Integrated Design-Bid-Build and its Effects on Integrated Project Delivery Drivers

Alexander G. Sargiss
California Polytechnic State University
San Luis Obispo, California

Integrated project delivery is becoming a more common and successful delivery method in the construction industry compared to more traditional methods such as design-bid-build. Integrated Design-Bid-Build is a hybrid between the two which has been implemented very few times to test if it can be used as a more viable delivery method in the future. There has been very little research in to Integrated Design-Bid-Build that is accessible for analysis. This research study examines case studies of projects completed using IPD and analyzes their "IPD Profiles" which are measured using five primary project drivers. These project drivers are: cost predictability, schedule predictability, risk management, technical complexity, and market position. Each have proven to play key roles when choosing to use IPD. The purpose of this study is to take the Integrated-Design-Bid-Build delivery method and apply it some of these projects completed using IPD and interpret how this new integrated delivery approach would affect each of those project drivers.

Keywords: Integrated Project Delivery (IPD), Integrated Design-Bid-Build (IDBB), Project Drivers, Collaboration

Introduction

Integrated project delivery [IPD] is a collaborative delivery method which takes the owner, contractor, architect, and other key players of a project and creates an environment focused on the best interests of a project rather than their individual goals. This type of collaboration is built on trust and when effectively structured has proven to yield successful results. IPD is still a fairly new approach for the construction industry, but is rapidly evolving and lessons learned from completed projects are already being carried on to the next IPD project. Many believe in an industry like construction where productivity has been on the decline since the 1960s that IPD could be the solution when applied to the correct project through the correct project team. Projects today face this lowered productivity due budget and scheduling conflicts as well as adverse relations between the owner, contractor, and engineer.

The contracts utilized in integrated project delivery offer new shared risk strategies that more accurately reflect the roles of the owner, architect, and contractor of a project. In more traditional delivery methods key players of a project focus on more on their respective roles and how to mitigate their own risk while simultaneously shifting risk to the other parties. This ideology does not encourage a collaborative work ethic like IPD does through shared risk and reward clauses implemented in contract documents. Integrated project delivery is a comprehensive process which encompasses the entire process of programming, design, construction, and building operations.

Key Principles of Integrated Project Delivery

In an integrated project, key participants are involved early in the design phase to make informed decisions that are going to significantly impact the project in the long run. Having all the key players together early on encourages discussion between the different disciplines and keeps everyone on the same page. The architect can propose different design options while the contractor can offer cost and feasibility analysis that meet the owner's expectations. This meeting of the minds early in the design phase helps create a more reliable budget and schedule

that participants can get behind. Upfront costs do increase as a result, but in theory this early collaboration should greatly reduce conflicts during construction and savings in the long run should outweigh the increased cost of early involvement. Shared risk and reward is also a key aspect of IPD through providing incentive to work collaboratively to meet common goals for the project and either reap the benefits together or share the losses equally. The sharing of risk and reward ties participants together and emphasizes a more balanced effort on meeting cost, time, and quality goals which avoids the tunnel vision tax of focusing on one of these goals and failing to meet the rest. Multi-party contracts are a fundamental component of IPD because it ties all the stakeholders together. In traditional delivery methods, the owner would likely hold separate contracts with the contractor and architect, but a multi-party contract holds all parties responsible to each other. Collaborative decision making and control is essential to ensuring all key participants are operating together in the best of interest of the project. Integrated projects have frequent meetings between the owner, architect/associated consultants, contractor/ key subcontractors. The objective of these meetings is to address any issues collectively and early to avoid further complication, while also focusing on the future of the project. Many integrated projects implement a committee approach to decision-making which is beneficial in being collaborative and consistent over the course of the project. The downside is that these committees are typically made up of core members from the key participants of the project, and it can be burdensome to gather them frequently. Building information technology [BIM] is a great tool used in IPD, which aids this collaborative process and accelerates the transfer of data between the parties to aid in making more collaborative decisions. Lastly, goals for the project must be developed jointly between the key participants to cultivate a common understanding of how the project is to be executed. Outlining these goals clearly and concisely will aid in decision making over the course of the project. Aligning these goals early is also important to ensure all participants are working towards these common goals as early as possible.

