 provides a list of core owner competencies, while Appendix A2 provides a list of core construction manager (CM) responsibilities.[8] Appendix A3 identifies a number of third-party constituencies that need to be considered and staffed by someone—the owner, the CM, the designer or the contractor—over the course of the project. Not all projects will need staffing for all of these roles, and many can be filled with external hiring. But an owner is well advised to have at least some of these competencies in the ranks of its own personnel.

There will be times when it makes sense for the owner to take on certain responsibilities without the EPCM being in the middle. If you're a business that buys highly specialized equipment, and you need to buy that kind of equipment for your brand-new facility, you're in a much better position to retain that procurement chore. You likely have better supplier relationships and credit standing than does your EPCM. For products that are commoditized, you may also be able to save and pocket the markup that an EPCM would otherwise charge, though that means you will have to deal with delivery and transportation risks and warranty claims processing.

FRONT-END LOADING (FEL) AND FRONT-END ENGINEERING DESIGN (FEED)

It is almost cliché in any context to talk about the importance of early planning. Well, in a gigaproject, it's important on steroids. A job that is bent at the beginning will not easily straighten out over time.

Planning gigaprojects calls for clear, robust front-end processes so that fundamental decisions and course corrections can be made while changes have limited cost and schedule impact. You may be proceeding with elements of the plan, but if it is early enough, even a major modification to that plan can be accommodated. Once major items are procured, a particular design is permitted, or foundations are poured, there are orders of magnitude difference in the impacts.

FEL-1	FEL-2
Initiation of front-end loaded (FEL) phases	Selection of scope within business unit and related specialty resources (FEL-2)
Opportunity assessment within business unit (FEL-1)	

FEL-3 / FEED	FID and beyond
Completion of scope with outside engineering contractor (FEL-3, usually called front-end engineering design (FEED))	Final Investment Decision (FID)
Detailed programming, cost and schedule estimates, market assessments, schematic design supporting financing, permits and corporate approvals	Execute engineering, procurement and construction and start operational training
	Commence full design, construction, commissioning, startup, completion and operation

The construction law terminology for early planning is "front-end loading" or FEL. As this table indicates, the process begins internally within the relevant business unit, focused on identifying and sizing the market and investment opportunity (FEL-1). If that unit is able to secure internal approvals to proceed, a second phase occurs that is still mostly internal to the owner organization, using staff resources outside the business unit and some relatively light outreach to outside consultants (FEL-2). If the project receives further approvals and is folded into the organization's overall plan for capital budgeting, the ensuing phase entails a complete planning exercise (FEL-3), typically with engagement of a top-flight engineering firm to perform a scope of work known as "front-end engineering design" (FEED). The FEED will serve as a road map for the completion of the rest of the project and provides the owner with a basis on which to make a "final investment decision" (FID). All of these activities are described in more detail in Appendix A4.

Sometimes the FEED firm remains as a consultant; sometimes it can or will be the contractor for the full work of improvement; and sometimes it is dismissed at the end of the FEED stage. If termination is an option in the hands of the owner, it will want to draft clear ownership of work product and cooperation language to facilitate the transition of work to another contractor at any stage. Likewise, if it is possible or expected that the FEED firm will be retained to perform ongoing CM, EPC or EPCM services, the owner will want to fix the substantive risk allocation and compensation terms in advance. This relates to the attrition of owner leverage point that will be discussed below.

Entities providing financing, whether debt or equity, can be invited to monitor and provide input during the FEL process. Suppliers or customers can have a view and offer their thoughts. Agencies, or at least consultants and counsel familiar with their likely reactions, may also participate. All of these stakeholders can start to get a feel for the project and what are the parameters for success.

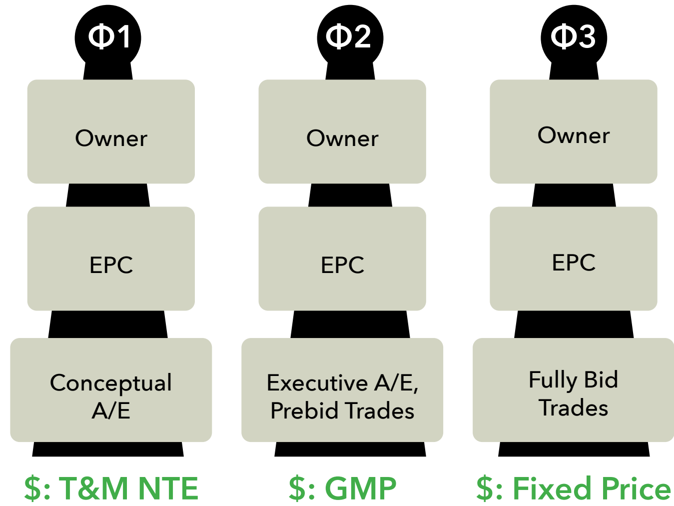
Edward Merrow has collected considerable data and reports that typically owners are stingy on front-end loading—most projects expend only about one percent of the total cost or less on the FEL process. He recommends spending on the order of two to three percent prior to FID.[9] Taking a bare gigaproject of $1 billion as an example, I think it would be a very brave mid-level corporate employee to spend $20 million to $30 million on a proposal that may not go forward. That would be quite a leap of career faith. I'd be interested to see evidence of executives incurring that level of FEL expenditure. I take his point that in *not* spending the 1%, 2% or 3% up front, a gigaproject owner may face multiples of that sum in cost overruns, delays and poor performance.

TIME PHASES

The following alternative methods go back to the first overarching insight, that risk allocations and compensation schemes do not need to be etched in stone forever at contract signing. They can shift at different points in the schedule. Risk allocations don't have to be of all the risks at the beginning or any other given time. Compensation schemes that might stand in place permanently on a 12-month DBB project, where all the designs down to the last detail are done before the contractor is even hired, might not make sense for a gigaproject. Again, pricing methods might vary over the course of a gigaproject's life.

Thus, we can have different chronological phases of work, here designated by the Greek letter *phi* (Φ). You can price the work on a time and materials basis during Phase 1, with very little if any risk shifting to the contractor for anything other than indemnity for worksite injuries. This is a time when the teams are getting to know one another, developing "conceptual" engineering, and going through a permitting process that often needs basic design and construction parameters. During Phase 2, the parties can shift to a "not to exceed" price limit, a form of cost control without really having a guaranteed scope of output. In this phase, you could have the "executive" architect or engineer produce better designs, at least sufficient to get order of magnitude quotations from the trade contractors. Finally, in Phase 3, you can go to the full fixed price or a well-defined scope-based GMP after you've been able to fully bid out those trades.

