The Transformation of Project Delivery

By Howard W. Ashcraft Jr.

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Predicting the future of project delivery—or of any other human endeavor—is a risky undertaking. As noted by Nate Silver in his recent book *The Signal in the Noise*,[1] most predictions fail. Moreover, the events that truly shape the future are the improbable events—Nicholas Nassim Taleb's *Black Swans*[2]—not those events that we can anticipate and predict. If we learn one thing from history, it is that the future is not history repeated and that the implications of change are often far different from the intentions. When DARPA[3] developed the Internet, it wasn't thinking about Facebook, Twitter, or Amazon. Nor did it consider how these might interact in political and social revolution, such as the recent Arab Spring.[4] Thus, over a long horizon, the events that may most affect project delivery are those we don't anticipate.

But although precise prediction may not be possible, there are forces afoot that are already transforming project delivery. In addition, there are more disruptivethat could radically change project delivery, perhaps eclipsing the concept of the project itself. These forces will also affect construction law practice and the conclusion of this article will reflect on how construction attorneys should prepare for inevitable change and remain positive contributors to the design and construction industry.

Forces Driving Collaboration

Project delivery is being affected by forces leading to increased collaboration. At the same time, changes in project financing are affecting project delivery—sometimes in opposition to other trends. Public-private partnerships (P3) are discussed in Deborah Ballati and Richard Robinson's companion article *Public-Private Partnerships: Lessons Learned and Predictions for the Future,* and issues related to them will only be briefly discussed here.

Collaboration[5]

Collaboration is being driven by three current forces: Lean[6] design and construction, sustainability, and technology. Individually, each of these trends benefits from early, deep collaboration. Collectively, they are an irresistible force for collaboration and integration. Moreover, these trends are becoming increasingly mainstream, and we can therefore expect ever-increasing levels of integration and collaboration in our project delivery methods. A brief look at each of these trends will demonstrate why collaboration and integration are becoming the new normal in private projects.

Lean Design and Construction

There is little doubt that design and construction are inefficient activities. Many of the current dysfunctions are chronicled in *The Commercial Real Estate Revolution*, where the authors estimate that half of all construction activity is nonproductive.[7] Studies of tool time (the amount of time actually spent working) have shown efficiencies as low as 19 percent,[8] and emeritus professor Paul Teicholz of Stanford University has analyzed construction productivity data,[9] consistently finding that construction productivity has declined over the last 20 years—despite all of the improvements in tools and construction technology. In contrast, during the same period industrial productivity has risen sharply. This is not a uniquely American phenomenon. Studies in the United Kingdom have reached similar conclusions regarding construction productivity.[10] Summarizing data from the United Kingdom, the United States, and Scandinavia, Sir John Egan's task force found that 30 percent of construction is rework, labor is only 40–60 percent efficient, accidents absorb 3–6 percent of construction costs, and at least 10 percent of all materials are wasted.[11] A more recent study of international megaprojects concluded that half result in failure (using a very lenient measure of success) and that failure in some industries is as high as 78 percent.[12] No rationalization can justify these abysmal outcomes.

Although there may be many contributors to this inefficiency, insularity and fragmentation are the main culprits. Traditional project delivery rewards individual success, regardless of impact on project outcome, and creates a system in which project optimization is difficult or impossible. Moreover, the design/bid/build approach inherently excludes trade contractors from design and denies designers the knowledge embedded in the trades. Construction documents reinforce these divisions, forbidding designers to be involved in means and methods and distancing builders from design responsibility. The upshot is that the existing industry is fragmented, adversarial, and inefficient.