Integrated Project Delivery in Industry Today

IPD is being utilized more often and more effectively across the nation as owners, contractors, and architects are gaining experience utilizing this approach and prospective owners are becoming open to new delivery methods to meet more aggressive goals. IPD is being used on a wide variety of project which is allowing better research to be conducted on how IPD can be best utilized. The range of projects IPD has been implemented on allows us to better compare IPD against traditional delivery methods and how different variables like: project type, size of project, contract amount, and location play a significant role in the outcome of the project. Furthermore, how important the process of selection is for key participants based on their experience in IPD and relationships with other stakeholders for a project. Research published by Jonathan Cohen of the FAIA shows that IPD is gaining noticeable traction in the healthcare construction industry. Cohen believes this is due to, “owners’ focus on lean operations and whole systems thinking now considered “best practice” in healthcare delivery.” IPD has also been implemented on K-12, education, higher education, office work, and even government work. Federal construction projects are typically not conducted using IPD, but AECOM recently announced a plan to hire three thousand workers in the next six months. This news came after their decision to form a federal contracting division. AECOM said, “the goal of the new division is to utilize design-build and integrated project delivery on projects for its federal clients, which include the military, General Services Administration [GSA], and the State Department” (Slowey, 2017). This is an unprecedented move in the IPD market and will produce some interesting data regarding the how IPD mixes in with federal construction contract requirements and Federal Acquisition Regulation [FAR].

Federal Project Integrated Project Delivery Hybrid

Procurement restrictions for federal projects are very strict and sometimes even hinder the quality of project delivery potential a project would have had it been pursued through a different delivery method. Under the Brooks Act and Federal Acquisition Regulation [FAR], design services are selected through a qualification-based selection process (GSA, n.d.). Firms competing for design contracts on federal projects are ranked based on their technical qualifications, and negotiations are conducted with the top ranked firm (GSA, n.d.). Construction contracts for federal projects under the prospectus level are awarded to the lowest responsive bidder through the traditional design-bid-build delivery method. Major federal construction contracts are selected through the FAR’s “Source

Selection" Method (GSA, n.d.). There are some variations to the Source Selection method, but typically management proposals and a price proposal are requested from bidders. These proposals are evaluated "technically, and then evaluated in terms of price" (GSA, n.d.). The process does allow tradeoffs, but is selected on a best value basis rather than lowest price. Discussion and negotiation can occur to allows bidders to correct technical proposals and clarify pricing before the contract that is the best value for the government is selected (GSA, n.d.).

Despite these strict procurement restrictions exceptions have been made for various federal projects to test different delivery methods and their success. The NGA New Campus East Engineer Proving Ground in Fort Belvoir, VA was an Integrated Design-Bid-Build [IDBB] project, which was similar to design-bid-build due to its contractual nature of the government holding separate design and construction contracts. Early involvement of the builder in the design cycle gives the project its integrated aspect. The advantages of this delivery method compared to typical design-bid-build primarily stem from the integration of construction expertise early in the design phase to improve the accuracy of budget and schedule goals through early identification of potential problems during the design phase. This also prevents the schedule burden of traditional design-bid-build where design must be fully completed prior to procurement by contractors which is followed by actual construction. The NGA project utilized a "Fast-Track" IDBB Sequence which allowed for procurement of the builder at the beginning of design and integration of the builder also during the design phase. This allows for construction to be phased with the beginning of construction occurring towards the end of design. The NGA project request for proposal [RFP] broke the project out in to ten discrete packages which dictated different phases in the construction schedule. These packages being made available in the RFP allow the builders to better evaluate costs and cashflow for the duration of the project. The IDBB builder's base bid is a firm fixed price that is negotiated at "production point" or when 100% plans and specifications are available. Bid options for this project were a unilateral right held by the government and did not include an "escape clause" for IDBB contractor. This placed a lot of risk on the IDBB contractor and made it difficult for contractors to bid ceiling price and take on this risk without an escape clause present in contract.