Phasing is often seen in *bridging design-build*, where the initial designer brings the plans and specifications to a point where other designers can take on the work within an EPC or EPCM environment. It is also encountered in *progressive design-build*, where the designer remains in the picture but the compensation changes from a reimbursable to a fixed or GMP basis.



Perhaps you can get a financing source who's coming in at Phase 2, let's say, to see the wisdom of this approach. The ideal is to get the lender to agree that, even if it enters during an early phase, it does not need to have a fixed price with liquidated damages right then and there. It can wait until the owner and contractor have a better handle on the project. If so, the owner/developer/borrower will have more chances to poke and prod the schedule and budget, and to ensure that there is fair value buried in those Excel spreadsheets and Gantt charts.

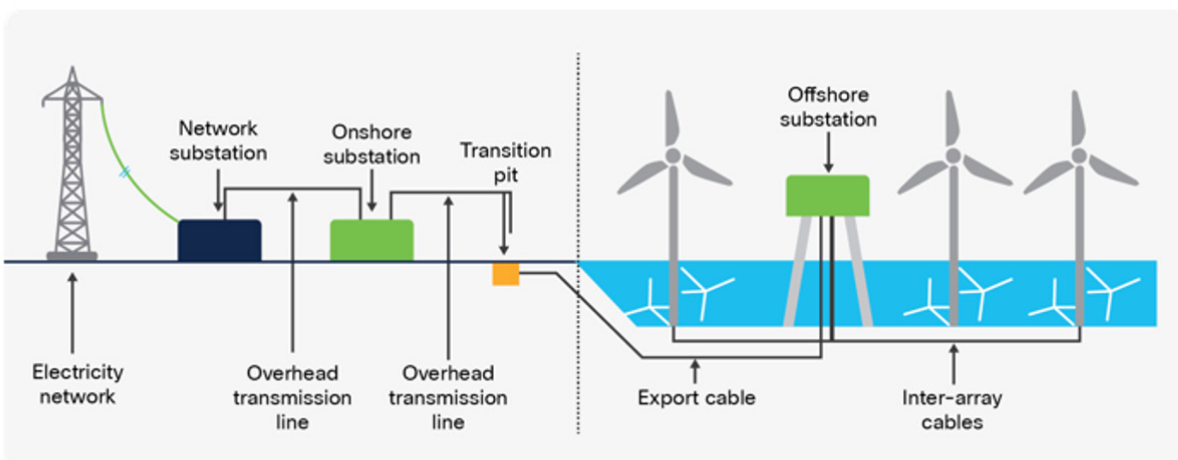
SCOPE SEGMENTS

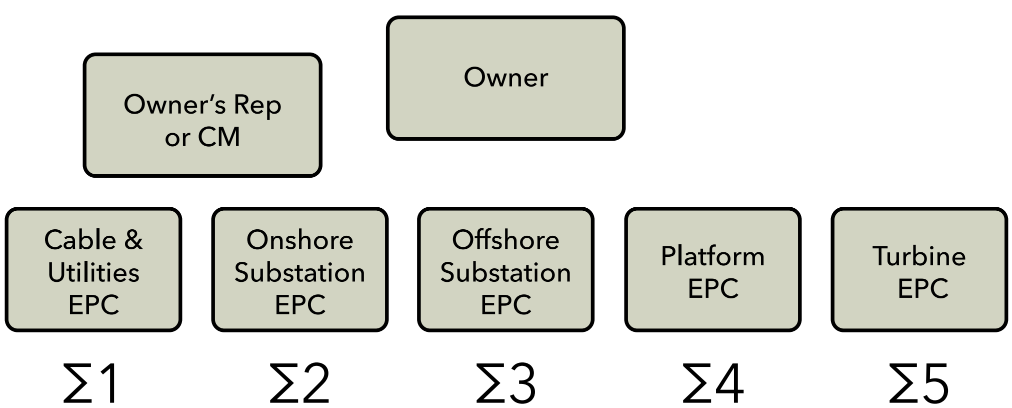
Similarly, a risk allocation does not have to apply to the entirety of the scope of work.

This illustration and chart offer an example from my experience. Offshore wind projects are constrained by contractor availability and specialization skills, and by the thin surety market, particularly in a new market like Taiwan or the northeastern United States. Out of that necessity came the parsing by scope—not by time phase, as designated earlier by the Greek letter *phi* (Φ), but by segments, as represented here by the Greek letter *sigma* (Σ).

We worked recently on a windfarm project 14 miles offshore Long Island. There were five different EPC contracts. There was one for the turbines, one for the platforms holding those turbines and whose foundations sank into the ocean floor, one for the electrical work offshore, one for the electrical work onshore, and one for the cabling and electrical work throughout. The latter electrical work required additional capabilities to interconnect with systems under the jurisdiction of the New York utility and independent system operator. A large integrated company was the operator for an international owner joint venture, and their personnel were all we saw as counsel for the offshore substation contractor. Internally or externally, they had the requisite construction management expertise to weave together the work under all these contracts.

Is this ideal? Hardly. Having *five different points* of "single points of responsibility" (the usual selling point for EPCs) is kind of an oxymoron. The financers could not have been happy. But necessity was the mother of invention.





