

The IPD Framework



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I. What is the IPD Framework?

The IPD Framework defines the relationships among the project participants and the processes that guide their actions. It embodies the project goals and creates consequences for success or failure tied to their achievement. It puts control in the hands of the project participants and makes them responsible for total project outcome, not just their individual performance. Correctly designed, it stimulates behaviors that increase creativity, improve productivity, and reduce waste. A strong IPD Framework leads to better outcomes, whether measured in value, aesthetics, sustainability or otherwise.

The IPD Framework is the result of an intentional process, purposely built for the project, and adaptable to changing conditions.

[P]roject delivery systems must be adapted to their contexts, and should be viewed as products of design. This design cannot be entirely completed at the start of a project, but rather must occur throughout project execution, responsive to emergent phenomena. Further, although the industry is strongly urged to create conditions under which the ideal project delivery system can be more completely realized, designing to context can be used to get the best outcomes from a given set of project circumstances—even when less than ideal.²

The IPD Framework functions on two interdependent levels, a Macro-Framework consisting of the contract terms and business structure and a Micro-Framework consisting of the protocols and processes used to implement the project. In general, the Macro-Framework documents goals, relationships, metrics and consequences, and is contained in the IPD contract. The Micro-Framework extends integration into the operational layers, addressing issues of Work Design, Information Design, and Team Design that may be recorded in contract exhibits, but are more often contained in subsidiary documents, such as BIM execution plans, work plans, process diagrams and project manuals. Together, Macro-Framework and Micro-Framework are the road map for IPD.³

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² Starting from Scratch: A New Project Delivery Paradigm, Construction Industry Institute Research Summary 271-1 (2011).

³ Executing an IPD project without a supporting Framework is possible, but risky. For example, the project team for the Walter Cronkite School of Journalism, successfully executed a "Virtual IPD" project by signing, but then ignoring, traditional design and construction contracts. Virtual IPD is risky because traditional contract terms do not restrain antagonistic behaviors in response to project stresses, and actually encourage them. Moreover, traditional contract terms balance risk and reward assuming that parties remain in their traditional, isolated roles. In a "virtual IPD" project, the mismatch between actions and contract terms can result in unanticipated and

(footnote continued)

II. The Relationship of the IPD Framework to the Business Deal

Although the principles of IPD are constant, their expression in the IPD Framework varies among projects and must reflect the legitimate interests of each party. For example, the participant's cash flow requirements in a long duration project may necessitate interim distributions or other financial accommodations. Similarly, an institutional owner may favor maximizing the value received from a fixed budget, whereas a speculative developer may prefer minimizing the cost of a defined scope. The IPD Framework must accommodate differing values and objectives.

The business deal must also be fundamentally fair. If the opportunities for gain and the potential for loss are not equitably distributed, the parties will not be motivated to collaborate. Resentment, not cooperation, will result. Financial targets and profit at risk should be carefully set to challenge the team members, but not discourage them.

In some instances, a party's requirements conflict with IPD principles. For example, an owner with absolute financial limitations, such as public bond financing, may not be able to obligate itself for costs that exceed bond financing, and must avoid this risk, even if it is slight and increases project costs.⁴ The owner's need can be addressed through a cost guarantee, recognizing that this undermines the project goals by encouraging overly conservative contingency reserves and creating conflicting interests among the parties. Similarly, public contract procurement processes may limit the choice of contract structure. In these instances, the IPD Framework needs to accommodate the constraints.

The structural elements of IPD are intended to create a self-regulating system. IPD's balance of interests and responsibilities responds resiliently to challenge and change. Constraints affect that balance and reduce resiliency and collaboration. It is important to recognize that some "constraints" are self-imposed limitations. "We have always done it this way," is an excuse, not a constraint. Although a constraint limited IPD approach may improve on traditional practice, it is less likely to achieve full IPD performance and is more likely to be derailed by adversity.⁵

In summary, the framework terms should not undermine the project values and the business deal should not distort the framework. Simply stated, the project must make sense.

inequitable liabilities. For a description of the Walter Cronkite project, see, *Integrated Project Delivery: Case Studies*, Joint Report of the American Institute of Architects California Council and the American Institute of Architects, 2010.

- 4 Risk avoidance rarely reduces overall risk or cost. Instead, it transfers risk to another party that will price it as a contingency to be included in project cost. In general, transferring risk to a person or entity that is not best able to manage or control the risk results in excessive valuation of the risk. [citation]
- 5 Some public projects, for example, may not be able to implement all IPD principles because of limiting procurement statutes or regulations. In these instances, the participants should attempt to use as many IPD principles as permissible and recognize that the resulting project delivery approach is improved, but not fully optimized.

III. IPD Framework Objectives

IPD is designed to encourage behaviors that lead to exceptional project performance and value. These goals are achieved through a properly crafted IPD Framework that should:

- Remove impediments to, and stimulate, communication, collaboration and creativity;
- Align participants to well understood and agreed objectives; and
- Encourage and reward behavior that increases project value.

These attributes must be built into the fabric of the IPD agreement. In practical terms, this means that no element of the contract should be inconsistent with the drivers of IPD, and that all elements should be consistent with IPD's values. Contracts built on these premises are fundamentally different from traditional construction contracts.

Some IPD agreements are filled with unenforceable aspirational language, such as exhorting the parties to act collaboratively, as if this will overcome structural flaws. This may be harmless,⁶ but it does not substitute for an effective contract structure. Aspirational language, alone, will not prevail against serious difficulties.

When negotiating or developing an IPD agreement, each major element should be tested for consistency with IPD principles. The contract drafter should ask whether the element encourages or discourages the behavior sought. This approach can be difficult if you have significant experience with traditional contracts. It is hard to see the adverse effects of familiar language and abandoning a "time-honored" concept can be disconcerting. But IPD agreements should be developed from IPD experience and theory, not bound by experiences from the past.

The transformation from traditional to IPD agreements requires a mental shift regarding how contracts are developed. Good traditional contracts are designed to be prescriptive. The drafter attempts to envision all of the possible scenarios and craft language that tells the parties what they must and must not do. The limitations of traditional contracts are discussed more thoroughly in the Appendix.

In contrast, IPD agreements are flexible and empowering. They fundamentally assume that a properly configured and incentivized team can best determine how to achieve project goals. Trying to predict what a creative team will develop and telling them what they must and must not do is futile and counterproductive. Instead, the IPD agreement focuses on collaborative project structure, enhancing communication, and providing opportunities and incentives for creativity.

6 Purely aspirational language can be problematic. The aspirational text may obscure the enforceable provisions of the agreement creating a perception that an agreement is highly collaborative when it is not. The lesson of partnering is that purely aspirational language does not guarantee collaborative behavior when problems are severe or the stakes are high. Similarly, unless the IPD contract embodies IPD terms, the aspirational language will not achieve collaborative behavior in hard situations—which is precisely when you need it to work.

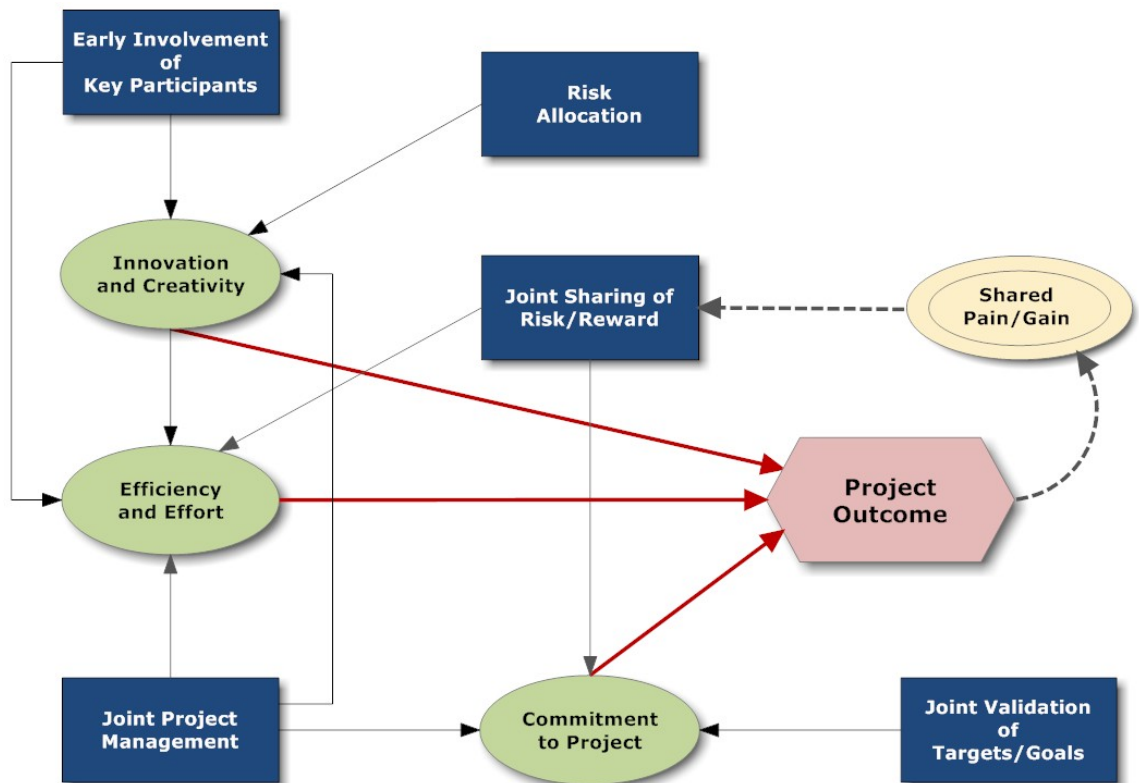
IV. The Five Macro-Framework Elements (and why)

A full IPD project has five major structural elements:

- Early involvement of key participants;
- Shared risk and reward based on project outcome;
- Joint project control;
- Reduced liability exposure; and
- Jointly developed and validated targets.