Literature Review

The AIA California Council Integrated Project Delivery Steering Committee and the AIA National Integrated Practice Discussion conducted a joint study, with research and report by Jonathan Cohen, in 2011 on six projects completed using IPD, "in as pure as form as possible" (IPD Case Studies, 2010). This was based on the key principles mentioned above being present on a case-by-case basis. The study evaluated projects of various scope and location to receive a more diverse set of data (IPD Case Studies, 2010). Cohen visited all six projects and interviewed in detail members of the principle parties involved on the project (IPD Case Studies, 2010). This included members of the architect, builder, owner, and even engineers or subcontractors in some cases. Based on his studies, Cohen claims, "that IPD is most successful when owners, architects, engineers, and builders step outside the boundaries of traditional roles into a more fluid, interactive, and collaborative process" (IPD Case Studies, 2010). All the owners responded in their interviews that the integrated delivery method did not require more demand than a traditional procurement method and that they were open to implementing IPD again on future projects (IPD Case Studies, 2010). Key participants from each of the projects self-reported project data for the study. (IPD Case Studies, 2010). The budget, contract, and final costs where all noted and broken out between design and construction so changes between the initial amounts could be monitored more in depth (IPD Case Studies, 2012). The initial and achieved schedules are also available for both design and construction on each project (IPD Case Studies, 2010). All members of the Integrated Form of Agreement [IFOA] or other multi prime contract were also available regardless if subcontractors were included or not. An integrated form of agreement or multi party contract binds all the principle parties, and sometimes key subcontractor trades, in to one contract that typically requires them to share risk and reward. Not all projects were strictly IPD projects from a contractual stand point, but did exhibit integrated project qualities like early involvement of participants, collaborative decision making, and jointly developed goals.

The revised study also utilized an IPD radar chart, which measures each projects IPD profile based on initial motivations versus perceived outcomes for five primary IPD drivers (IPD Case Studies, 2012). These drivers are market position, technical complexity, risk management, schedule predictability, and cost predictability (IPD Case

Studies, 2012). Market position focuses on history for that type of project being pursued through IPD and the markets created for the principle parties through gaining experience in IPD. Technical complexity acts as an IPD driver through encouraging greater collaboration for the team to design to a very fine level of detail to facilitate better construction practices on more complex projects. Risk management encourages IPD through utilization of the single multi-party contract and sharing risk rather than the parties attempting to shift risk to each other during the project. Schedule predictability and cost predictability are very strong drivers which push owners to utilize IPD on their projects. The early involvement of key participants from the principle parties creates greater predictability for both the budget and schedule. Trust between the principle parties is also important for cost and schedule predictability to be accurate. Designers need to be able to fully design various options for the contractor to estimate and conduct a feasibility analysis and the contractor needs to be comfortable doing all these estimates even though they may not be used (IPD Case Studies, 2012). This mutual trust between the key parties create a collaborative environment which allows them to get the most out of their budget and meet schedule milestones, thus making IPD a more viable option for owners.

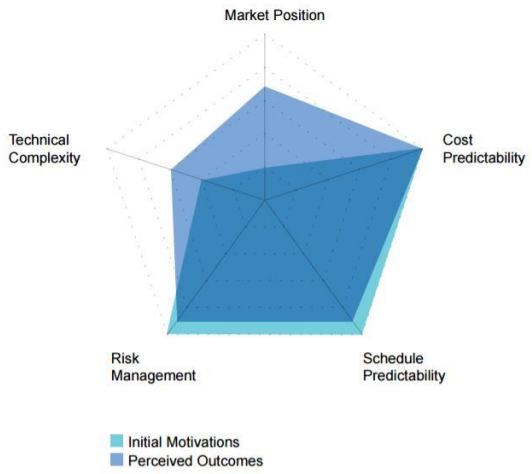

Figure 1: IPD Profile Radar Chart for Cathedral Hill Hospital
Source: AIA & University of Minnesota

In September of 2008, the Army Corps of Engineers [USACE] in conjunction with the North Atlantic Regional Business Center created a presentation regarding IDBB and its application to the NGA New Campus East (USACE, 2008). This presentation was created during construction near completion of the design phase. The goal of this project was to consolidate multiple NGA facilities located throughout Washington D.C. to Fort Belvoir, VA (USACE, 2008). The USACE selected the IDBB delivery method for this project because of the advantages offered by incorporating the constructor early during design (USACE, 2008). The increased cost estimating accuracy offered by adding the constructor in during the design phase provided the opportunity for pricing to occur in real time rather than waiting until the procurement phase of a traditional design-bid-build for the contractor to be able to begin estimating the project (USACE, 2008). The builder has time to compile costs for materials, labor, and transport during design and take advantage of these prices before they fluctuate for the worst (USACE, 2008). IDBB also provided fast track opportunities for the project similar to those of a design-build project. The presentation also covers the breakdown of NGA New Campus East in to ten scope packages, which also aligned with design and construction phasing in the proposed project schedule, made available in the RFP (USACE, 2008). These bid options contained pricing for the general conditions, an initial target price which was to include profit and contingency, and a GMP (USACE, 2008). When the "Production Point," or end of design, is reached the government and contractor are to negotiate a firm fixed price. Until the firm fixed price is established the contractor must be transparent with all accounting and cost information pertaining to the project (USACE, 2008). The options proposed are a unilateral right of the government and do not include an escape clause for the contractor selected (USACE, 2008).