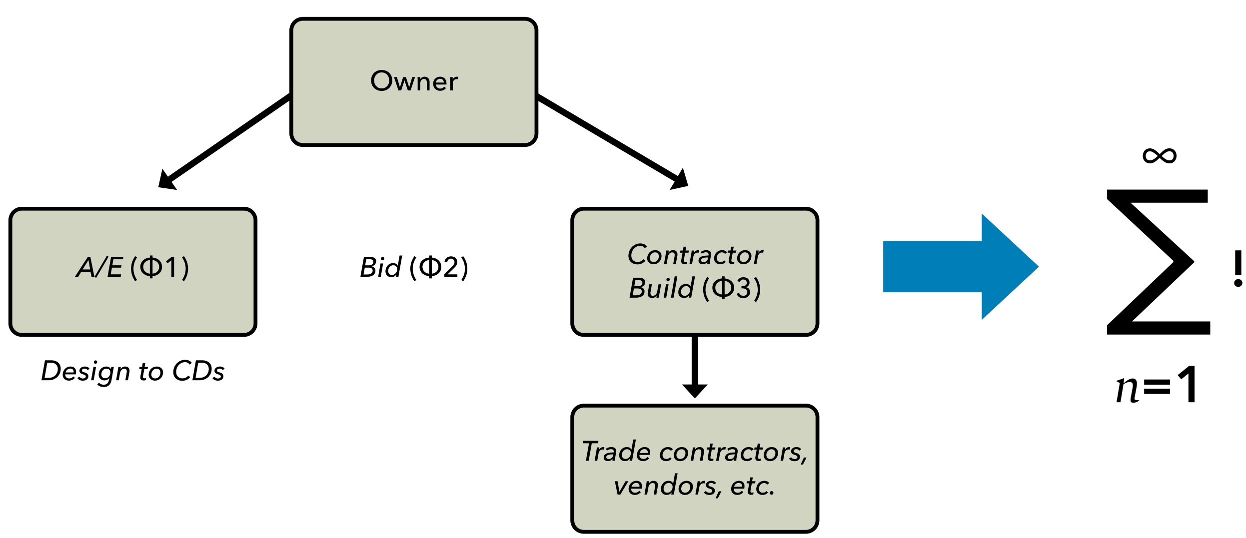
REPEAT SUPPLY CHAINS

What I try to instill in the contract and performance process is a *relationship attitude* rather than a *transactional attitude*. A transactional attitude is one that can be seen at the extreme in cases where you and I know we are never going to deal again with one another. In that situation, without appropriate restraints each of us can make sharp readings of the contract, overreach on an aspect the other party is not focused on, or exploit a leverage point.

The contracts might be design-bid-build, they might be EPC, or they might be EPCM. But the distinctive factor is that there are multiple serial projects. The same group of contractors, architects and engineers are intended (repeat, intended) to be retained on several similar projects. Before I heard the “repeat supply chain” moniker,[10] I had already employed this system in the health care industry. A provider these days may build distributed operating rooms and imaging centers in many communities. It will tend to use the same two or three architects and the same two or three contractors. No one company will get each and every contract, but those in the circle know they are in the mix job after job. If you are working on project #1, the fact that you could be hunting for projects #3 and #4 is going to constrain your appetite to exploit something.

There is a further opportunity for all the parties to benefit from a learning curve. More globally, there is an opportunity for a lawyer for any of the participants—not just the owner—to play a role as “lawyer for the project,” conducive to long-term success across the entire construction program for a client, a sector and an industry.[11]

Each project in a repeat supply chain context still stands on its own. When you have a number of projects of this discrete nature, treat them as bands playing in a parade.[12] One of the bands may get a little ahead of others, may fall a little bit behind, or may even be playing different music in a different key. Repeat supply chain contracting says that diversity is okay. Don’t try to coordinate all of them simultaneously as you might conduct a symphony orchestra, or you will lose the advantage of that learning curve and be less able to confine the leverage points.



ALLIANCE AND INTEGRATED PROJECT DELIVERY (IPD)

There is an alternative that offers a more fundamental reconception of the roles and interests of the parties. On a long-term basis, this is referred to as an “alliance contract.” (Lawyers frown on use of the occasional term “partnering contract.”) On an individual job, it is more commonly known as the integrated project delivery (IPD) method. This is what we might call the ideal form of contract. I suspect that IPD is used for infrastructure projects in Utopia, for example when a new train needs to be added to a Utopian wastewater treatment plant.

IPD endeavors to put the success of the project ahead of the interests of any individual party. The owner, the designer and the builder all sign a single integrated project delivery agreement. There are forms issued by the American Institute of Architects (AIA) and the ConsensusDocs organization, as well as manuscript forms.[13]

The participants co-locate their senior staff and other departments. There is a premium put on information flow and collaboration. In theory, these steps create an environment conducive to fewer mistakes and misunderstandings, because everybody knows more about what everyone else is doing. All are sharing information far in advance to avoid surprises and late changes. And the number one idea is not to have anybody’s interests left out of key decisions. As those calls are being made, determinations should accommodate important interests of all of the players.

With IPD there is the prospect of reduced numbers and magnitude of change orders and claims among the owner, designer and contractor. Liabilities that flow from joint decisions are borne jointly; often the parties are absolved of specific liability except for intentional misconduct or gross negligence. The compensation schemes vary, but one common IPD feature is that the owner bears all direct costs (inclusive of local overhead) with the three companies’ margins for profit and other overhead being placed in a pool, to be shared in the case of on-budget performance or to be consumed in the case of overruns. The designer and builder might lose their margins, but it is the owner that thus bears the full risk of costs that exceed the pool and any other incentive sources. It is a wonderful theory of contracting. It hasn’t broadly caught on, for several reasons that may be obvious. Owners and their financing sources covet a point of responsibility, or at the very least discrete points of *some* clear responsibility. Conversely, service providers understandably are nervous about their objective entitlement and clear pathways to

compensation for unexpected costs and delays.[14]

There nonetheless are sectors and locales where IPD has found favor. In the health care industry it has some attraction because they have a lot of repeat projects. IPD is also championed internationally for nuclear power facilities, as there are a small number of qualified repeat players and a limited pool of projects. Outside those settings, it is rarely encountered in the United States, though there is a devoted following who evangelize for this form of delivery.[15]

It would be a very useful exercise if we could find a way to make IPD concepts, or the spirit of IPD, more welcome across the construction industry. Familiarity with and trust in your fellow contract parties are musts because a significant amount of trust is required. Each participant in principle wants the project to be successful—though if the project is not successful, it doesn't want the problem resting on its shoulders either.

Sometimes human drives get in the way of one another. The idea or ideal of IPD is to align the parties' interests so that everyone understands that project success will be its success. It sounds like a terrific idea! It feels good just to talk about. The reality is that the occurrence of contingencies, especially in this country, tend to wind up adversarial. In the long haul of a gigaproject, those adversities will often involve constituencies who were not at the original bargaining table and sold on the IPD concept—such as public utility commissions, ratepayers, shareholders, new executives eager to distinguish themselves from prior management, and survivors of corporate mergers. Arbitration and litigation are not a great fit for IPD projects, in part because the record of correspondence and decisions often will not facilitate either the assertion of typical construction claims or defenses against them.

In the health care and nuclear sectors where IPD has caught on, there is an entire ecosystem of owners, contractors and engineers who have accumulated and earned the requisite trust. It would be very difficult for a particular party to branch out and enter into the first IPD in a new industry. That would be a brave designer or builder. It would more likely take an owner or owners with a number of future projects and a lot of money to impose the necessary discipline and inspire the necessary cooperation.[16]

PATHWAYS TO GIGAPROJECT SUCCESS

In this section, I offer some freeform commentary on other issues I have encountered in drafting, negotiating and administering gigaproject contracts.