The Lean Community, led by the Lean Construction

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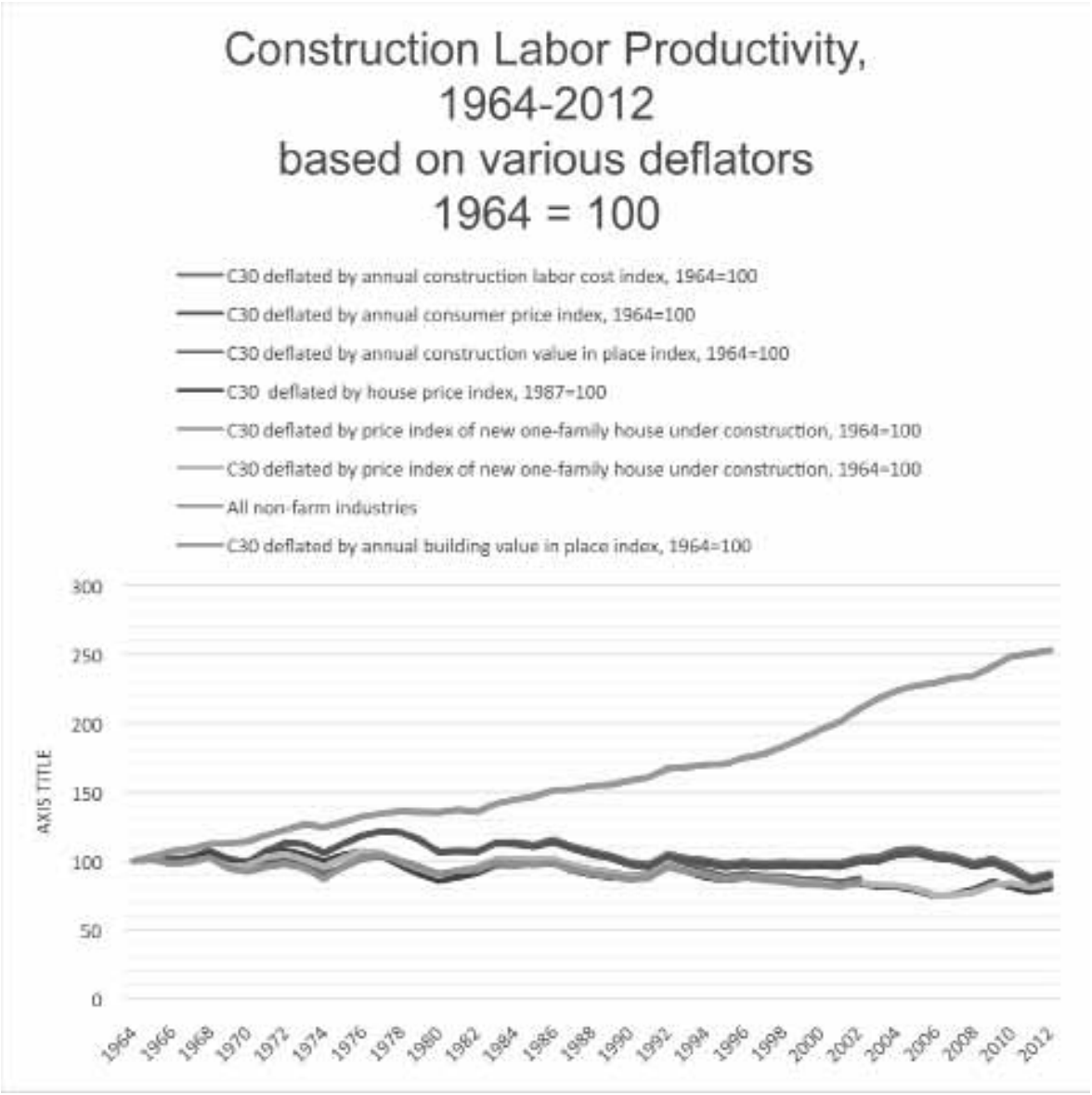

Figure 1. Construction Labor Productivity*

Institute and the International Group for Lean Construction, is aggressively attacking the underpinnings of inefficiency. Applying principles from Lean manufacturing and other concepts, the Lean Community has sought to improve the flow of work through the design and construction system, break down barriers to efficient work transition between participants, elevate planning to a joint activity based on customer needs (pull), and focus project execution on optimizing the entire project, rather than a specific step or trade. Even where projects are not being executed using a complete Lean approach, portions of Lean principles, such as the Last Planner System, are being adopted to improve productivity.

The Lean approach relies on close collaboration among all key participants. In short, it requires viewing the project as a single organization dedicated to achieving shared goals. Decisions are made on a "best for project" basis, work is performed by the most appropriate party—when it is needed by another participant, not when most convenient to the party doing the work—and the team focuses on optimizing the whole project, rather than its component parts.

Lean requires intense collaboration in an industry that is locked into operational and contractual silos. Recognizing this conflict, Will Lichtig,[13] in concert with the Lean Construction Institute, developed an integrated form of agreement to create a contractual structure for executing Lean projects. Somewhat in parallel, the American Institute of Architect's California Council began developing

* Labor Productivity in the Construction Industry 1987-2012 Compared to Labor Productivity for All Nonfarm Industries. Paul Teicholz, AECBytes Viewpoint #67 (Fig. 6), Mar. 14, 2013. From the article *Labor-Productivity Declines in the Construction Industry: Causes and Remedies (Another Look)*, available at http://www.aecbytes.com/viewpoint/2013/issue_67.html. Reprinted with permission.

the basis for integrated project delivery (IPD).[14] These complementary approaches meld in a recent Construction Industry Institute report, which concluded that the optimal project delivery method would be an integrated approach executed under Lean principles.[15] Most of the author's IPD projects use Lean principles and tools supported by proprietary IPD contract documents and business models that are designed to support collaborative processes.

Sustainability

Sustainability is another force behind the trend to collaboration. Optimizing sustainability requires simultaneous consideration of multiple variables and options. For example, energy use in a building is related to the shape, orientation, materials, and massing of a structure. But it is also related to the cooling/heating loads, which are dependent on energy losses and gains. Moreover, it is also affected by lighting loads, which generate heat (requiring more energy for cooling) as well as direct energy use. And lighting demand is affected by the level of daylighting, ceiling heights, internal layout, and the reflectance of surface materials. Additionally, different systems and equipment have advantages, disadvantages, and cost differences that must be considered to optimize the project in balance with its cost. Creating an optimal solution requires information from manufacturers, specialty contractors, engineering consultants, designers, facility personnel, and many others combined with a vigorous dialogue regarding the options. This can't occur unless the key parties engage in this dialogue throughout the project, from design inception through commissioning.