The sections below discuss the importance of each element and how it affects IPD behaviors. The influence diagram in Figure 1, summarizes the discussion by linking elements to behaviors.

Figure 1: IPD Elements and Outcomes



A. Early Involvement of Key Participants

Early involvement of key participants—defined as those who have the greatest influence on project success—is the most important IPD element. A project participant deeply influences project success if it can impart knowledge that improves the effectiveness or constructability of design or if its interactions with other organizations enhances project productivity. Identification of key participants is specific to a given project, but—in addition to the owner, designer and builder—key participants generally include the mechanical, electrical and plumbing designers and contractors because their knowledge strongly affects design and these parties must cooperate closely for the project to proceed smoothly. Depending upon the project, steel erectors, framers, curtain wall contractors, major equipment vendors and others may similarly be key participants.

The key participants' diverse viewpoints improve project performance in many ways. Studies of creativity in commercial contexts note that teams with diverse backgrounds are more creative.

...[O]ne common way managers kill creativity is by assembling homogeneous teams. The lure to do so is great. Homogeneous teams often reach “solutions” more quickly and with less friction along the way. These teams often report high morale, too. But homogeneous teams do little to enhance expertise and creative thinking. Everyone comes to the table with a similar mindset. They leave with the same.⁷

The broad experience of the diverse team also benefits target value design. Designers provided with information concerning effectiveness and constructability of alternative concepts can more accurately choose systems and layouts that efficiently achieve the project goals. Moreover, the key specialty contractors can provide pricing information that is current and accurate, leading to better price control and fewer surprises. Finally, when parties are engaged in developing the project design, they develop a commitment to the overall project, not just to their individual component.

The timing of key participant involvement is also important. Key participants should become engaged when their participation will benefit the project. This is almost always earlier than traditional design and construction practice, and the reference to “early” is meant to highlight this change in practice. It does not imply that all key participants commence simultaneously, and in most projects, the core team will be augmented by additional key participants as the project progresses. Restated, the rule is that key participants should become involved at the appropriate time, which is when their contributions will significantly affect project outcome.

B. Shared Risk/Reward Based on Project Outcome

IPD agreements tie compensation to achievement of project objectives. Although formulations vary, all or part of the participants' profit is placed at risk and profit may be augmented if project performance is met or exceeded. Individual profit is not a function of

⁷ T. Amabile, *How to Kill Creativity*, Harvard Business Review, Sept.-Oct. 1998.

the amount of work performed, or of individual productivity, but is proportionate to overall project success.

Tying profit to project performance discourages selfish actions. Because of the compensation structure, selfishness is self-defeating. Shared risk/reward also increases project commitment. The parties perceive that they are rowing the same boat. Thus, a party benefits by providing suggestions or assistance to other parties. Parties become interested in how they can optimize the whole project, not just a single system or element.

Shared risk/reward also serves to align the parties to the project objective. If compensation is based on achieving that objective, it behooves each party to understand precisely what the objective is and how it is best achieved.

Reward structure requires careful consideration. In her study of creativity, Professor Teresa Amabile concluded that monetary incentives are not a principle driver for highly creative teams,⁸ although an absence of reward or recognition was often correlated with low creativity.⁹ A recent study of six completed IPD projects uncovered pointed disagreement concerning the necessity of rewards programs.¹⁰ Some participants believed they were absolutely essential, others thought that they were unnecessary.

This disagreement may reflect the difference between corporate and individual viewpoints. A firm considering IPD must assess the risk of engaging in the project. Expressed preference studies show that people are willing to accept a higher risk if they believe the activity is beneficial.¹¹ The possibility of superior profitability also lowers psychological barriers to entry.¹² Managers considering whether to commit their organizations to IPD will consider its potential benefits to their organization. Shared reward not only makes risk more tolerable, it provides a basis for rationally preferring IPD projects. Thus, a workshop of design and construction managers concluded:

Shared Risk/Reward Pool

The Group felt that structuring participant's compensation to be raised or lowered according to performance against predetermined targets is the most important and effective driver—it provides a monetary reason to collaborate.¹³

In contrast, once an organization has committed to an IPD project, its employees are motivated by a combination of intrinsic as well as extrinsic rewards. Participants in IPD projects have commented that the positive, non-antagonistic focus of IPD is, itself, a signif-

8 T. Amabile, *Managing for Creativity*, Harvard Business School 9-396-271, February 1996.

9 *id.*

10 *Integrated Project Delivery: Case Studies*, Joint Report of the American Institute of Architects California Council and the American Institute of Architects, 2010.

11 P. Slovic, *Perception of Risk*, *Science*, Vol. 236 (1987).

12 A major barrier is the concept of anticipated regret. When a person recommends or undertakes a task that it could have avoided or ignored, the person runs the risk of embarrassment or otherwise regretting a decision he or she did not have to make. Anticipated regret amplifies risk perception. Nordgren, et al., *Unpacking Perceived Control in Risk Perception: The Mediating Role of Anticipated Regret*, *Journal of Behavioral Decision Making* 20:533-544 (2007). The opportunity for superior performance can help overcome this barrier to implementing IPD.

13 *Experiences in Collaboration: On the Path to IPD*, AIA National/AIA California Council, p. 9, 2009.

ificant reward. Thus, the supposed disagreement may simply reflect the viewpoint differences of persons considering IPD compared to those already engaged in a collaborative project.

Shared risk and reward should extend to all key IPD participants, not just the owner, contractor and designer. Key participants are those who have a significant effect on project outcome, particularly if project outcome is tied to their successfully working with others. These subcontractor and consultant key participants can be brought into the IPD agreement by flow-through provisions in their respective agreements with the contractor and designer, or can be included in the IPD agreement by “joining agreement” amendments.

C. Joint Project Control

Joint project control requires real communication between the parties. To achieve consensus, the parties must clearly explain the issues from their perspectives and listen to the perspectives of others. The increased understanding provides a clearer and jointly held understanding of the issues. Miscommunication, although certainly possible, is less likely.

Joint project control also reinforces the communal nature of the undertaking. It is not “their project.” It is “our project.” In addition, joint project control balances the interests of the parties and provides a check against favoring the interests of one party over the other. It also reflects a fundamental fairness. In IPD parties are accepting risk based on project outcome and should certainly have a voice in decisions that affect those risks.

Joint project control also affects the perception of risk, as well as risk itself. Risk perception research indicates that perils a party cannot control are feared more than those they can.¹⁴ As noted below, fear chills creativity, and results in defensive behavior. It also results in excessive risk hedges through explicit or implicit contingencies. Thus, joint management serves to reduce defensive behavior and avoids unnecessary contingency expense.

In an IPD project, joint project control is effected through a project management team comprised of at least the owner, contractor and designer. The project management team is authorized to manage the project to achieve the jointly agreed objectives. Thus, each member of the project management team must have the authority to bind its respective entity and each party must be able to rely on the agreements of the others. Senior management “second-guessing” of project level decisions is toxic, undermines trust and reduces parties’ willingness to place project objectives ahead of their short-term interests.

Joint project control is a significant paradigm shift for many owners. Traditionally, the owner’s project representative functioned as the owner’s “eyes and ears,” but did not actively participate in the development of design or construction solutions. Instead, the contractor or designer proposed options and solutions that were approved or disapproved by the owner’s senior management after being communicated by the project representative.

The IPD owner, in contrast, is actively involved in the development and analysis of options and solutions. This level of owner involvement and control is, in fact, one of the major advantages of IPD for owners. In no other project delivery method does the owner have such a strong role in fashioning the project to meet its needs. But this strength implies responsibility to commit sufficient capable resources authorized to make reliable decisions.