OTHER VARIATIONS, PPPS AND FORMS

My discussion does not exhaust the possible contracting schemes and does not delve into the documents that have evolved. Sometimes the EPCM or similar provider is referred to as a "construction manager as advisor" (CMa). The AIA uses this term for one of their versions of a CM agreement. This terminology is opposed to "construction manager at risk" (CM@R), a CM who has greater amounts of cost and schedule accountability.

Sometimes we hear contractors say, "I'm a CM *not* at risk." My response (as an owner lawyer) is, "Yes, you do have some risk because you have a duty of professional care." I prefer the AIA's "construction manager as advisor" language rather than concede that I have hired someone who is "riskless." In any project, nobody should be entirely clad in non-stick coating.

You will run into many acronyms to indicate that you're working in the area of public-private partnerships: PPP most generically, but also P3, PFI, BOO, BOOT, DBFOM and other variants. What these structures add to EPC usually entails one or more of a *finance role*, bringing the capital sources to the table; an *operating and maintenance role*, with service provision and risk and reward exposures arising after construction completion, assuming responsibility for the functioning of the resulting work of improvement; or a *concession role*, taking on the more complete risk and reward of the sources of profit to be generated by the completed facility. There is a separate literature on the structure and performance of PPPs.[17]

There are a few gigaproject agreements written on forms of industry trade associations, such as those of AIA, DBIA, EJCDC and ConsensusDocs. In the UK, the NEC sponsors an EPC form, and the Institute of Chemical Engineers recently unveiled an EPCM form.[18] FIDIC forms of one color or another are used on industrial EPC projects, and a FIDIC EPCM document is reportedly in the works.

In my experience, "manuscript" forms—contracts drafted by individual project participants and their lawyers and engineers—dominate in industrial and public works of improvement, once you get beyond commercial office construction. Where do you find these manuscript forms? You can go on EDGAR or serach bankruptcy filings. I am either proud or ashamed to say that I've scavenged through both sources. (You should be careful with forms found in bankruptcy dockets. Maybe they were a proximate cause of that chapter 7 or 11 filing.)

One interesting aspect of both manuscript forms and markups of industry forms is that you can often tell which specific issues have arisen in the past for a lawyer or a company. That is because the relevant clause has been unusually heavily edited. One company's markup may be light or non-existent while another company's markup of that same paragraph is dense, reflecting whether that particular issue has torched the drafter in question yet. I refer to this phenomenon as that party's "scar tissue."

MOVING FROM ONE STRUCTURE TO ANOTHER MIDWAY

What happens if part way through the project, you realize the wrong contract form was used, and it becomes apparent that it is the wrong tool for the job? Besides improvisation, how can teams mitigate being stuck in the wrong format?

I advised on twin projects for a large hospital system, each of which started off with guaranteed maximum price (GMP) contracts for a defined scope. These health care projects were subject to oversight by regulators. The regulatory scheme changed dramatically during the eight-year time period of the project, requiring seismic and other foundational modifications to partially constructed buildings. There followed multiple change orders, requiring the contractor to get quotes for the change and the contractor, owner and architect to negotiate the adjustment to GMP and schedule. Over time, this item-by-item approach became untenable.

We made a general settlement of claims through a halfway date, and from that point onward we more or less compensated the contractor for changes on a budgeted time and materials basis. That took some selling to the nonprofit health care board of directors, believe me. But it was smarter than trying to hold to a contract we had negotiated when we had leverage and had a good original GMP based on a good fixed scope. The regulatory grounds were shifting so much that we bit the bullet and relinquished our entitlement to a maximum price, which had in effect already become a moving ceiling.

That was a leap of faith, but the leap proved prudent. The hospital system is still doing work with those contractors, which helps to demonstrate the potential power of relational contracting. Health care systems seemingly are always building, always have more jobs, and are in a good position for a repeat supply chain. That prospect helped tensions decompress a bit.

THE COSTS OF RISK TRANSFERS

The essence of contracting is getting the right people to participate, with the right risk allocation, incentivized by the right compensation structure. Key to achieving that objective is recognizing that a risk transfer is not free. That is true for normal projects, and it is doubly true for gigaprojects.

What is the context in which you transfer a risk to a contract party? First, what is the competitive environment when you try to do so? Is your counterparty worried about losing the job or having others make better proposals? If so, you might get a very good price for that risk transfer. But if you do not have competitive pressure at that point—if you have already selected the contractor and *now* you are trying to shift the risk—that is going to be pricey.

What is the state of knowledge when you seek to transfer a risk? If uncertainties are relatively high, or if one party has greater information about or control over the risk in question, that status will affect how much you pay for that allocation of responsibility.

And once you *think* you have transferred that risk, that's not necessarily the end of the story. If you push the risk to the contractor, it is going to push it onward to a subcontractor, the subcontractor is going to push it on to someone else, all the way down to the proverbial buck private. Each of those parties is being asked to bear a risk on a *gigaproject*, after all, something that defines mission-critical success for some enormous human adventure. That has "risk" written all over it. If the service provider is delayed or does a poor job, maybe an oil refinery shuts down or a high-speed rail system doesn't start on time.

People aren't going to take on a slice of a large enterprise risk for nothing, not even a liquidated or capped slice. They are going to put something in their cost and schedule quotations to protect themselves, and, if competitive circumstances permit it, a little more for themselves. That is going to add up, and your overall cost of the project will rise.

Finally, even if you have spent all that money to transfer that risk, you haven't totally eliminated the prospect of litigators coming back and saying, "You know, yes *that* risk was transferred, but not *this* one, the one that actually transpired. So here's a claim for delays, extras and impacts." You paid for what you thought was a risk transfer, but claims can come back anyway.[19]

So be savvy—when you transfer a risk, you are guaranteeing yourself neither a good deal nor a quiet life. True, as any guide to good contracting says, you certainly want to decide who can best bear any particular contract risk. But at what time, and for what scope? Make sure that you break that question apart so that you're making the transfers at the right time, for the right work segment, and with the right process.

THE ATTRITION OF LEVERAGE

Behind the negotiation of gigarisk transfer lies a concept I call "the attrition of leverage." An owner has maximum bargaining power in the request for proposals (RFP) phase or its less formal equivalent.[20] People are taking you out for dinner, complimenting your jacket, barely losing to you at golf ("Good shot!"), or cajoling you to award the contract to them. Once the ink is dry on that contract, however, the leverage tips, and tips pretty fast. It's not subtle. As soon as the agreement is signed, the service provider has greater ability to protect itself on price and schedule, and in presenting and pursuing claims. Your best day as an owner is your first day, when you're first inviting contractors to bid. It is a war of attrition from that point forward—to hold fast to your principles and entitlements and to hold the other parties to *their* principles and commitments.