The solution to multivariable optimization is intense collaboration among diverse project participants. Recognizing the need for integration, the American National Standards Institute has published a standard for an *Integrative Process*, which it defines as:

> The Integrative Process actively seeks to design and construct projects that are cost-effective over both the short and long terms, by engaging all project team members in an intentional process of discovering mutually beneficial interrelationships and synergies between systems and components, in a way that unifies technical and living systems, so that high levels of building performance, human performance, and environmental benefits are achieved.[16]

As with Lean, this Integrative Process requires intense collaboration and, like Lean, it views IPD as a complement to the Integrative Process.[17] ASHRAE, the American Society of Heating, Refrigeration and Air-Conditioning Engineers, has a technical committee "concerned with facilitating interaction among all building disciplines, from earliest concept development throughout the building life cycle, in order to achieve integration of design efforts and operation of the total building."[18] And after summarizing the economic benefits of Integrated Project Delivery, the US Department of Energy in a recent publication stated that "Integrated project delivery teams are required to achieve deep energy savings (savings greater than 20% in existing buildings), due to the need for interconnectivity between building systems."[19] Thus, if we are going to create increasingly sustainable buildings—which we must—we must also use project delivery methods that are integrated and highly collaborative.

Technology

Building information modeling (BIM) has emerged as a leading technology affecting design and construction. McGraw-Hill, in their BIM SmartMarket 2013, reports high levels of usage across the world. But BIM use can range from a tool to produce traditional design documents and occasional 3-D renderings to a suite of tools for design, optimization, simulation, constructability, manufacturing, prefabrication, estimating, scheduling, building automation, and facility management. These mature BIM uses require integration of information from disparate disciplines and, to be effective, must be designed from inception to include this information in forms that are useful to all project participants. The ultimate goal of BIM use is to create a database of information that can be accessed and manipulated by all project participants assuring accuracy, clarity, and universal utility. Achievement of this goal requires early and intense collaboration from all project participants throughout the process.

The increasing use of prefabrication highlights the need for collaborative BIM. For example, hospitals and other complex projects are prefabricating mechanical, high- and low-voltage electrical, medical gas, and fire protection systems as fully assembled units, such as utility racks above corridors, patient room headwalls, or entire rooms themselves. To achieve the necessary constructability and coordination, the various manufacturers and trades need to integrate their design efforts with the architecture and engineering design. This, in turn, necessitates an early dialogue about the structure of the building information models,[20] including the data that will be included, tolerances, granularity, and who should be responsible for integrating specific information into the model. Moreover, the prefabricated spaces need to be constructed virtually to not only avoid conflicts, but also to develop the means and sequences for efficient assembly and installation. In addition, the conventionally built portions of the project must be constructed at the locations and tolerances necessary to avoid field adjustment of the prefabricated assemblies. Everyone in the process needs to interact in this virtual, digital world.

Implications for Project Delivery

Traditional project delivery approaches insulate parties from each other. Designers aren't responsible for means, methods, cost, or schedule. Builders aren't responsible for errors or omissions in design. Failure by one

subcontractor results in change orders from other subcontractors due to the effect the failed subcontractor has on their operations. Design omissions result in change orders from the general contractor or construction manager. Each party is responsible for its own outcome and can seek redress if affected by any of the other participants. This insular structure is designed to compartmentalize failure, not avoid it. Each contract provides remedies to the injured party but does not require joint action to resolve the problem or mitigate its effects. In addition, trades are hired after design is largely complete, obviating any opportunity for target value design. The parties may agree that profit is a worthwhile goal—but they are all focused on making *their own profit* rather than on optimizing project outcome and increasing profit for all. In this environment, it is all too easy for a traditional project to devolve into change orders, back-charges, disputes, and claims. Moreover, the completed project often becomes a victim of value engineering and compromise. The story may be familiar, but it is no longer acceptable.

There are project delivery methods that do embrace collaboration, either partially or completely. IPD stands out as a project delivery method built on collaboration. It requires the early involvement of key participants, alignment around agreed goals, and joint project management and ties individual profitability to overall project success.[21] The key parties are equal, with the owner central in the process. In the author's practice, IPD has become the predominant method of project delivery and is currently being used for university projects, health care, semiconductor manufacturing, commercial, industrial, pharmaceutical, sustainable, and other project types. Moreover, the pace of projects has increased significantly, and IPD projects have spread across the United States, Canada, and internationally.

In these projects, Lean has led to IPD and IPD has led to Lean. As parties seek to engage more deeply, they realize that their contractual systems are not tuned for collaboration. Thus, Lean projects tend toward IPD, and IPD projects tend toward Lean as a means of execution. Most of the projects[22] structured by the author's team have combined Lean and IPD, and the project outcomes have ranged from very good to exceptional.[23] Because of the success of IPD projects, the approach is being increasingly adopted by forward-thinking firms, as well as firms that realize they must change to meet difficult commercial challenges.[24]

At its core, IPD is a fundamental reordering of the business and contractual project models that ties directly to fundamental changes in behavior. But there are other approaches that do not address contractual misalignment, but focus solely on the behavioral changes. For example, the Alliance for Construction Excellence proposes a process, entitled Advanced Integrated Practice, to create a "Culture of Collaboration."[25] Many of the principles of IPD are embedded in their processes.