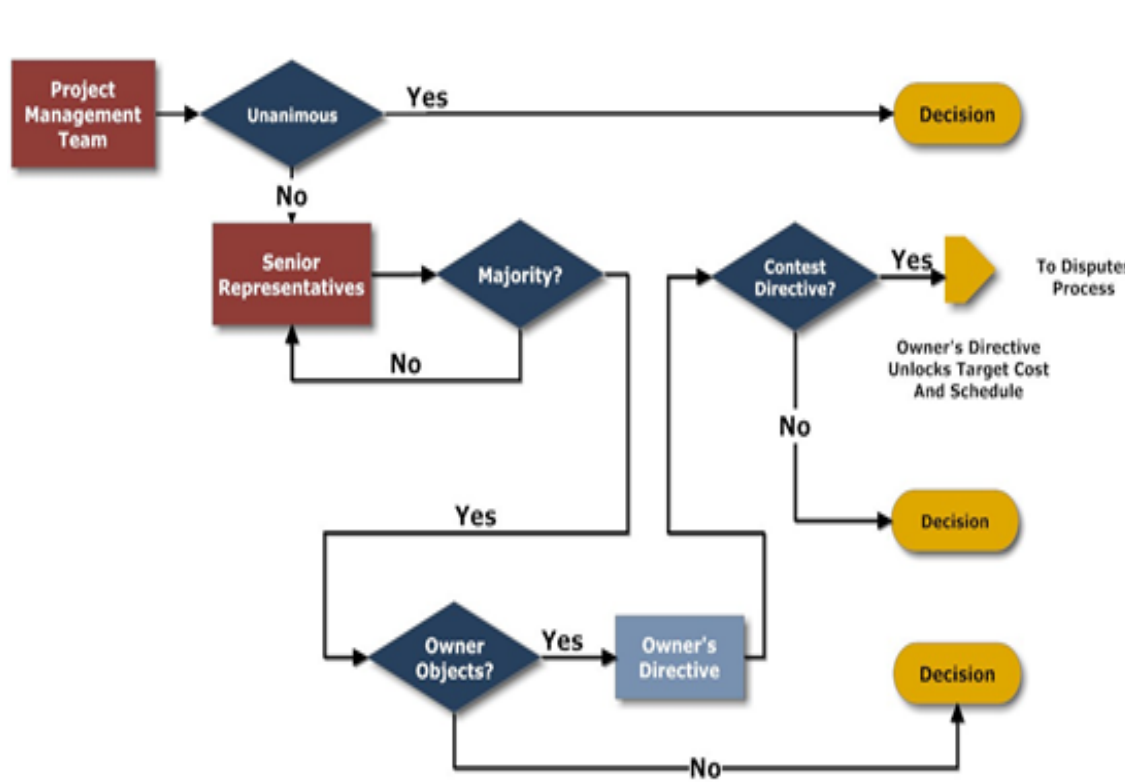
14 P. Slovic, *Perception of Risk*, Science, V. 236 (1987).

This change in practice can be particularly difficult for owners that have traditionally vested their project representatives with little authority.

Although all current IPD agreements have some form of joint project control, the detailed decision process and ultimate authority of the participants varies significantly. Variation is inevitable given the needs of specific projects and participants. But joint project control is designed to provide parties at risk with some control over the risks they have undertaken and to increase parties commitment to the project as a whole. Thus, skewing control in favor of one party or the other may undermine the behaviors IPD seeks to create.

One approach that attempts to balance project control is shown in the flow chart (Figure 2) below. In this approach, unanimous decisions at the project management team level are binding and unappealable. If the project management team is unable to reach a decision, a senior management team decides the issue by majority vote. This is also binding and unappealable, unless the owner decides to override the decision by issuing an owner's directive. If the designer or contractor challenge an owner's directive, it is resolved through the contract's dispute process and may result in an adjustment to project cost and schedule. Thus, all parties have a voice in decisions and authority is fairly evenly distributed with the owner having slightly more authority through the owner's directive. The owner's authority is balanced, however, by the ability to appeal unilateral owner decisions through the dispute process.

Figure 2: Project Decision Flow



D. Reduced Liability Exposure

The primary reasons for limiting liability are to increase communication,¹⁵ foster creativity, and reduce excessive contingencies.

Information sharing and collaboration support all three components of creativity. Take expertise. The more often people exchange ideas and data by working together, the more knowledge they will have. The same dynamic can be said for creative thinking. In fact, one way to enhance the creative thinking of employees is to expose them to various approaches to problem solving.

With the exception of hardened misanthropes, information sharing and collaboration heighten peoples' enjoyment of work and thus their intrinsic motivation.¹⁶

Unfortunately, freely exchanging information can lead to greater liability. For example, many states¹⁷ permit actions for negligent misrepresentation under the guidelines of section 552 of the Restatement of Torts, Second.¹⁸ Under that standard, a person providing errant information is liable for the damage caused to anyone whose reliance was intended. This has led to bottling up information to limit liability expansion, although this diminishes creativity and performance. Liability waivers support creativity by removing this concern.

In addition, liability waivers serve to generally reduce fear of failure. In a creative project, there must always be a safety net below people who make suggestions. A climate of fear is not conducive to creativity and undermines intrinsic motivation.¹⁹

15 The liability concern, and its potential harm, was neatly summarized in the commentary *Intelligent Building Models and Downstream Use*, Comments of the Technology in Architectural Practice Advisory Group submitted for the 2007 revisions to AIA Documents B141 and A201, AIA 2005.

We fear there will be a tendency, driven by valid concerns about liability and insurability, to prevent such use of the architect's design data. We believe this is the wrong answer and would jeopardize the future of architectural practice as we know it. ... Obstacles to a free flow of data among the project participants should be overcome so that the architecture firm can deliver the full value of its work to the client and be rewarded commensurately.

16 T. Amabile, *How to Kill Creativity*, Harvard Business Review, Sep.-Oct. 1998.

17 See, for example, *Bily v. Arthur Young & Co.*, 3 Cal.4th 370 (1992).

18 § 552. Information Negligently Supplied for the Guidance of Others

- (1) One who, in the course of his business, profession or employment, or in any other transaction in which he has a pecuniary interest, supplies false information for the guidance of others in their business transactions, is subject to liability for pecuniary loss caused to them by their justifiable reliance upon the information, if he fails to exercise reasonable care or competence in obtaining or communicating the information;
 - (2) Except as stated in Subsection (3), the liability stated in Subsection (1) is limited to loss suffered;
 - (a) by the person or one of a limited group of persons for whose benefit and guidance he intends to supply the information or knows that the recipient intends to supply it; and
 - (b) through reliance upon it in a transaction that he intends the information to influence or knows that the recipient so intends or in a substantially similar transaction.
 - (3) The liability of one who is under a public duty to give the information extends to loss suffered by any of the class of persons for whose benefit the duty is created, in any of the transactions in which it is intended to protect them.
- 19 T. Amabile, *How to Kill Creativity*, Harvard Business Review, Sep.-Oct. 1998.

Liability exposure also directly raises project costs through increased contingency allocations. A rational negotiator assesses the risks his or her organization faces, attempts to quantify the risk, and includes an allowance in the project cost. This rational action is repeated by each participating organization with the result that the summed risk allowances exceed the actual contingency required for the project. Moreover, the division of project contingency into many smaller allocations impairs effective contingency management.

Liability concerns also create hidden costs caused by defensive design and reluctance to consider using new materials and techniques. Old practices may be costly and inefficient, but they are comfortable and appear safe.

Liability waivers also reduce litigation costs, and can be justified on this ground alone, but as noted above, the primary reason for liability waivers is to increase communication, creativity, and to limit unnecessary contingencies.

E. Jointly Developed/Validated Targets

Jointly developed targets are the parties first collaborative act. They document the parties agreement regarding objectives and confirm that they are achievable. In addition, the targets serve as metrics for compensation adjustment and as goals for target value design. Because they are jointly developed, each party owns the objectives and is committed to their achievement.

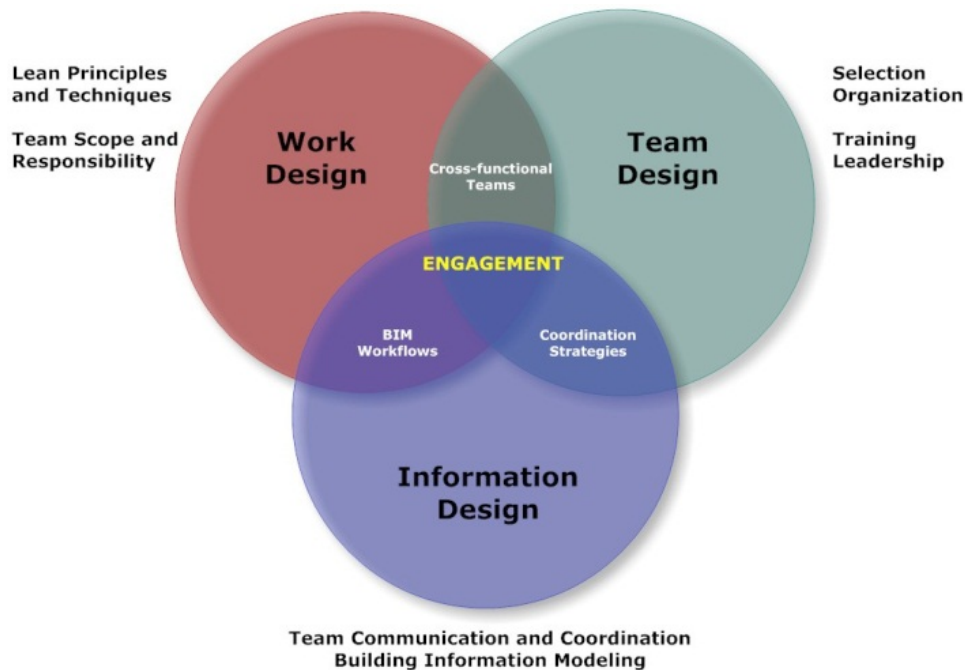
Jointly developed and validated targets are the mission statement of the IPD project.