FINANCING AND THE "THREE-BODY PROBLEM"

Banks will typically resist the use of DBBs, EPCMs or frankly any method other than *(drum roll)* "fixed-price turnkey EPC with beaucoup liquidated damages for delay and underperformance." Why is that?

We worked on a project where a large bank financing the project was resisting a proposal for the contractor to provide subcontractor default insurance (SDI) rather than requiring more expensive surety bonds, letters of credit, or large retentions for the contractor and all of the subcontractors in the chain. We were simultaneously working for a developer of a processing center *for that very same bank, spending its own money*. On that other job, the bank readily agreed to the use of SDI.

The bank said, "Heck no" to SDI on a project it was financing, but said, "Heck yeah" to SDI when building for its own account. That experience crystallizes the issue: A lender may force parties to prematurely shift risks, with a fixed fee and schedule that might be called robust or (more bluntly) padded, all to avoid a lesser risk to the lender. Hence my analogy to the three-body problem in physics.[21]

It was a teachable moment for all of us. A financing source will readily and sensibly agree to an intelligent retention of risk for its own account, yet resist it when it has only downside from its borrower, which wanted to take some risk to get better pricing and delivery. Better project results make for healthier borrowers, at least over the long term. Any loan officer is of course more concerned about the short run—that is, about this very project!

Renewable energy projects sometimes face a similar issue. They may want to demonstrate firm, competitive pricing and a hard delivery deadline in order to solidify or advance their position in the interconnection queue, or to succeed in a "reverse auction" procurement. That timing may be ahead of when the engineering and bidding can be efficiently accomplished. The real or perceived demands of third parties are an unresolved problem more broadly, not just with financers.

One precedent that gives me hope hails from that same renewable energy industry. The project developer typically has a long-term master purchase agreement for wind turbines or solar panels and inverters, equipment that is mission-critical to its business plan. In that context, the banks have become comfortable that their borrower, the developer, will buy those items by itself, and only enter into an EPC for the "balance of plant," or BOP. (Again, in construction law we say what we mean; "balance of plant" *means* the balance of the plant.)

Once the banks have admitted that the EPC does not cover 100% of the project, I think there's the opportunity for a dialogue with them about owner-retained scope and risk—even for gigaprojects. As lawyers for owners and contractors alike, we can help convince them that, just as with turbine or panel purchases, gigaproject owners can intelligently retain, or at least defer the transfer of, risks of all types.

We should respect the rational motivations of the lender (and the individual loan officer or investment committee) for a bank's logical drivers. At the same time, we should consider the entire topic of gigaprojects, and infrastructure investment writ large, as an investment class and economy-wide activity, across many projects and many contracts. Relationship contracting over a long time horizon may help to bridge this misalignment. As an example, we are working to form large procurement pools and credit support facilities for advanced nuclear reactors to mitigate and spread the "first of a kind risk" that might otherwise prevent a new technology from ever being financed.[22]

SUCCESS METRICS

Edward Merrow's books list several factors that he used to define success of projects in his database.[23] They are worth looking at.

First, did the project cost and schedule meet predicted levels? In other words, did they achieve the FEL or FEED projections of schedule and budget used at the time of final investment decision or FID?

I don't know how useful a FEED estimate is as a metric. We all know those budgeted numbers are sometimes engineered. But the cost and schedule that were internally socialized to management and capital sources, at the time a project was approved, are certainly one fair measure. Did you come in where you reported upwards you would complete on cost and schedule?

Second, how did the actual project cost and schedule of this project compare to how competitors in your market are doing with their similar projects? This is even a murkier area. It is very hard to compare apples to apples, especially "giga-apples." Nonetheless I think it's a question you ought fairly to ask—a measure not only of predictability internally, but of competitiveness externallyy.

Third, what was the safety record of the project? In some ways, this is an objective metric, depending on OSHA Form 300 Days Away, Restricted, or Transferred (DART) reports and the like. Cynically, some parties refer to safety metrics as an "incentive for underreporting."

Fourth, was the project of high quality? These data are hard to source, but the occurrence or non-occurrence of warranty claims and your claims experience may be instructive.

Fifth, did the finished project achieve the owner's objectives? This may seem an unfair criterion to pin on the design and construction parties—didn't the owner specify what it wanted designed and build? But it is fair to ask whether the facility achieves the owner's purposes. After all, that one factor can dwarf variances in the construction capital cost and schedule. The ultimate test of a project is performance that meets the owner's ultimate objective, not its mere cost.

Each of these success criteria can be questioned, especially as quantitative measures. But qualitatively, they are good places to start. Did the project achieve your own projections? How does it compare to comparable projects of others, particularly competitors? Was it performed safely? Was the work of high quality? And did the project achieve the owner's ultimate market objectives?

LUCK, SKILL, RAIN AND BASEBALL

This example from my own practice more than anything demonstrates that *it is better to be lucky than good*—although I'm hopeful that we were both lucky and good.

We advised the owner of a baseball stadium costing several hundred million dollars that was planned, designed and built from 1996 to 2000. The team, predictably, had no developer experience; the current management team had not built even a sandlot before. As previously noted, Appendix A1 illustrates owner competencies, and Appendix A2 is a further listing of competencies one might expect from an owner's representative or CM. In our case, our client had very few of them. Nearly everything had to be hired, from the insurance managers to the permitting consultants. The advisers would shake hands introducing themselves to one another as they walked into meetings for the client with the government, having not worked with each other before. This staffing is not ideal but was essential here.

The contract structure was essentially a fixed-price turnkey EPC, driven by the fact that the debt capital was being furnished through insurance companies. The team signed promissory notes to them—I think they were even negotiable promissory notes. So there was no sense or possibility of lender alignment with deeper owner relationships, with respect to the marketing or intangibles associated with the project and with a ballclub's and fan base's new home. It was a transactional attitude focused solely on the team having cash flow to service the payments of principal and interest.

We had an inflexible deadline. The team was only going to absorb two more seasons at the old beloved or accursed ballpark. The project needed to be finished in April 2000. So there was no alternative to a single point of responsibility with liquidated damages for delay. I would say, however, that we did plan for completion well before April 2000, and inserted a generous grace period before the draconian liquidated damages really kicked in. Major League Baseball cooperated by changing the schedule so the team opened on the road, giving us another precious week and a half.