In the author's practice, IPD is beginning to be adopted internationally. But there is also a somewhat similar approach that has been used in the United Kingdom and elsewhere based on *partnered contracting.* Partnering, in this practice, must be distinguished from noncontractual partnering used in the United States. Initially published in 2000 by the Associated Consulting Architects, the PPC 2000 series of documents set forth an integrated approach that has many of the characteristics of IPD.[26]

Design/build, at least in some forms, can be collaborative, too. By bringing design and construction together, design/build overcomes some of the fragmentation within the industry. But too often design/build is only partially collaborative. Although design/build could be executed by equal designers and contractors, the experience has been that design/build is generally led by the contractor with the designer taking a subordinate role. Moreover, unless the trade contractors and consultants are on a cost basis and can share in the risk and reward of the project, the dysfunctions of traditional systems are not eliminated; they are just pushed down a level.

For design/build to approach IPD in collaboration, the parties retained by the design builder must share in the risk and reward and should not, in general, be able to assert claims against each other. They must function as a single organization. In addition, the key parties should be engaged before design is well under way to allow the builders and designers to collaborate before key design decisions are made and to enable target value design.[27] Bridging design/build, in which key design decisions are made prior to engaging the design/build team, does not meet this requirement. But it is possible to create a design/build approach that at least mimics some of the more collaborative aspects of IPD.

The owner's role in design/build is less participatory than in IPD, which can be an advantage to some owners. Although the owner has a strong role in setting the desired design/build outcomes, it is generally less involved during project execution. One of the advantages of design/build is that it transfers project execution authority to the design/builder, which can use this flexibility to improve cost and schedule efficiency. Moreover, where the owner does not have the staff or expertise to participate in joint project management, it may not be able to effectively engage in an IPD project. Finally, many owners choose design/build as a method of *disengaging* from the process by transferring all responsibility to a single design/build entity. These owners may still get a limited benefit through lower pricing allowed by the integration of design and construction, although many of the efficiency benefits will accrue to the design/builder in compensation for the risks undertaken. For owners incapable of fully participating in an IPD project, design/build can be an appropriate step on the collaborative path.

Alliances are another collaborative project delivery method. Alliances are less common in the United States but are used in the United Kingdom, Australia, Canada, and former Commonwealth countries. Although

they have been used for individual structures, alliances are more often used for civil, natural resource, and public infrastructure projects. The alliance form, like IPD, is generally cost-based, does not have a fixed price or guaranteed maximum cost, and has joint sharing of risk among alliance participants. Like design/build, alliances sometimes try to manage cost risk by subcontracting portions at fixed prices, which tends to drive the dysfunctions down a level, rather than eliminate them. Pertti Lahdenperä, in an article published in 2012, compares alliances, partnering, and IPD.[28]

There are also a variety of noncontractual collaborative approaches under different names and using slightly different methodologies. Most attempt to bridge the divide between design and construction, foster an early dialogue among the parties, and seek to create more productive communications. Partnering, which has existed in a variety of forms, is an example of this type of collaborative approach. Other projects have decided to "act like we are using IPD" or use "IPD principles" in executing a project under conventional contracts.

In the author's opinion, these "virtual collaboration" approaches are well meaning but fundamentally flawed and potentially dangerous. They are often used because the parties don't want to—or feel they can't—modify their contractual relationships. But it is the disconnection between how the parties act and how their contracts say they should act that limits these approaches and makes them unwise. Because the parties are not tied together by risk/reward provisions and limitations on claims and change orders, there is an incentive to abandon collaboration when the going gets tough. True collaborative approaches don't allow one of the parties to "opt out" if it is in their economic interest to do so. Moreover, traditional contracts create bright lines between design responsibility, means and methods, and similar concerns. Notice provisions require strict compliance or waiver of claims. If during project execution parties cross boundaries and ignore contract requirements, the result—if problems arise—is a potentially lethal stew of waiver, confusion, and uncertain insurability. In contrast, contractual collaboration methods are more stable, reliable, and legally consistent. With collaboration, going "all in" is less legally risky than putting your toe in the water.

The upshot is that private projects will become increasingly collaborative in order to meet the needs of efficiency, technology, and sustainability. Because full collaboration is more stable than virtual collaboration, projects will increasingly be supported by appropriate contract devices and related products, such as integrated insurance designed for collaborative projects.[29] The trend to contractually supported integration is already being realized through IPD, partnered contracts (UK), project alliances, and collaborative forms of design/build.

Forces Opposing Collaboration

Although there are strong forces driving collaboration that, in the author's opinion, will eventually transform project delivery, there are opposing forces that will impede this transformation.