V. Three Micro-Framework Elements (and why)

The Macro-Framework sets the stage for project execution. It enables positive behaviors, removes dysfunctional restrictions, and aligns the parties to a common goal. But it does not get the project designed or built. The Micro-Framework builds on the Macro-Framework to create the structures and processes required to efficiently execute the project. Unlike the Macro-framework, which is defined in the business and legal structures of the project and which is fixed prior to project commencement, the Micro-framework is organic and is developed by the team based on their capabilities and needs. Moreover, the Micro-Framework structure evolves during the project, continuously incorporating lessons learned during the project. The Micro-Framework is a process, not a fixed formula.

Within this variability, however, are three broad Micro-Framework concepts that must be addressed in virtually all IPD projects: work design, information design, and team design. Although these concepts are theoretically distinct, in practice, specific actions will affect, and be affected by, several or all of these concepts.

Figure 3: IPD Micro-Framework



A. Work Design

Work design encompasses how project tasks are divided, grouped and organized as well as the techniques for efficiently executing these tasks.

In conventional projects, specialized entities with clearly defined competencies are bundled to provide the resources necessary for project execution. This approach has led to compartmentalization and internal competition. An IPD project seeks to gain the knowledge of specialized firms, but in a unified, collaborative structure. This requires intermingling project personnel and rethinking the composition and scope and leadership of project teams. Moreover, in larger projects, the work cannot be completed by a single team and the leadership must develop an efficient division of labor. These work design decisions are interrelated with Team Design issues because the organization of work impacts team effectiveness.

Teams work best when employees have freedom and autonomy, the opportunity to utilize different skills and talents, the ability to complete a whole and identifiable task or product, and a task or project that has a substantial impact on others. The evidence indicates that these characteristics increase members' sense of responsibility and ownership over the work and make the work more interesting to perform.²⁰

In a traditional project, work is allocated along trade or professional lines, such as CSI MasterFormat divisions. In IPD, work is allocated to the entity or person best able to perform that work, which may result in trade contractors doing work outside of their tradi-

²⁰ Stephen P. Robbins, *The Truth About Managing People*, FT Press (2007), p. 130.

tional divisions or designers doing more or less work than they might do in other projects. Not only is work matched to capabilities, work can be organized in small batches to reduce variability and increase the reliability of planning and scheduling of work. Instead of a linear approach to design development, an IPD team may choose to use set based design²¹ to advance competing alternatives until a definitive choice becomes apparent or apply integrated concurrent engineering²² principles to overcoming challenging problems.

Work design also includes the techniques for work execution. These can range from a limited focus on improving tool time to a systems approach that results in completely rethinking how work should progress and the essential nature of the organization. The Lean Construction Institute²³ has focused on how work should be optimized. LCI approaches design and construction as a production flow and has developed tools and techniques for optimizing value and eliminating waste in construction processes. Broadly speaking, LCI has applied portions of the Toyota Production System to construction and design processes. These include techniques such as pull scheduling, value stream mapping, A3 analysis, big room collaboration, visual management, and reliable commitments as well as more philosophical concepts such as queuing theory, continuous improvement, go see, and root cause analysis. Even firms that are not Lean adherents have begun to adopt some of these concepts and tools.

The upshot is that the organization of work should not be presumed, but should be intentionally designed to improve the effectiveness of the IPD participants.

B. Information Design

*The road to agility is paved with information.*²⁴

Information Design focuses on how information will be created, exchanged and managed. In a traditional project, information, if considered at all, is organized to favor and protect its creator. But in IPD, information should be arranged to meet the needs of the project, which requires shifting emphasis to the information recipient and how the information will be used.

The design of an IPD information system should be organized around the following principles.

- Information should create a common basis of understanding and a shared context for action.
- Information should be accessible to those who require it.
- Information should be available when needed by the recipient.

21 Sobek, Ward and Liker, *Toyota's Principles of Set-based Concurrent Engineering*, Sloan Management Review (1999).

22 See, description of concurrent engineering in Jeffrey Smith, *Concurrent Engineering the Jet Propulsion Laboratory Project Design Center*, Society of Automotive Engineers (1997).

23 www.leanconstruction.org.

24 D. Alberts and R. Hayes, *Power to the Edge: Command and Control in the Information Age*, Department of Defense, Center for Advanced Concepts and Technology, (2003), p. 24.

- Incomplete information should be shared to allow team interaction and refinement.
- Information should be structured for use by the entire project team, not just the author.
- Communication paths should be short, preferably without intermediaries.
- Data should be universal, information systems should be interoperable
- Actionable data should have an author and a clear source of truth.
- Unless information is a directive, it should be pulled rather than pushed.
- Persistent data should be securely stored and archived.

To develop a coherent system, the designer will likely consider at least four major areas, Communication Flow, Communication Infrastructure, Building Information Modeling and Financial Modeling. There are overlaps between these areas, and in some instances, there may be conduits between them, such as links between Building Information Modeling and Financial Modeling, but they are best understood by addressing them separately.

1. Communication Flow

Communication flow describes the organization of information exchange. The structure should be intentional, although the level of formality will vary depending upon the project's needs. In developing the communication flow, the following issues should be considered.

What are the paths for information exchange?

Is it direct from creator to recipient? Are there way points or points of transfer or translation? Do information requests follow formal or informal pathways? How long does it take for an information request to be satisfied?

Is information pushed or pulled?

If the requirements of the recipient are well understood and the context is stable, then it may be more efficient to push information to the recipient. For example, a trades person may be most efficient if provided with specific instructions regarding what he or she will be doing on a specific day, perhaps in nature of assembly instructions. This approach, known as smart, smart, push, requires that the creator understand what information is needed (smart), who needs the information and when it is required (smart) and to use a delivery system that transmits that information to the recipient without request (push). This places almost all of the communication burden on the author.²⁵

If the context is uncertain and the action to be taken varies depending upon an analysis of the situation and assessment of alternatives, then it is almost impossible for the author to know what information will be required, to whom it should be directed, and when it will be required. In this situation, information is more efficiently exchanged by smart, post, pull. As with smart, smart, push, the creator needs to have the subject matter expertise to

²⁵ *id.* at 104-113.

create useful information (smart). The information is transferred to an accessible information network (post) and then withdrawn as requested by the recipient (pull). The recipient, who is aware of context and the types of information required at that moment it is required, carries most of the communication burden.²⁶ For example, in the early stages of design, when many alternatives are being considered, information should be posted with team members selecting the information they require to undertake their specific tasks or analyses.

What is the source of truth?

At any point in project development, there may be inconsistent or competing information. The information system should include a mechanism for determining who, or how, correctness is confirmed. On a complex project, the source of truth will be dependent upon the specific type of information.

Who is authorized to access data, and more importantly, who is authorized to modify it?

Relatively little project information is confidential and information systems should default to provide broad access to team members. If information is sensitive, most digital systems will allow access control. The more significant issue is determining who can make changes to information and how those changes are documented and potentially rolled back.

What information must be documented?

In every project, there are countless informal communications that are never recorded or documented because they do not affect other project members. But at some point, information and decisions should be documented so that others may be aware of the information and be able to rely upon it.

2. Communication Infrastructure

The Communications Infrastructure includes the physical arrangement of project participants and the tools they use to communicate virtually.

Communication is sensitive to physical layout of workspace. Placing people together increases the quality and quantity of interactions and builds the relationships that create trust. It reduces misunderstanding and stimulates the interchanges that stir creativity. The physical layout of the co-location space should be designed to increase the number of useful interactions. When Pixar designed its Emeryville headquarters, creativity was encouraged by arranging space and flow patterns to increase the frequency of chance interactions between employees²⁷. Similarly, project workspaces should be laid out to improve communication and interaction, rather than being arranged by individual status or company affiliation.

On larger projects, collocation may be a semi-permanent state with all key team members at a single structure or location. On smaller projects, collocation may be used judiciously to accelerate progress at critical junctures. But even on the smallest projects, some collocation or an extended charette period, will be beneficial.

²⁶ *id.*, at 113.

²⁷ W. Isaacson, *Steve Jobs*, Simon and Schuster, 2011.

Big rooms are also used as meeting places where individuals and groups can assemble to jointly discuss, analyze and solve problems.

Wall space is another physical communication asset. White boards, cork boards, or the walls, themselves, can be used to visual develop and display information to be, critiqued, improved and documented in highly accessible, neutral space. Walls can be used to store and display goals, plans, schedules, budgets or any other information that needs to constantly be in front of the entire team. Walls advertise project progress and focus teams on the common goals.