I craftily devised allocations of risk attempting to shift *almost* all risks to the EPC. In the environmental realm, I had the contractor assume all conditions other than a high level of contamination of subsurface soil. In the timetable realm, I built up a kitty of over a hundred days of weather excuses before the contract schedule could be affected. For everything else, the contractor would take the risk. The owner could not be hit for claims for site conditions or weather barring extreme occurrences.

I was very proud of my handiwork. Then, as is typical of gigaprojects, everything unusual happened and we experienced those extreme occurrences!

First, there was contaminated subsoil exactly as I had carved out, right there on the site where the structures and outfield were going. Fortunately, we were able to convince agencies that the best course was to encapsulate the soil and leave it in place, rather than disturb and excavate it and truck it to Utah at far greater expense.

Second, 1997 was one of the wettest El Niño winters in recorded California history. We had huge rainfalls, which exhausted my carefully planned 2½-year weather allowance in that first winter. But the rains came pouring down during the demolition phase. They kept the dust from affecting angry nearby yacht club members and other neighbors. The foundation piles drove into the rain-sogged ground like butter.

So the extreme occurrences skirted my environmental allocations and wiped out my weather allowance, but they happened in the right times at the right places. In other words, the contingencies occurred, though in practice they had no impact on schedule and not much impact on cost.

The architect and principal trade contractor had worked on quite a few urban ballparks that were developed in the late 1980s and 1990s. They saw one another regularly on other jobs, and planned to see each other again. So this turned out to be a "repeat supply chain" project before I had ever heard that name, just with different owners rather than with the same owner.

Serendipitously, that trade contractor happened to have a division that performed concrete work. That internal capability was never focused on when selecting our roster of service providers. But that self-performance unit was marvelously helpful when we ran into problems trying to build a masonry façade. We switched to a concrete product resembling brickwork and overcame an obstacle that might have pushed completion into mid-season and heavy losses.

Thus, we were able to achieve our goals on this project in an EPC environment after all. I reiterate that it is better to be lucky than good—and I think we were a little bit of both.

GIGAPROJECT EXECUTION

The best contract in the world will not spell success for a project if the terms are not enforced or if the project is not well managed. These are commonplace thoughts, and project execution is a topic of its own—and on top of that, it is an art rather than a science. None of those disclaimers prevents the offering of some thoughts on the subject.

First, the price terms incentivize behavior. You get what you compensate, for better or worse. So make sure the original base remuneration is set at a fair level, one that does not cause one party or the other to immediately look for ways to adjust it. Use liquidated damages judiciously—financing sources may mandate them but relax them in other circumstances if there are ways to incentivize performance through bonuses. If you do have a damage or bonus scheme and the incentive runs out, consider replenishing it—let a sinner gain redemption!

Second, as in my ballpark example, deal with subsurface conditions and permit requirements before commencing vertical work. Any early work to get ahead on the construction schedule will be offset by the need to cease work or even go backwards upon an adverse discovery or agency order.

Third, don't poison the start of a relationship with unrealistic schedules. As Merrow observes, "Unlike smaller projects, megaprojects cannot be used to 'fill in a gap' in your production or 'meet a market window.'"[24]

Fourth, watch for cognitive biases, like framing, over-optimism, and risk aversion. I have gathered notes on almost a hundred such biases in general,[25] and many of them apply to construction projects of all types. I like to refer to lists of such sins from time to time, and think of occasions in my law practice or personal life when I committed them or was sorely tempted to do so.

Fifth, avoid the requirement for too much information flow. Sometimes owners demand up front a greater role in project administration than they can really manage or really need. That puts pressure on a contractor, and it also puts risk on an owner. The more the owner knows, the more it is going to be charged with knowing, and with having had and not availing itself of the opportunity to affect decisions about which it later complains. Having an experienced construction manager is invaluable in making sure that the appropriate things, and only the appropriate things, reach the owner for information or for action.

Finally, read and enforce the contract. Monitor performance. Have regular meetings and keep and distribute accurate minutes with action items, responsible people, and due dates. Hold everyone, including your own forces, accountable for their commitments.

CONCLUSION

Gigaproject contracting is different, or at a minimum gigaprojects should lead the project professional to think afresh. General principles of risk transfer and compensation incentives break down when the contracting pool thins and the contractor tolerance for bearing exposures cannot be accommodated. The risks themselves increase with the number of decimal places and timetable years. My key advice is to imagine all the possible contracting structures; take advantage of front-end planning before major procurement and unchangeable fieldwork; transfer risks and build compensation schemes in a dynamic rather than fixed manner; build core owner and construction manager competencies; and instill a relationship attitude rather than a transactional attitude wherever you can.

ENDNOTES

1 *See, e.g.*, Edward W. Merrow, Industrial Megaprojects: Concepts, Strategies, and Practices for Success (2d ed. 2024); Charles M. Sink, "Mega Project Construction Contracts: An Owner's Perspective," 55 Rocky Mt. Min. L. Inst. 21B-1 (2009) ("megaprojects" described as those costing over $500 million). In the other direction, Saudi Arabia has announced a $1.5 trillion capital budget for the Neom municipal complex; I reckon that would be a "teraproject."

2 *See* Robert A. James, *Finesses and Game-Changers in Frontier Project Development: The Case of Carbon Capture and Storage*, White Paper No. 87, Program in Energy and Sustainable Development, Stanford University (2009).

3 Helpful details on many of these contract types are found in Design-Build and EPC Contracting: A Practical Legal Guide (American Bar Association Forum on Construction Law, 2024) (herein ABA EPC).

4 *See, e.g.,* Robert A. James & Shade Oladetimi, *California Public-Private Partnership Contracting Statutes* (2022).

5 For illustrations of and distinctions between EPC and D-B contracting, and detailed discussion of EPC compensation schemes and risk allocations, see ABA EPC; Laura LoBue et al., *Hat Trick of Success: Mastering Cost, Schedule and Quality in Power Project Delivery*, ABA Forum on Construction Law (2024); Robert A. James, *A Guide to EPC Agreement Provisions* (2d ed. 2015); Robert A. James, *Construction Fee Factors* (2014).

6 *See* Damian McNair, *EPCM Contracts,* in Investing in Infrastructure (PricewaterhouseCoopers, 2016) ("It is no longer unusual to see Contractors refusing to bid for the usual fixed price and time contracts. … Sophisticated Owners are often not prepared to pay large risk premiums and profits to Contractors under traditional fixed time and cost contracts").