Financing

Financing creates an entirely different set of pressures that can run counter to the trend toward collaboration. In the author's experience, lenders seek "riskless"[30] projects that generate predictable returns. They often do so by attempting to contractually transfer risk from the lender (or the borrower) to other project participants. On paper, there is little risk because it has been passed to others through fixed prices, indemnity, and other legal devices. Moreover, lenders prefer standard contract terms because they may be selling part of their risk to others and don't want to have to explain how, for example, a soft target may be more reliable than a contractual guarantee. This approach seems odd to the author, who, having spent a substantial portion of his professional career litigating delay and impact claims in fixed-price and guaranteed-maximum-price projects, can attest that these project methods do not bring price or schedule certainty.[31] In contrast, some of the experienced users of collaborative methods that do not rely on price guarantees use these approaches because they find they have greater price certainty than fixed-price or guaranteed-maximum-price contracts.[32]

The ultimate goal is a database of information that can be accessed and manipulated by all project participants assuring accuracy, clarity, and universal utility.

Project financing, i.e., where the project, not the participants, is the primary guarantor of loan repayment, tends to have the most intrusive lender requirements. Projects that are bond financed, or where financing is based on public entitlements, such as public-private partnerships, also tend to assume that a risk contractually transferred has miraculously vanished and spend considerable effort to try to allocate every conceivable risk. This builds high walls that reduce performance and increase costs.

The upshot is that if projects are beholden to lenders and lenders' counsel, much of the advances in collaborative project delivery will be discouraged (or forbidden) by those with the capital necessary for the project. And, in this case, money talks. One hopes, however, that as the reliability and success of collaborative projects become more widely known, lenders will become open to collaborative projects.[33]

In the author's experience, P3s are primarily financing tools.[34] They infuse a public project with private financing with the hope that the sponsors will reap a solid return on their investment. Because they are financing tools, P3 projects tend to be very focused on finding and closing financing. These investors and their lenders want to reduce their risk by contractually transferring it to others, such as an engineer/procure/construct (EPC) consortium. In addition, the financial consultants may be paid based on financial closing and want to avoid any issues that might reduce the number of potential lenders or delay project closing—and payment of their fee. As a result, the sponsors, lenders, and consultants favor project management approaches that require no explanation. P3s offer significant opportunity for creativity and can be a boon to cash-strapped public agencies. But because they are finance-driven, they are often accompanied by contractual handcuffs that limit integration and collaboration. (For a more detailed discussion of P3, see Deborah Ballati and Richard Robinson's article in this publication.)

At its core, IPD is a fundamental reordering of the business and contractual project models that ties directly to fundamental changes in behavior.

One might hope that lenders would eventually learn to view risk holistically and to embrace project delivery approaches that reduce waste and actually result in more reliable outcomes. One might hope that sponsors and lenders in P3 projects will equitably share risk and embrace collaborative project delivery.

Public Contracting

Public contracting is also a force counter to collaboration for valid, and somewhat less valid, reasons. In the public sector, the default project delivery method is design/bid/build, where the designers may have been selected based on quality, but the contractors are determined principally on cost. The difference in procurement approaches can make it difficult to put designers and contractors into a single agreement.

This approach has several benefits. If the bidding process is competently executed, it is difficult for public contracts to be fraudulently awarded. The concurrent and public opening of sealed bids is a reasonable protection against backroom dealing. In addition, public agencies should make their work available to all citizens, rather than a chosen few. By using a blind open bidding process, opportunity to contract is broadened, which is an important public value.

But the open bidding process inherently prohibits the early involvement of contractors and trade contractors in the design.[35] You can't hard bid something that hasn't been designed, and you can't procure the contractors without bidding. Moreover, the practice in hard bid contracting is to hard bid virtually all of the trades, which spreads the dysfunction of a hard bid into lower contractual tiers. Each of these hard bids, with separate contracts that aren't tied to overall project performance, creates the very silos that collaborative projects seek to demolish. Once the contracts are signed, everyone is in it for him/herself.

But all is not lost. Many public agencies have options other than pure design/bid/build. Depending on the jurisdiction, the agency may be able to use a Construction Manager at Risk (CMaR) approach, design/build, or a combination with best value. Moreover, skillful use of an integrated form of multiprime contracting may allow early involvement of trades, especially design/build trades. The key, in the author's experience, is whether the public agency has the desire, competence, and political will to engage in collaborative processes. If it does, there are often ways to approximate a truly collaborative process, although they are often needlessly complex.[36] Often, the more significant issue is whether the public agency has the expertise and commitment to execute collaborative projects. Moreover, middle management may oppose or subvert collaborative projects because middle management has shared responsibility for project outcome, not just the bidding process.[37]

It is possible to create a public form of IPD that preserves the public goals of equal opportunity, fairness in procurement, and transparency. There is precedent for this approach. Design/build developed in private contracting but has gradually spread into the public sector.

A Few Predictions

So, what will the future bring? In private projects, collaboration will prevail, and in the immediate future will be a mix of true IPD, virtual IPD, and collaborative forms of design/build and CMaR. Complex projects where the owner will continue to own and operate the facility will tend toward IPD and contractually based collaboration. Projects that are simpler,[38] or where the owner doesn't have the ability to function on the project management team, will tend toward design/build. CMaR will continue where owners want to move incrementally toward integration. The only certainty is that the future of collaborative projects will be exciting and that it will be a mix of project types. Moreover, many projects—particularly the larger and more sophisticated projects—will use business and contractual models that are tuned to the outcomes sought by the owner and project team.