The digital infrastructure should help bind the disparate project participants into a virtual whole. Rather than rely on individuals systems linked by email, it is preferable to have project participants on a single IT backbone. This greatly reduces delays in data transfer and improves the likelihood of true interoperability. On large projects, the amount of data will require ample storage capacity and bandwidth.

Technology is constantly changing the tools we use to communicate and many projects make extensive use of existing technology. Three technologies that could affect project communication are high-definition videoconferencing, digital tablets, messaging and social networking.

IPD is meeting intensive, but it is not always possible or practical to meet in person. Team members may be widely dispersed and personal attendance may be too expensive, given the cost of travel and lost time. And finding times that are clear on everyone's schedule can be challenging. Web conferencing allows presentation of information, but lacks the immediacy of direct interaction. Early attempts at video conferencing were hardly better because of latency and resolution issues. High end digital systems, such as Cisco's Telepresence or HP's Halo, that can provide experiences similar to personal attendance were too expensive and were limited because all meeting locations needed compatible systems. But recently, improvements in high definition video-conferencing have greatly improved quality while reducing cost. These systems are IP based and generally interoperable with other IP systems. In the future, it may be possible to create, at reasonable cost, virtual "big rooms" with walls that are lifelike displays of connected walls in other locations.

If a project relies on collaboration technologies, it would be wise to map the type of communication to the technical tool used. For example, phone conferencing may be limited to confirming schedule and status, web conferencing may be used for presenting and explaining information, whereas direct physical interaction is used for creative development.

Digital tablets create the opportunity to create windows on project information that are accessible on location. Moreover, with the accelerometer and location capabilities being built into tablets, they can intelligently show information from the perspective of the viewer's position. This can allow designers, builders and facility managers to see what should be, will be or is at the very place they are standing. It also allows downloading information relevant to the specific activities that will take place in that location. Tablets put in their users' hands the power of project information.

Social networking has changed how a large percentage of the population interacts. Systems like Twitter, Google+ or Facebook are *smart, post, pull* technologies where authors create content, post it, and the recipients choose the information they want by deciding who and what to "follow." Although these systems are open, closed systems are being used by the intelligence community (A-Space, eChirp) and open source and proprietary

microblogging and collaborative technologies are available. Although we do not yet know how these systems will change project information flows, we do know that project participants will increasingly be fluent with these technologies and they can supplement and sometimes replace in-person collaboration.

A simple example of how social media might be used is status updates to create virtual cross-functional communities. Project team members would issue posts (“tweets” in Twitter parlance) concerning the work they are performing that day, laying out ducts in a corridor, for example. The “poster” would make no attempt to determine who was affected by this information. However, other project members would follow those people whose work might affect theirs. They would receive notice that ducts were being laid out in a specific area and might contact the poster to discuss where and how the ducts were being laid out. This would be similar to a stand-up status meeting, except that it would be limited to those who were actually interested in the information and it would not be limited to those who could make a scheduled meeting. Hash tagging technology also allows the poster to categorize posts allowing followers to obtain information about the subject, without necessarily following the person. And more detailed information about what individuals can do and are doing together with communication between the person and other project participants can be facilitated and organized through individual pages and microsites.

3. Building Information Modeling

Almost all IPD projects of any complexity will rely upon Building Information Modeling to virtually design, build and in some cases operate and maintain the project. In fact, the most fundamental BIM decision is to determine how the information will be used. This will inform how the data will be structured and who is necessary to create and maintain it.

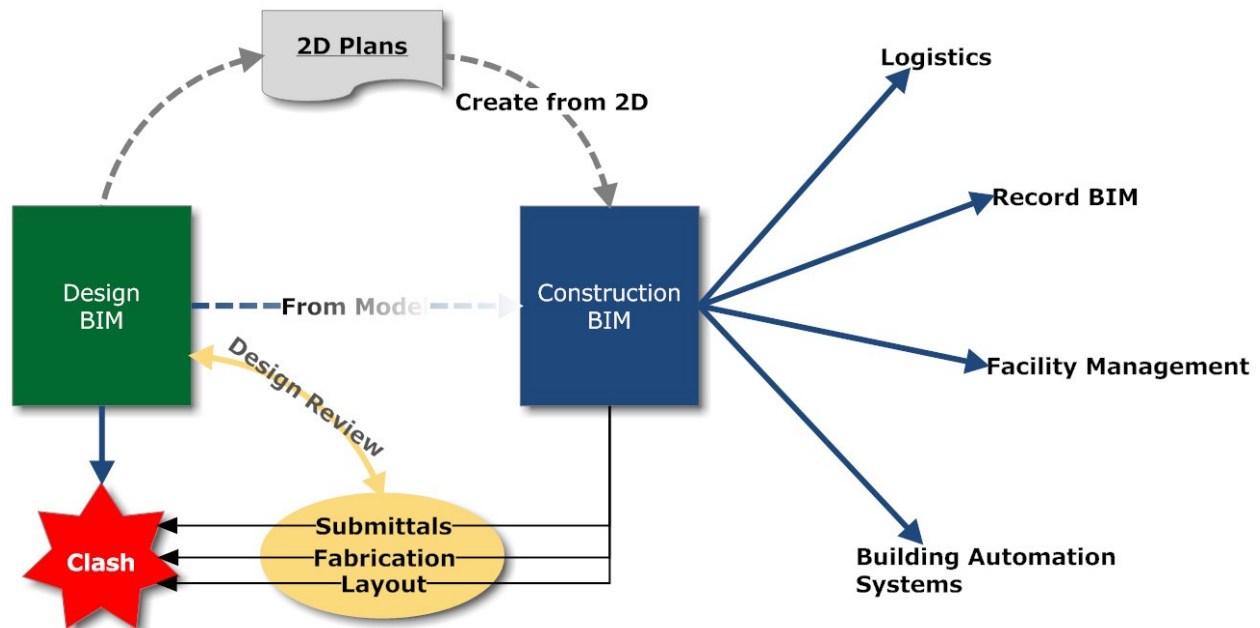
Currently, BIM use follows the fragmentation of the ACE industry. Designers use BIM to prepare contract documents that describe the end state of their vision. Contractors use BIM for coordination, construction simulation and cost evaluation. Subcontractors and vendors may use their BIM models to create drawings or digital files for fabrication or may fabricate directly from their models using CNC techniques. Finally, the project operator may extract information from the BIM for operational and maintenance needs. The construction BIM is often created from the 2D documents and very little information, as denoted by the vanishing arrow, is directly transferred from the design BIM. This current state shown in Figure 4, mirrors the siloing of information that IPD seeks to overcome.

The vision of BIM is quite different. As defined in the National Building Information Modeling Standard, 2.0:

*A BIM is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward.*²⁸

28 <http://www.buildingsmartalliance.org/index.php/nbims/about/>.

Figure 4: Current State BIM Information Flow



The underlying premise of this definition is that BIM is a framework for collaboration that can be used by stakeholders throughout the project lifecycle. Thus, the first goal in BIM design for IPD is to create data structures, that from inception, support subsequent downstream usages. Rather than recreate data at points of transition, data should be continuously augmented as the project moves from design and preconstruction, through construction and into commissioning and use. See, Figure 5. This requires understanding and respecting the needs of downstream users as the BIM structures are being designed.

The development and organization of BIM has received considerable attention in manuals, publications, standards and contracts. Virtually all of these sources recommend that the project team use a BIM execution plan. The National Building Information Modeling Standard, 2.0, incorporates the approach developed by the Computer Integrated Construction Research Program at Penn State in the BIM Project Execution Planning Guide and Templates.²⁹ The American Institute of Architects and ConsensusDOCS also have standard documents that provide an approach for developing BIM execution plans.³⁰ Moreover, several government agencies have published their BIM standards.³¹ These, and other tools,

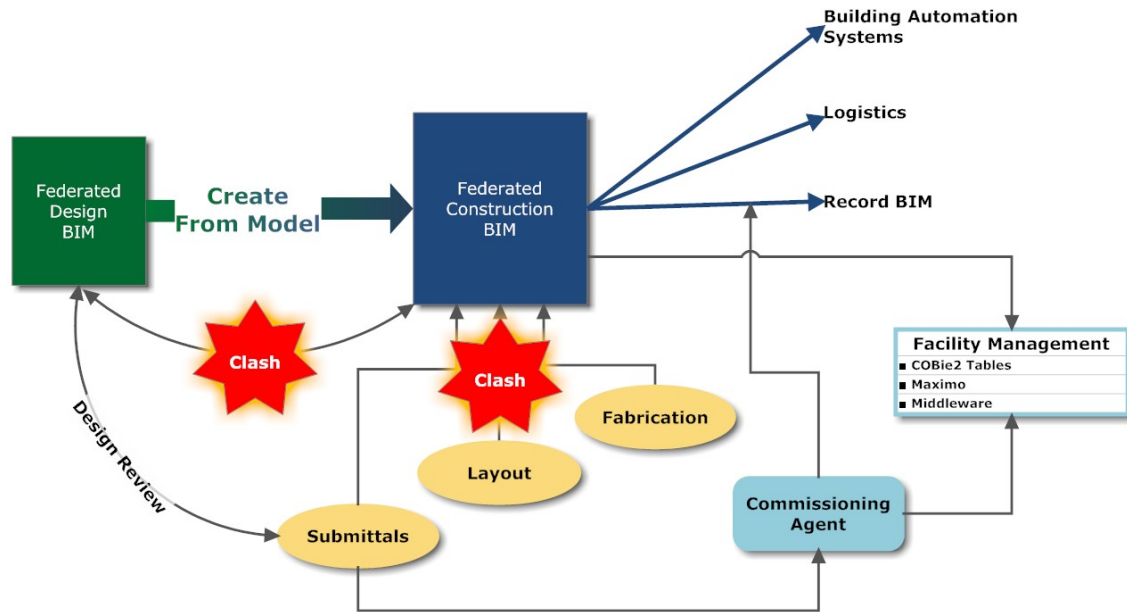
29 NBIMS ballots V2-021 and V2-022 at <http://www.buildingsmartalliance.org/index.php/nbims/balloting/>; <http://bim.psu.edu/Project/resources/default.aspx>.