7 *See* ABA EPC at 252 ("[D]espite the naming similarities, the EPCM contract has a completely different risk profile than the EPC contract"); Paul Loots & Nick Nenchie, *Worlds Apart: EPC and EPCM Contracts* (Mayer Brown, 2007).

8 These lists are based on excellent resource materials in Merrow, note 1 *supra*.

9 *See* Edward W. Merrow, Contracting Strategies for Major Projects (2023).

10 Designated as such in Merrow, note 1 *supra*.

11 See the thoughtful commentary by Andrew Ness & Edward Merrow, *Being a Lawyer for the Project*, American College of Construction Lawyers (2022).

12 Cited in Merrow, note 9 *supra*.

13 *See, e.g.*, American Institute of Architects (AIA) form C191; ConsensusDocs form 300.

14 For critiques of IPD, see Edward W. Merrow, *How Do Project Delivery Methods Align with Project Outcomes? A Reality Check*, American College of Construction Lawyers 35th Annual Conference (2024); Merrow, notes 1 and 9 *supra*.

15 *See, e.g.,* Howard W. Ashcraft, Jr., *Integrated Project Delivery Agreements—A Lawyer's Perspective*, CCCL Journal 105 (2014).

16 For a measured and even-handed overview of IPD and alliance contracting, see Pertti Lahdenperä, *Making Sense of the Multi-Party Contractual Arrangements for Project Partnering, Project Alliancing and Integrated Project Delivery*, 30 Construction Management & Economics 57 (January 2012).

17 *See, e.g.,* Bay Area Council Economic Institute, *Public-Private Partnerships in California* (2018), available here; Robert A. James, Project Finance and Public-Private Partnerships in the USA (2022), available here.

18 *See* The Blue Book: Form of Contract: Engineering, Procurement and Construction Management (EPCM) Contract (Institute of Chemical Engineers (IChemE)) (2023).

19 *See* James Zack, *Claimsmanship*, Association for Advancement of Cost Engineering (1992).

20 *See* Robert A. James & Marques Peterson, *The Art and Science of the RFP Response* (2021), available here.

21 The same analogy is used for a different balancing of tripartite financial factors in Chris Nichols, *Solving the Three-Body Problem in Banking*, South State Bank (2024).

22 Energy Futures Institute, Kick Starting Small Modular Reactor Procurement (2025); Pillsbury Winthrop Shaw Pittman LLP, Term Sheet for Cost Stabilization Facility (2025); available here.

23 *See* Merrow, notes 1 and 9 *supra*.

24 Merrow, note 1 *supra*, at 3.

25 *See* Robert A. James, A Hundred Cognitive Biases (July 26, 2025); Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decisions Under Risk*, 47 Econometrica (1979); Daniel Kahneman, Thinking, Fast and Slow (2011).

APPENDIX A1.

CORE OWNER COMPETENCIES

ENTERPRISE

- Project Executive
- Financial Modeling Lead
- Facility User Executive

PROJECT MANAGEMENT

- Project Manager
- Information Management Leads
- Building Information Management (BIM) Leads

ENGINEERING

- Engineering Manager
- Design Engineer Leads
- Process Engineer Leads

PROCUREMENT

- Procurement Manager
- Supply Chain Leads
- Materials & Logistics Leads

CONSTRUCTION

- Construction Manager
- Labor Relations Specialist

CONTRACTS

- Contracts Manager
- Change Order Specialists

ENVIRONMENT

- EHSS Manager
- Permitting Leads
- Safety Leads
- Health Leads
- Security Leads
- Sustainability/Recycling Leads

CONTROLS

- Project Controls Manager
- Cost Engineer Leads
- Scheduler Leads
- QA/QC Leads

PROFESSIONAL

- Construction Legal Counsel
- Construction Human Resources Lead
- Insurance/Bonding Leads

OPERATIONS

- Production/Operation Manager
- Operation Leads
- Maintenance Leads
- Training and Certification Leads

FINANCE

- Investor and Lender Relation Leads
- Financial Advisor

COMMUNITY & GOVERNMENT

- Government Relations Manager
- Government Liaisons
- Customs Specialist
- Community Relations Lead

APPENDIX A2.
CORE CONSTRUCTION MANAGER COMPETENCIES

- Advise on packaging of work into contractor work scopes and compensation schemes
- Advise on project sequencing (logistics, staging, workforce interference, hot work days, etc.)
- Administer or advise on critical-path method (CPM) schedule
- Monitor performance against schedule and budget and provide owner reports
- Manage submittals and requests for submittals, work orders, change orders, and claims
- Coordinate inspections and tests
- Coordinate safety and QA/QC programs
- Manage General Conditions items procurement and operation (lift/crane, scaffolding, security, trailers, etc.)
- Interface management among contractors, vendors, operations
- Manage design professional agreements especially in Construction Administration phase
- Administer project meetings, maintain minutes and enforce accountability for action items
- Coordinate relations with independent engineers, investor/lender representatives
- Coordinate relations with authorities having jurisdiction

APPENDIX A3.
CORE THIRD-PARTY RELATIONSHIPS

- Authorities having jurisdiction
- Utilities (electricity, gas, water, waste, telecommunications, etc.)
- Landowners, including easement holders and adjacent occupants
- Lenders, investors and their independent engineers
- Logistics firms (transport, storage, customs)
- Vendors (procurement, delivery, installation, commissioning, warranty claims administration)
- Labor organizations
- Third-party related projects simultaneously under way
- Community organizations
- Community more broadly

APPENDIX A4.
CORE FRONT-END LOADING ACTIVITIES

Front-end loading (FEL) is a structured approach to project development, focusing on identifying and mitigating risks early in the lifecycle. It is commonly divided into key stages—here called FEL-1, FEL-2 and FEL-3, though terminology varies. Each stage successively evolves the project scope, cost and schedule estimates, and risk evaluations to support a decision to proceed, commonly called the Final Investment Decision (FID). Below is a breakdown of the typical tasks performed in each stage, as well as the key inputs that may be desired for FID.

Construction attorneys should be familiar with the cost estimating protocols of the International Association for the Advancement of Cost Engineering, or AACE. The AACE classification system (including Class 3 and Class 4, featured below) includes consideration of factors that can be used in the drafting of specific criteria for substantial completion, performance metrics, and FID submittals.

FEL-1
OPPORTUNITY IDENTIFICATION AND CONCEPT SCREENING

OBJECTIVE:

Evaluate the feasibility of the project concept and align it with business goals. Typically this stage is undertaken entirely within the business unit contemplating the project. Such units often do not want to signal a possible initiative until these elementary precautions are taken.