Project-financed projects will remain stuck in noncollaborative project delivery for some time because of the prevailing view among financiers that risk can be abolished by contract. Public projects will be increasingly collaborative, but at a slower pace than private projects. Moreover, one might hope that public collaborative approaches are developed that

maintain transparency, opportunity, and protection from backroom dealing. This will require skillful legislation and negotiation with the many interests that compete in the public sector, but it is a worthwhile and possible goal.[39]

Implications for Construction Lawyers

In the past, a good construction lawyer needed to be well versed in construction law and skilled at aggressively negotiating (and drafting) contract language that protected his or her client from the various pitfalls of construction. A great construction lawyer had some understanding of the industry and his or her client's business and could vigorously prosecute or defend those interests before a judge, jury, or arbitration panel. It didn't much matter if the project was a success as long as the client did "well." And a good outcome might be measured in negotiating (or deflecting) strong contract terms or "winning" in court. Waste due to the system was largely unseen and irrelevant to determining "winners" or "losers." Victory was measured by the percentage of the slice, not the size of the pie.

As collaboration expands, traditional skills will be less relevant. There will be fewer claims in private projects (it is very hard to have claims in a properly structured IPD project), and, with the exception of an occasional disaster, most of the traditional litigation will be in public projects, where, in the immediate future, collaboration has limited influence. If you are looking to litigate, focus on public projects, project-financed projects, international megaprojects (which are mostly fixed price), and some P3 projects.

Lawyers in collaborative projects need broader views and different skills. The collaborative lawyer must understand the dynamics of the construction process and must develop a business and contractual model that leads to a successful project—because the client's outcome is tied to the project outcome. Thus, the lawyer may be in the position of recommending a business or contractual structure that is designed to increase the likelihood of project success even if—in traditional terms—the client could strike a "better" deal. Thus, much of the learning from past project negotiations is irrelevant and even counterproductive in the collaborative project.

This broader view means that the lawyer must understand what makes a project successful and what does not. This implies a detailed understanding of how Lean principles and processes are used on projects. It also implies understanding how collaboration should be structured, including full, partial, and virtual colocation and the roles and responsibilities of parties in collective decision making. The new construction lawyer must understand the basics of organizational behavior and team structure, leadership, and dynamics. The lawyer needs to balance empowerment and prescription in the drafted agreement. The business structures and contracts that he or she creates should create appropriate responsibilities without handcuffing the teams.

The lawyer will need to learn to be a facilitator as well as a negotiator and have the skills to align the many project participants to jointly agreed goals. In some instances, the lawyer may be retained by the entire team, which will raise ethical issues accompanying joint representation. Even if only representing one party, the lawyer needs to understand that the client is best served by a successful project, not by winning the negotiation.

Collaboration also requires that the lawyer have a detailed understanding of the new technologies being used on projects and that will be used on projects in the future, such as digitally automated design; CNC fabrication from building models; computer simulation for operation, sustainability, and constructability; multidisciplinary cloud-based optimization; and digital techniques for communication and collaboration.

Finally, the collaborative lawyer needs to be an expert in construction law, too. And as new project delivery methods and new technologies arrive, he or she must be able to translate legal principles into tools that integrate the new developments into a coherent system.

Senior lawyers—assuming they have developed the skills—must make sure that the attorneys who follow them are equally engaged in developing the broad skills necessary for a collaborative practice. This can only be done with study, experience, and effort. But it is also a satisfying intellectual challenge that creates better and more efficient projects, more sustainable projects, and more profitable projects—which benefit your client and the greater society. And that is reason enough.

Endnotes

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4. Peter Beaumont, *The Truth About Twitter, Facebook and the Uprising in the Arab World*, The Guardian, Feb. 24, 2011.
5. As used in this article, *collaboration* is the process of individuals working together across organizational lines to jointly accomplish common goals. Collaboration should be distinguished from *coordination*, which implies organizing work *between* entities. A fully integrated project relies on collaboration, with all individuals acting as if within a single, albeit virtual, organization. Current project delivery methods use coordination but, with the exception of IPD and, to a lesser degree, design/build, are not fundamentally collaborative.
6. *Lean* refers to principles, procedures, and tools designed to improve value and eliminate nonproductive activity throughout the design and construction process. *Lean* is commonly associated with the Toyota Production System, and Lean design and construction incorporate and expand on the principles espoused by Toyota, as appropriate to design and construction projects.
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(Continued on page 57)

Public-Private Partnerships

(Continued from page 34)

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33. B. Scott Douglass & Jeffrey A. Sykes, *Public-Private Partnerships in California, Part 1 of 2*, 36 Cal. Pub. L.J., no. 3, May 2013, at 2–3 [hereinafter *California P3s 1 of 2*].

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35. *California P3s 1 of 2*, *supra* note 33, at 3.

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37. Matthew Roth, *Planners Expect Public-Private Partnership to Lower Doyle Drive Costs*, Streetsblogsf (Nov. 15, 2010), http://sf.streetsblog.org/2010/11/15/planners-expect-public-private-partnership-to-lower-doyle-drive-costs/.