30 American Institute of Architects, E202, Building Information Protocol Exhibit; ConsensusDOCS 301, Building Information Modeling (BIM) Addendum.

31 For example, the Veteran's Administration BIM Guide <http://www.cfm.va.gov/til/bim/BIMGuide/>, the GSA Building Information Modeling Guide Series, <http://www.cfm.va.gov/til/bim/BIMGuide/> the United States Army Corps of Engineers BIM Project Execution Plan, <https://cadbim.usace.army.mil/default.aspx?p=s&t=18&i=23>, and the Military Health System Facility Life Cycle Management (FLCM) Building Information Modeling (BIM) Requirements, https://www.mhsworldclassfacilities.org/home/bim?page_id=2524.

provide the raw material for an IPD team to determine how BIM will be used and organized for the specific project.

Figure 5: Integrated BIM



4. Financial Modeling

IPD is a project delivery system for delivering value. Value often includes consideration of issues other than pure cost, but even where value has qualitative elements, the projection and tracking of costs will be critical to project success.

Ideally, an understanding of cost parameters precedes and informs design. A first step is to develop a deep understanding of the project's purpose and how this may be expressed in a business case supporting development of the project. The project sponsor, with assistance from the team, will begin to develop parameters for the overall project as well as develop a sense for the appropriate level of investment into project elements.

The second step is to validate the conceptual program against the business case to determine whether the project, as envisioned, is feasible. This leads to developing cost targets and, in some instances, sub-targets for systems or related systems. This framework becomes the basis for target value design.

The financial modeling system must provide contemporaneous feedback to allow the project team to choose between design options and to understand the implications of the decisions they are making. Moreover, the system must be capable of predicting what project costs will be, rather than merely estimate the cost of constructing the design at its current level of development. This process, referred to as conceptual estimating or cost projection, requires different skills than used in a takeoff-and-estimate process.

Finally, the financial modeling system must be able to determine whether the project being constructed is remaining within the boundaries set by the cost model and must provide information that the project team can use to identify potential problem areas and develop cost remediation plans.

The task for IPD management, is to develop a financial modeling system that reliably reflects project status, projects costs that will likely occur, and provides contemporaneous feedback for the project team. Moreover, the financial modeling system must be transparent in order to maintain trust among project participants.

C. Team Design

Virtually all work in IPD is executed using teams. How they are created, organized and managed significantly affects project outcome, and is the subject of a companion paper, *IPD Teams: Creation, Organization and Management*. There is a direct connection between work design and team design. The size and composition of teams is tailored to the work they perform. In general, work should be divided to fit the size and competency of the IPD teams. On larger projects, there will be many interdisciplinary and cross-functional teams that must be given latitude to execute their tasks, but within a structure determined by project management. Information design is similarly affected because little can be accomplished without information passing between teams.

VI. Constructing the Frameworks

IPD projects, at least at the current state of development, must be crafted to match the specific project and project team. This requires considerable effort at project commencement to create the Macro-Framework that governs the project and the Micro-Framework structures and procedures that implement the IPD principles at an immediate level.

In current practice, the Macro-Framework is created through contract negotiation. Unlike traditional contract negotiation, the IPD Agreement is developed through simultaneous negotiation of multiple parties with a high degree of transparency. The parties need to be able to openly discuss their goals and concerns and to trust the information being provided by their prospective teammates. Because the IPD Agreement is based on fundamentals that are radically different from traditional construction contracts, the contract negotiation workshop should be led by, or should include, an attorney or attorneys experienced in IPD agreements. In some projects, the IPD team uses project counsel—an attorney jointly retained by all parties to facilitate contract negotiations and develop the IPD agreement—to lead the contract negotiation workshop.³²

The Micro-Framework is developed during process design workshops. Unless the team has significant IPD experience, the project may benefit by having these workshops facilitated by someone who can lead the team through the key process and technical issues.

A. The Contract Negotiation Workshop (Macro-Framework)

The contract negotiation workshop will usually have two phases: negotiation of the prime IPD agreement and negotiation of joining agreements or IPD subcontracts and consulting agreements.

³² Attorneys usually represent a single party and owe an obligation to act vigorously on behalf of that party, alone. Under the ethical rules applicable to attorneys, an attorney cannot represent multiple parties negotiating among themselves unless there is a written waive of the conflict interests. The implications of joint representation should be explained before the parties decide to use joint counsel.

1. The Prime IPD Agreement(s)

Negotiating an IPD Agreement³³ contains a thorough discussion of principles, issues and options affecting IPD agreements. Parties that have not negotiated an IPD agreement should review this or another similar work before entering into IPD Agreements. This is more important than studying individual contract examples because you need to understand the reasons for contract provisions before you can safely accept or modify them.

One of the first issues to address is who needs to participate in the negotiation. Every entity that will sign the agreement should participate, but in some instances significant at-risk trade contractors and consultants may participate, as they may need to agree on business and legal terms that will flow through to them from the prime agreement.

The negotiation workshop³⁴ should focus on issues that affect the behaviors desired, the significant issues list, and their relative priority varies between projects. However, there are a series of questions that can focus discussion and highlight the most important issues:

- Which parties are within the shared risk/reward group?
- Will the contract be 3 party (Owner, Architect, Contractor) or will all at-risk parties sign a single agreement?
- What is the size of the at-risk pool, and how is it funded?
- Is the at-risk pool distributed at project end, or at milestones?
- Who has the authority and responsibility to make decisions?
- How are the targets defined and measured? When are they set?
- Are contingencies explicit or implicit? If explicit, how can they be used and when must they be used?
- What are the consequences of missing a target?
- How is non-collaborative behavior prevented or discouraged?
- What events justify changing a target?
- What liabilities are not waived?
- How does insurance relate to the unwaived liabilities?

2. Subcontractors, Consultants and Joining Agreements

Contractors and Architects rarely perform their full contractual scope of work, delegating much of their scope to subcontractors and consultants. Architects may retain less than half of the total design fee and some contractors retain no self-performed work, at all. If IPD seeks to energize the people actually doing the work, it must clearly engage subcontractors and consultants. Moreover, if IPD is to provide the owner with a sufficient buffer

33 H. Ashcraft, *Negotiating an IPD Agreement*, available at http://www.hansonbridgett.com/practices_industries/IPD_BIM.php.

34 As noted previously, it is very helpful to have this workshop lead by a person who has significant experience in structuring IPD projects.

against cost overruns, the subcontractors and consultants—or at least the key participants—must also share in the risk/reward structure.³⁵

Because IPD is a collaborative, trust-based delivery method, the consultants and subcontractors chosen must embrace IPD and must be able to work cooperatively with the other parties. Thus, in most IPD structures, the subcontractors and consultants are jointly chosen by the owner, designer, contractor team, or the team has interview and veto rights over the designer's and contractor's preferred consultant and subcontractor choices.³⁶

There are two primary methods for incorporating the key consultants and subcontractors that did not sign the prime IPD agreement: subagreements and joining agreements.

In the subagreement approach, the key IPD elements flow through the prime agreement (designer or contractor) into the subagreement (consultant or subcontractor). These includes key risk and reward terms as well as any liability limitations and waivers. The at-risk compensation of the subcontractor or consultant is a portion of the at-risk compensation of its respective prime. In almost all instances, the business structure of the subagreements mirrors the business structure of the IPD agreement, except that the subcontractors and consultants are less involved and have no or limited voting rights at the project management level.

In a joining agreement approach, the key subcontractors and consultants execute an agreement that amends the IPD agreement to add them as a party. The risk/reward provisions are amended with each added key subcontractor or consultant to reflect the amount of compensation the added party has placed at risk. If all parties are added to a single agreement, the IPD agreement must be able to adjust terms, such as project management processes, to accommodate the change nature and number of participants.

The IPD team must decide how subcontractors and consultants are selected. In some instances, the designer and contractor may propose with their preferred subcontractors and consultants and be viewed as an existing team. In other instances, the team will need to develop a process for assuring that the selected subcontractors and consultants will work effectively with each other and with the overall IPD team.