TASKS:

1. **Define Business Objectives:** Identify the strategic goals and drivers for the project (e.g., cost reduction, capacity increase, compliance).
2. **Identify Key Stakeholders:** Develop a roster of potential internal and external stakeholders whose support—or lack of opposition—would be requisites of success.
3. **Concept Development:** Generate high-level project concepts or alternatives to achieve business goals. Visuals and computer-aided design are often introduced at an early stage.
4. **Preliminary Risk Assessment:** Identify major risks (e.g., environmental, regulatory, financial) and opportunities for mitigation and for transfer via contract, insurance or bonding.
5. **Order-of-Magnitude Cost Estimates:** Develop rough cost estimates based on historical data and conceptual designs. At this stage, the AACE process is rarely utilized.
6. **High-Level Schedule Development:** Provide a preliminary timeline for project phases.
7. **Site Selection:** Evaluate potential sites based on high-level criteria (e.g., location, utilities, access). Consider land purchase or lease options on a confidential basis.
8. **Identify Regulatory Requirements:** Outline major permitting and compliance needs.

DELIVERABLES:

- Conceptual project scope.
- High-level cost estimate (perhaps +/− 50%).
- Initial risk informal assessment.
- Preliminary business case.

FEL-2
SCOPE DEVELOPMENT AND CONCEPT SELECTION

OBJECTIVE:
Develop and evaluate project concepts in greater detail to select the best alternative. At this stage, the affected business unit usually engages other business units and subject matter experts within the corporate group or in outside advisory firms.

TASKS:
1. **Refine Scope:** Develop a more detailed project scope based on the selected concept.
2. **Preliminary Engineering:** Conduct feasibility-level engineering to support cost and schedule development (e.g., process flow diagrams, preliminary layouts).
3. **AACE Class 4 Cost Estimate:** Provide a more detailed cost estimate (perhaps +/− 30%).
4. **Environmental and Regulatory Analysis:** Conduct initial environmental impact assessments and confirm permitting strategies. Knowing whether a project may require an environmental impact statement or simply a finding of no significant impact can seriously affect the project economics, viability and schedule.
5. **Market and Supply Chain Analysis:** Validate assumptions about materials, suppliers and labor availability.
6. **Risk Identification, Mitigation, and Transfer Register:** Create a formal risk register and identify mitigation and transfer strategies for significant risks.
7. **Execution Strategy:** Develop a preliminary project execution plan, including contracting and procurement strategies.
8. **Stakeholder Engagement:** Reach out to key stakeholders and endeavor to secure their support or lack of opposition on the scope and impacts, and adjust project conditions consistent with critical feedback.

DELIVERABLES:
- Refined project scope.
- Preliminary engineering designs.
- AACE Class 4 cost estimate.
- Formal risk register.
- Environmental and permitting plan.
- Draft execution strategy.

FEL-3 DETAILED SCOPE DEFINITION (including Front-End Engineering Design or FEED)

OBJECTIVE:
Finalize the project definition and ensure it is sufficiently detailed to support the Final Investment Decision (FID). This stage typically involves all relevant corporate business and support units. It is often referred to as FEED, but much more than engineering and design takes place during this period.

TASKS:
1. **Retention of FEED Contractor:** Evaluate qualifications and award FEED contract to appropriate engineering and construction management firm. If the FEED may play an ongoing role on the project, such as a CM, EPC, or EPCM, owners will want to negotiate ownership of work product rights and fix the critical scope, compensation and risk allocation terms up front.
2. **Detailed Engineering:** Complete front-end engineering and design (FEED), including key technical deliverables (e.g., process diagrams, equipment lists, material specifications).
3. **AACE Class 3 Cost Estimate:** Provide a highly detailed cost estimate (perhaps +/− 10-15%).
4. **Comprehensive Risk Analysis:** Finalize the risk register, including quantified risk assessments (e.g., Monte Carlo simulations). Price potential risk transfers such as insurance and bond premiums and estimated contractor charges for bearing exposures.
5. **Schedule Development:** Create a definitive project schedule with critical-path analysis for key elements.

6. **Execution Plan:** Finalize the project execution strategy, including detailed contracting, procurement and construction plans.
7. **Permitting and Regulatory Approvals:** Secure or confirm plans for obtaining necessary permits.
8. **Stakeholder Approvals:** Obtain final buy-in from essential internal and external stakeholders to the extent practical. Some conversations and clearances may not be possible until after FID, in which case the project contracts need to address the contingencies, typically through conditions precedent.
9. **Pre-FID Reviews:** Conduct independent project assurance reviews to validate readiness for FID.

DELIVERABLES:

- Detailed project scope and FEED deliverables.
- AACE Class 3 cost estimate.
- Definitive project schedule.
- Final risk register with mitigation plans.
- Final execution strategy.
- Permitting and regulatory plan.

POTENTIAL INPUTS FOR FINAL INVESTMENT DECISION (FID)

1. **Detailed Project Scope:** Fully defined and approved by stakeholders.
2. **AACE Cost Estimate:** Class 3 cost estimate (perhaps +/− 10-15%) with contingencies and conditions precedent defined and included.
3. **Project Schedule:** Definitive schedule with conditions precedent, milestones, Mechanical Completion, Substantial Completion, Commissioning, Final Completion or comparable definitions, and schedule critical paths identified.
4. **Risk Register:** Comprehensive risk assessment, including mitigation and transfer strategies and quantified risks.
5. **Execution Plan:** Approved execution strategy, including procurement and contracting frameworks.
6. **Permits and Approvals:** Status of regulatory permits and environmental compliance.
7. **Stakeholder Alignment:** Evidence of stakeholder buy-in and alignment with project objectives.
8. **Financial Analysis and Approvals:** Return on investment (ROI), net present value (NPV), and internal rate of return (IRR) calculations. Confirmation that resources are available for the project, based on a schedule of quantity and timing of sources and uses of funds.
9. **Funding Plan:** Confirmation of financial resources or funding approvals.
10. **Market Validation:** Analysis of market conditions, demand forecasts and supply chain readiness.
11. **Independent Review Reports:** Assurance reviews from independent experts as required by business unit or by management or capital sources, confirming project readiness for FID.

SUMMARY

The FEL process is a disciplined approach to managing the risks and uncertainties of construction projects. Each FEL stage builds upon the previous one, progressively refining the project's scope, cost and risks. The objective is that by the time a project reaches FID, decision-makers have a well-documented basis to move forward confidently, supported by comprehensive engineering, financial and risk analyses.

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