38. *See* Frank Beckers et al., *A Risk Management Approach to a Successful Infrastructure Project: Initiation, Financing, and Execution* (Mckinsey Working Papers on Risk No. 52, 2013).

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40. B. Scott Douglass & Jeffrey A. Sykes, *Public-Private Partnerships in California, Part 2 of 2*, 36 Cal. Pub. L.J., no. 4, Nov. 2013, at 43 n.3 [hereinafter *California P3s, 2 of 2*].

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The Transformation of Project Delivery

(Continued from page 41)

Issue_67.html.

10. Sir Michael Latham, Constructing the Team: Final Report of the Government Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry (HMSO 1994); Sir John Egan et al., Rethinking Construction: Report of the Construction Task Force to the Deputy Prime Minister, John Prescott, on the Scope for Improving the Quality and Efficiency of UK Construction 15 (Dep't of Trade & Ministry 1998).

11. Rethinking Construction, *supra* note 10, at 15.

12. Edward Merrow, Industrial Megaprojects: Concepts, Strategies, and Practices for Success (Wiley 2011).

13. Currently Vice President for Business and Process Development with The Boldt Companies, a progressive general contractor headquartered in Appleton, Wisconsin.

14. Am. Inst. of Architects Cal. Council, Integrated Project Delivery: A Working Definition (2007). This document was updated in 2014. Am. Inst. of Architects Cal. Council, Integrated Project Delivery: An Updated Working Definition (2014), http://www.aiacc.org/new-ipd-pdf-form/.

15. Glenn Ballard et al., RS271-1, Starting from Scratch: A New Project Delivery Paradigm (Constr. Indus. Inst. 2011).

16. Am. Nat'l Standards Inst., Integrative Process (IP)—ANSI Consensus National Standard Guide 2.0 for Design and Construction of Sustainable Buildings and Communities (2012).

17. *Id.* at 1.C.2.

18. *Integrated Building Design*, ASHRAE Tech. Comm. 7.1, http://www.tc71.ashraetcs.org/.

19. Kristen Parrish, Lawrence Berkeley Nat'l Lab., U.S. Dep't of Energy, A Path to Successful Energy Retrofits: Early Collaboration Through Integrated Project Delivery Teams (Oct. 2012).

20. In current practice, there is rarely a single building information model that describes the entire project and is useable from design through fabrication and construction. The principles of integration, however, are equally applicable to the use of multiple federated models. For convenience, this article refers to the model, rather than the many related models.

21. Howard W. Ashcraft Jr., *Integrated Project Delivery Agreement—A Lawyer's Perspective*, 2014 J. Can. Coll. Constr. Law. 105 (May 2014); Howard Ashcraft, *Negotiating an Integrated Project Delivery Agreement*, 31 Constr. Law., no. 3, Summer 2011, at 17; Am. Inst. of Architects & Am. Inst. of Architects Cal. Council, Integrated Project Delivery Guide (2007); IPD: An Updated Working Definition, *supra* note 14; Nat'l Ass'n of State Facilities Admins. et al., Integrated Project Delivery for Public and Private Owners (2010); Chuck Thomsen, Joel Darrington, Dennis Dunne & Will Lichtig, Constr. Mgmt. Ass'n of Am., Managing Integrated Project Delivery (2010); *also see* AIA contract documents C191 and C195 and ConsensusDOCS contract document CD-300.

22. As of the writing of this article, this team has structured more than 60 full IPD projects with a combined value of approximately $8 billion and is starting new projects ranging from a few to tens of millions USD to more than $2 billion.

23. A number of the health care projects, such as Sutter Health's Castro Valley Medical Center, MaineGeneral's New Replacement Hospital, and others, have been studied and discussed in the media. Many of the newer projects, however, are in the financial, entertainment, software, semiconductor manufacturing, and pharmaceutical industries, where the projects are considered confidential and subject to nondisclosure agreements.

24. In the author's practice, the firms adopting IPD were initially those facing critical commercial challenges (the burning platform) and those that focused on continuous improvement (early adopters). In the last several years, however, firms between these extremes have begun moving to integrated approaches.

25. Alliance for Constr. Excellence, Advanced Integrated Practice: Create a Culture of Deep Collaboration (2014) (ebook).

26. The Associated Consulting Architects publishes an entire series of documents, principally authored by Dr. David Mosely of Trowers & Hamlins. The documents can be ordered from ACA at their website, http://www.acarchitects.co.uk.

27. Target value design is the discipline of designing to a specific target cost rather than designing to include desired scope and then value engineering the resulting cost back to an acceptable budget. Target value design requires builder involvement at an early stage to inform designers of the cost implications of alternate strategies and to assure that predicted cost and eventual cost remain aligned. Although simple to describe, target value design is a sophisticated practice that is fundamentally different from traditional design workflows.

28. Pertti Lahdenperä, *Making Sense of the Multi-Party Contractual Arrangements of Project Partnering, Project Alliancing, and Integrated Project Delivery*, 30 Constr. Mgmt. & Econ. 57 (2012).