There will always be some subcontractors that will be procured on a fixed price or time-and-materials basis. These parties are typically outside of the risk sharing and liability waiver provisions of the IPD agreement. A typical arrangement in a multi-party agreement is shown graphically in Figure 6, and a Polyparty agreement in Figure 7.

35 As a general rule, at least half of the anticipated construction cost should be within the risk/ reward structure, and preferably more.

36 Another option is to have each new project participant interviewed by the entire team that precedes it. Although this may work on smaller projects, it becomes increasingly cumbersome as the number of project participants increases.

Figure 6: Multiparty Contract

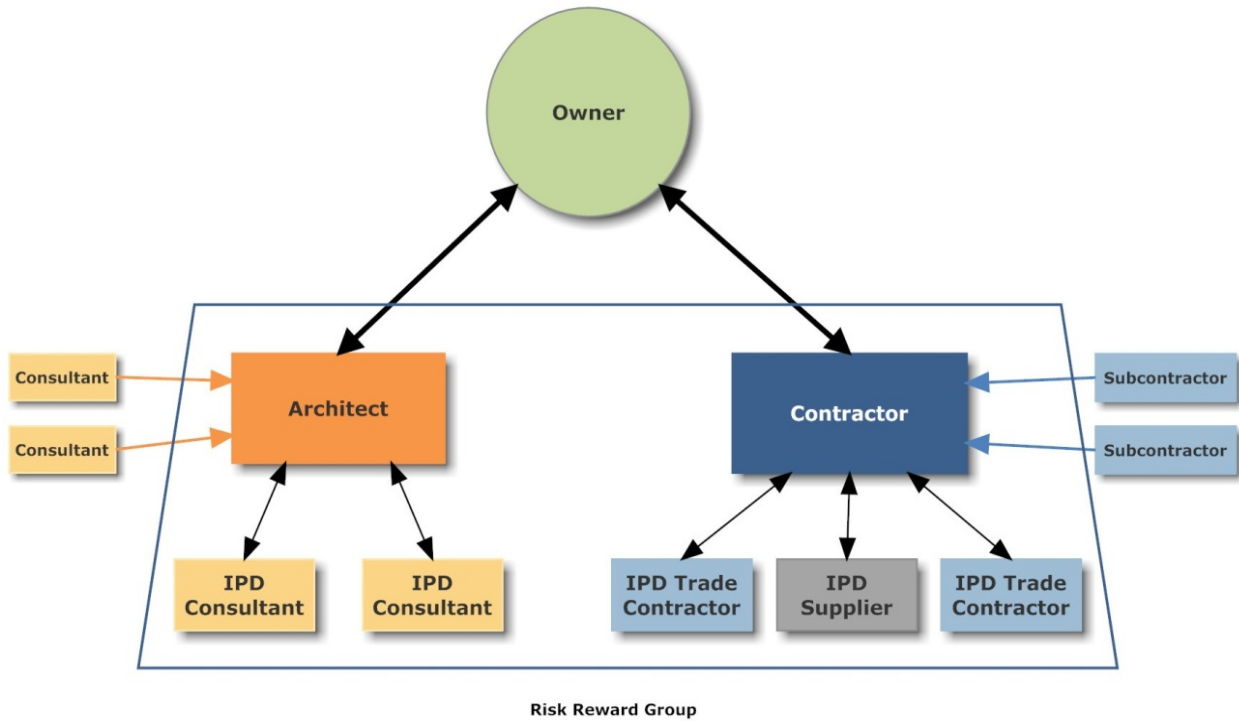
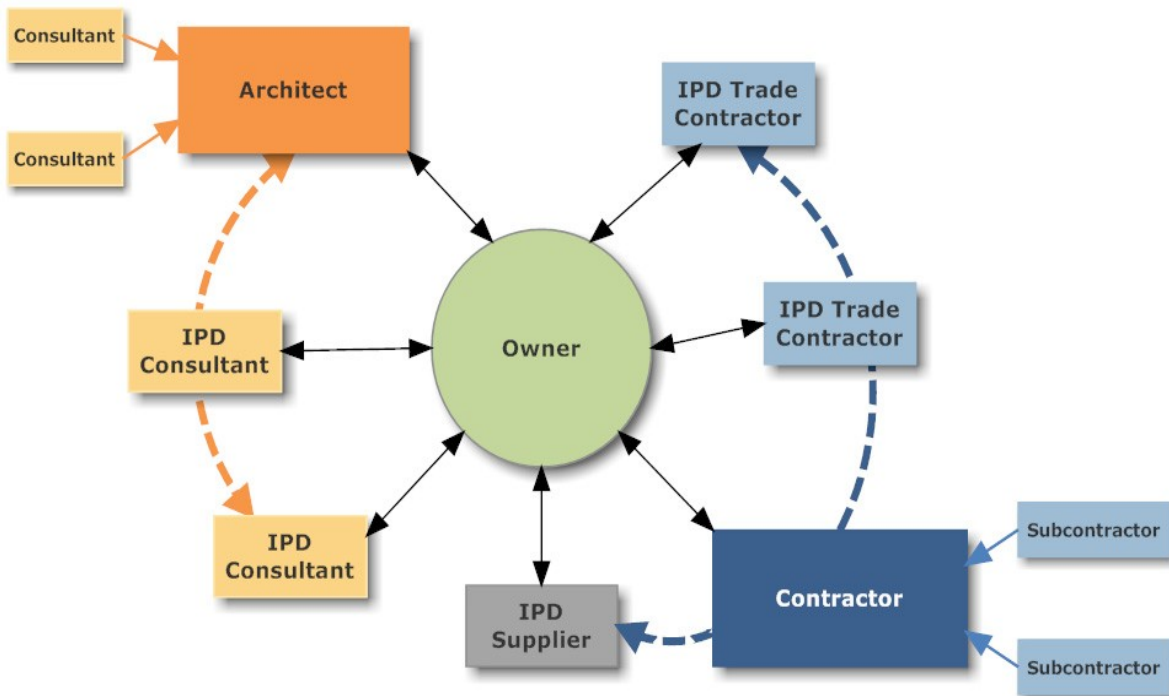


Figure 7: Polyparty Contract



B. The Process Design Workshop (Micro-Framework)

Many of the Micro-Framework elements will be developed by the project team during a process design workshop held shortly after project commencement. The workshop's most obvious purpose is to develop a road map that defines how the project will proceed. But the process design workshop also provides the first opportunity to meld disparate organizations into a cohesive team.

There are almost an infinite number of issues that might be considered during process design and their importance and priority will differ among projects. Some of the questions that might be considered are:

- What tasks need to be performed? Which tasks that “traditionally” are performed do not need to be performed?
- Who has primary responsibility for the task?
- Who supports the task?
- Where will the tasks be performed? Will the teams collocate? When and to what extent?
- How will work be scheduled? Forward pass, pull scheduling or a hybrid?
- How will communication be managed? How is information efficiently made available to all who need it? How are decisions recorded?
- How will the Building Information Models be used? Who will prepare which portions of the models?
- How must the models be constructed to support use by multiple parties?
- How will non-modeled information be integrated with the models?
- What conventions should be established to maintain digital clarity?
- How should multi-organizational teams be organized?
- How does collaboration move to decision?
- When should design become fixed? Should alternatives be designed in parallel?
- How will target value design proceed? How will cost information be used to inform design?