29. Integrated insurance products already exist and the author has negotiated and assisted placing products on IPD projects. As of the date of this article, Zurich, Catlin, AIG/Lexington, and XL have products designed for collaborative environments. Currently, these products differ significantly in terms of coverage and cost. As collaboration expands, product offerings will expand further.

30. The ultimate example of the riskless project is one with a firm, fixed price. If this really worked, delay and impact claims would not exist, nor would we have the myriad of consultants specializing in these types of claims. As noted by Edward Merrow, "One of the ironies of large projects around the world is that most of them are executed on fixed-price (lump-sum) contracts. And yet many of those so-called fixed-price contracts end up anything but fixed." Merrow, *supra* note 12. Yet lenders regularly demand fixed or guaranteed maximum price contracts to "assure" price certainty.

31. The author is not alone in this opinion. Edward Merrow notes, "One of the ironies of large projects around the world is that most of them are executed on fixed price (lump-sum) contracts. And yet many of those so-called fixed-price contracts end up anything but fixed." *Id.* at 914. Moreover, the author has sought—with no success—any researched evidence that openly bid fixed-price contracts even result in lowest first cost.

32. Howard W. Ashcraft Jr., *Integrated Project Delivery: The Owner's Perspective* (Hanson Bridgett White Paper 2012) (interviews with Robert Mitsch of Sutter Health, who was managing a nearly US$8 billion hospital upgrade and expansion program, and William Seed, who was managing a smaller (by average contract size) but more numerous program for Universal Health System).

33. Most of the author's IPD projects have not been project-financed. However, there have been a few recent projects that have received conventional financing. Moreover, there have been a few developer clients that are looking to use IPD for their projects. Thus, there is some reason to believe that conventional lenders could support IPD projects.

34. The author is aware of at least one public agency that uses P3 as a tool to enable different project delivery methods, rather than as a means to finance projects it can afford to build. But this is an exception.

35. In some jurisdictions, the involvement of a party in the development of the design precludes that party from submitting a bid because of an institutional conflict of interest.

36. The author and attorneys in his firm have created "near IPD" public projects that have used innovative combinations of multiprime, best value CMaR, and integrated best-value design/build. All have required significantly more contracting effort as they can require interlocking agreements, must be drafted to meet specific procurement authority, and can become quite complex. The contractual vehicles for these projects were not perfect, but they did create opportunity for greater collaboration.

37. If public employees follow the rules for openly bidding a project—and it results in cost overruns and delays—they can always say that they did everything right. They are accountable for following their process, not for project outcome. If they deviate from the normative low-bid process, then they become accountable for project outcome and may have to justify their "risky" decision to a publicly elected board. It shouldn't be surprising that middle-level public officials (and similarly situated employees in some large corporations) prefer the personal safety of a lowest responsible bid system. Generally, when a public agency moves to collaboration, it is because of a strong and reasonably senior champion in the system, not because the procurement section is begging for change.

38. In this instance, simpler is only weakly correlated to project cost. One can have a project with a clear definition, few trades, and few moving parts, but that is expensive because of its size. This would be a simple project. A project that has many trades and requires a high level of creativity to solve unique problems is complex, regardless of value.

39. Trade and professional unions, for example, must be included in any conversation leading to changes in procurement. Minority- and women-owned enterprises may also fear a system where the identities of the contracting parties are known prior to award, or where the ability to collaborate becomes a barrier to entry for public projects.

Construction Bills

(Continued from page 45)

(iii) The applicant ratio and hiring ratio for the previous year, based on the data collected pursuant to § 60-300.44(k);
(iv) The contractor's recent assessments of the effectiveness of its external outreach and recruitment efforts, as set forth in § 60-300.44(f)(3); and
(v) Any other factors, including but not limited to the nature of the contractor's job openings and/or its location, which would tend to affect the availability of qualified protected veterans.

19. Office of Fed. Contract Compliance Programs, Affirmative Action and Nondiscrimination Obligations of Contractors and Subcontractors Regarding Special Disabled Veterans, Veterans of the Vietnam Era, Disabled Veterans, Recently Separated Veterans, Active Duty Wartime or Campaign Badge Veterans, and Armed Forces Service Medal Veterans, 78 Fed. Reg. 58,614, 58,639 (Sept. 24, 2013).

20. *Id.* at 58,708, 58,785.

21. *See* 41 C.F.R. § 60-741.44(k)(1); 41 C.F.R. § 60-300.44(k)(1).

22. Prior regulations required only two years. *See* 41 C.F.R. § 60-741.80; 41 C.F.R. § 60-300.80.

23. 41 C.F.R. § 60-741.42; 41 C.F.R. § 60-300.42.

24. 41 C.F.R. § 60-300.42(c).

25. 41 C.F.R. § 60-741.60(c); 41 C.F.R. § 60-300.60(d).

26. Associated Builders & Contractors, Inc. v. Shiu, CV 13-1806, 2014 WL 1100779 (D.D.C. Mar. 21, 2014).

27. 5 U.S.C. §§ 601–612.

28. Memorandum Opinion, Docket No. 29, Associated Builders & Contractors, Inc. v. Shiu, CV 13-1806, 2014 WL 1100779 (D.D.C. Mar. 21, 2014).

29. 5 U.S.C. §§ 603, 604.