Figure 8: Constructing the Framework

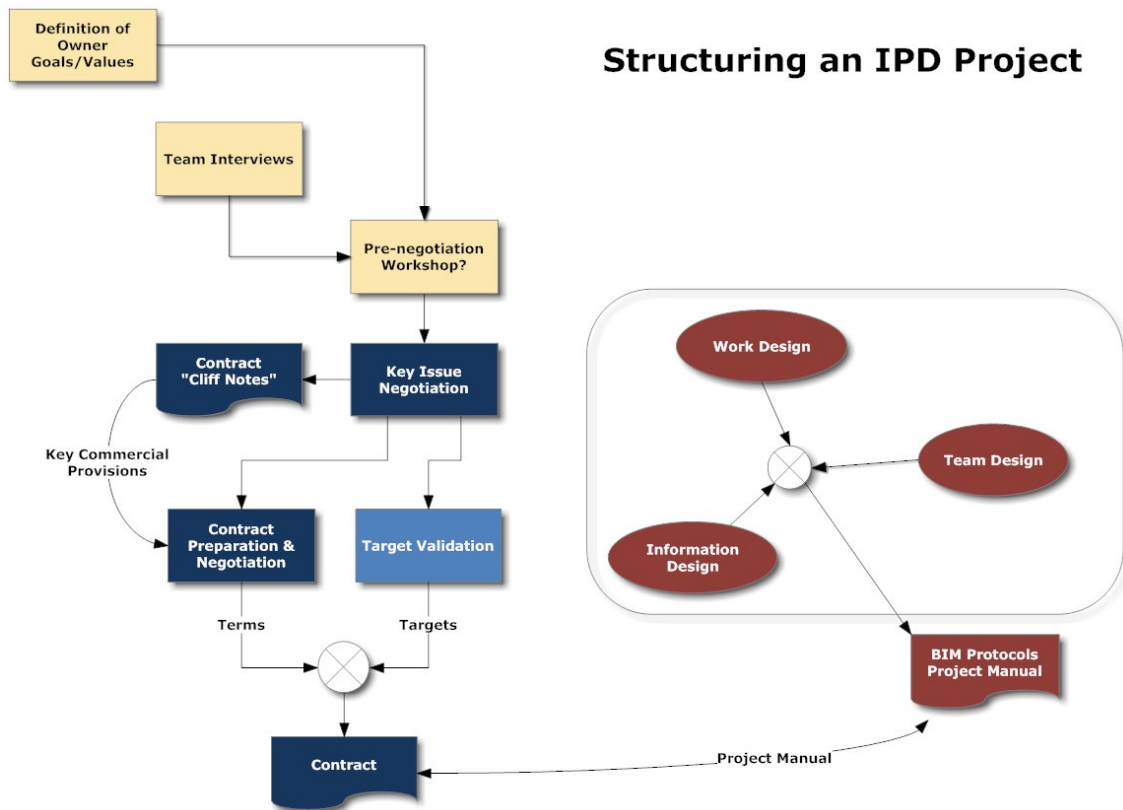


Figure 8 represents an approach that melds the two workshops. The process starts with a pre-negotiation workshop to provide all parties with a similar understanding of the key IPD principles and issues. This can partially overcome some parties' lack of IPD experience and focus negotiation on issues that matter in this new paradigm. After the pre-negotiation workshop, the parties begin to negotiate the key terms of their agreement. At this stage, negotiation focuses on principal business points, not specific contract language, to avoid being distracted from the significant issues. The general business structure, such as choosing a multi-party agreement, should be discussed during this phase.

The key terms summary is then translated into actual contract language. At the same time, the parties must decide on the targets they wish to achieve and determine how the targets should be measured. On simpler projects, the target validation period may coincide with contract development, but on larger projects, where validation may be lengthy, the targets will likely be added to the contract by amendment.

While the contract is being developed, or soon thereafter, the parties also engage in the process design and BIM communication workshops. Again, depending upon project complexity, the agreements reached in these workshops are appended to the contract as exhibits, or become part of a project manual that is referenced in the IPD agreement. At the conclusion of all negotiations, the parties should have a clear understanding of project structure and how it will be implemented. As the project progresses, the process design should be periodically re-evaluated to incorporate improvements in communication and workflow and to accommodate changes that may have occurred.

VII. Leadership in A Collaborative Project

For IPD to succeed, the key participants must be able to freely exchange information and comment on each other's work. Ideas should be respectfully discussed and differing opinions must be voiced. But in the end, decisions need to be made, documented and the project moved forward. This requires leadership.

IPD leadership encompasses mentorship, facilitation and accountability. It is not a command-and-control relationship as the leader must encourage innovation from bottom up. Moreover, the IPD leader needs to know when discussion needs to be transformed into action and how to forge consensus from differing opinions. But IPD is based on creating behaviors that can achieve superior results. And if behavior does not meet IPD expectations, whether due to lack of teamwork, failure to meet agreed obligations, lack of transparency, or creation of discord within the team, action must be taken to correct the behavior or remove the non-compliant party from the team.

The leadership role may fall on one person or party or may be distributed among the parties based on the level of project development or topic issue. The designers will naturally tend to lead during the early portions of the project with a transition to the builders as physical construction commences. In addition, leadership may be distributed based on systems, such as mechanical or structural systems, with systems leaders reporting to the collaborative management team and the overall team leader. The structure of leadership will vary between project, but the need for effective leadership will not.

The owner's role in IPD differs significantly from the owner's role in other project delivery methods. The owner in an IPD project must be actively involved during every stage of the process, not just as a reviewer or approver, but as a contributing member of the design and construction team. It thus follows that the owner has a special leadership role, as well. The owner must continuously communicate its needs and vision while recognizing the legitimate interests of the other parties. By working with and for the other parties, the owner can expect them to work for the project, and to achieve the owner's vision.

Appendix

I. How Traditional Construction Contracts Undermine IPD Objectives

Traditional construction contracts are inconsistent with fundamental IPD principles because they discourage or prevent desired IPD behaviors. They should not be used on IPD projects unless they are radically modified, and in most instances, starting from a good IPD agreement is simpler and more effective.

A. Traditional contracts create an inherently antagonistic environment

Lump sum and GMP contracting create conflicting interests between owner, designer and builder. When bidding a lump sum job, the contractor must interpret the contract documents in the least expensive way possible. If work is omitted from the plans, it must be omitted from the bid. Once the project has begun, the contractor is encouraged, through the change order process, to discover and document each design error or omission. Knowing that the contractor may bid and manage the project aggressively, the designer will attempt to defensively over-design and transfer design risk to the contractor through specifications requiring extensive verification, coordination, and contract interpretation clauses. None of this is in the owner's best interest.

The situation under Guaranteed Maximum Cost (GMP) contracting is quite similar. For example, under a GMP with pre-construction services and shared savings (a modern GMP approach), the first difficulty pits the parties against each other. Because the contractor cannot know whether costs will remain under the GMP, it must issue a claim notice because it may need to include this claim to support a change order increasing the GMP. Often, this will lead the contractor to contend that the construction documents are incomplete or flawed. In response, the owner will contend that the change is within original scope or was implied, and the designer will respond defensively to allegations of a flawed design. The upshot is that fear of exceeding the GMP drives antagonistic behavior among all the parties.

B. Traditional contracts rigidly divide work based on traditional roles

Traditional contracts carefully segregate participants' roles and responsibilities. This has created a self-reinforcing dynamic because case law, insurance coverage, and professional regulations assume contractual segregation and circularly create a reason for contracts to segregate roles, which reflects back into insurance, professional regulation and liability decisions. Two examples from the General Conditions for Construction (AIA A201) issued by the American Institute of Architects reflect this traditional segregation.¹

The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. (A201,

¹ The use of an AIA example is not a criticism of the AIA contract documents. A201 is being used as an example because it attempts to accurately reflect existing industry norms. AIA has recently issued a series of construction documents that are intended for IPD projects and are less structured and more collaborative. (www.aia.org/ipd.)

§3.3.1.)

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The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. (AIA A201, §4.23.)

Similarly, the contractor is not responsible for design. Thus, because neither architect or contractor is responsible for overall project performance, there is no incentive—indeed there is a liability disincentive—to looking over the other's shoulder to make suggestions or spot errors. IPD reduces these disincentives by encouraging communication and collaboration, tying compensation to project outcome, and waiving liability among the parties.

C. Traditional contracts constrain communication to specific and inefficient paths. Again, AIA A201 provides a convenient example

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner. (AIA A201, 4.2.4)

Traditional construction contracts also limit participant's reliance on information developed or provided by others. For example, standard language in the Engineers Joint Contract Documents Committee (EJCDC) take a very conservative approach toward electronic information prohibiting reliance on the exchanged electronic information.²

2 EJCDC Document C-700, §3.06.Electronic Data

A. Unless otherwise stated in the Supplementary Conditions, copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests

(footnote continued)

More recent contract documents from the AIA³ and ConsensusDOCS⁴ have improved communication flows by permitting reliance under specified circumstances, although they have not eliminated concern that expanded reliance might result in expanded liability. Thus, they create pathways and standards but, by themselves, do not eliminate disincentives to communication.

IPD strives to shorten communication paths to encourage rapid information exchange, reduce information loss or misunderstanding, and stimulate innovation and creativity. This requires communication flows unburdened by the limited and highly structure paths of traditional contract documents and liability concerns.

D. Traditional contracts reward individual, not group, performance

Traditional construction contracts optimize individual performance. For example, a lump sum plumbing subcontractor can increase individual productivity (and hence profitability) if its installation precedes the dry mechanical or life safety subcontractors—even though the dry mechanical should have first access to space because of duct size constraints. Similarly, a contractor has little financial interest in finding design errors during pre-construction if they would support change orders after award. And designers have little incentive to consider the constructability of their designs because doing so could increase their liability exposure and they do not share in any productivity increases. Thus, the compensation terms of traditional contracting breed competition rather than cooperation and the owner ultimately bears the cost of the inefficiency created.

E. Traditional contracts are accretions of bad experiences, not guides to success

Unpleasant project experiences cause contract drafters to insert contract provisions that hopefully will avoid repeating the last catastrophe. This impulse is understandable, but it leads to poorer contracts. As time passes, the contract form appends very specific provision after very specific provision with little concern for readability or usability. Moreover, the individual provisions detract from the contract's logical structure and its primary purpose as a project management tool. And finally, the specific event that occurred to drive the contract change is likely a relatively rare event (at least when compared to the common events of budget and schedule overruns). Overtime, this results in contract documents that are unfocused and confusing.

or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

3 AIA Documents E-201 Digital Data Protocol Exhibit and E-202 Building Information Modeling Protocol Exhibit.

4 ConsensusDOCS Documents 200.1 Electronic Data Transmission Protocol and 200.2 Building Information Modeling Addendum.