This presentation concluded with challenges and lessons learned from the project to date. The project required a minimum of three competitive bid for each subcontract (USACE, 2008). Upon selection of the IDBB contractor, no subcontracts were executed, which made buying out subcontractors a key objective following award (USACE, 2008). Another challenge that faced the contractors proposing bid options was the risk created by establishing a "ceiling price" or GMP so early in design without an exit clause (USACE, 2008). The USACE established in their presentation that for future IDBB projects they to find a way to better convey the risk associated with their unilateral bid option requests. The USACE also stated the, "Need to make sure offerors understand how involved the government wants them to be during the design process" (USACE, 2008). Their reasoning was that this integrated approach works best if the contractor can value engineer, but if they're not willing to do so early in the project and decide to wait until more solid drawings are provided, than potential schedule impacts are created (USACE, 2008).

Methodology

The objectives of this research study are as follows:

- To evaluate case studies for projects completed using IPD and understand what characteristics drive IPD.
- To understand IDBB hybrid through its application at the NGA campus.
- To highlight how IDBB would affect IPD drivers if projects completed using IPD were delivered through IDBB.

The methodology primarily used was evaluating qualitative data provided through the integrated project delivery case studies conducted by the AIA and University of Minnesota. These studies provided insight to the goals and motivations that drove IPD. They also offer quantitative data such as: schedule restrictions, budgets, and size of project. Taking in to account all this data from the case studies IDBB can applied to see how the five IPD drivers would be effected had the project been procured and delivery as the NGA project was.

Integrated Design-Bid-Build's Application to Completed IPD Projects

To best understand how IDBB affects IPD drivers over a range of projects, projects with different background must be selected for evaluation. For this research report Sutter Health Fairfield Medical Office Building [SHFMOB] and Autodesk Inc AEC Headquarters. The primary difference between these projects is in the table below.

Project	SHFMOB	Autodesk HQ
Location	Fairfield, California	Waltham, Massachusetts
Building Type	Healthcare – MOB	Office – Interior Renovation
Contract	Sutter IFOA	Multi-Party Contract

Figure 2: IPD Project Table

Technical Complexity

Technical complexity for both projects was low for various reasons. The Autodesk HQ project as an interior build out posed little technical complexity aside from some intricate architectural design elements. Beyond this there was a late owner initiated change which called for a three-story atrium to be cut through the center of the building. A change such as this surely would create conflict if the project was delivered through IDBB. The GMP established at the production point could not account for a change of this magnitude and with the very strict scheduling restrictions of this project the contractor would be placed in a bind. This change also came close to the end of the project when in a IDBB delivery model design would have been completed and the architect would likely not have the resources available on such short notice to design this change.

The SHFMOB project was one of Sutter Health's first time implementing IPD on one of their projects and was chosen to test the IPD delivery method because of its lack of complexity (IPD Case Studies, 2012). Had this project been delivered using IDBB technical complexity would likely not be a driving factor.

Schedule Predictability

Schedule management was another reason why Sutter Health decided to implement IPD on this project. They believed the collaborative delivery method offered by entering the principle parties in to an IFOA created better schedule predictability (IPD Case Studies, 2012). IDBB could have further enhanced schedule predictability through commencing construction earlier in the design phase. If the same RFP method used on the NGA project was implemented for the IDBB procurement phase of the SHFMOB then the contractor would have scope packages already structured that could be utilized to accurately price work and begin earlier.

The schedule for Autodesk HQ project was critical because of the need to vacate their existing facilities by a scheduled date to move in to their new headquarters. Since this project was a renovation and not new construction IDBB would likely not be strongly considered for schedule predictability. Bot delivery methods integrate the contractor in to the design phase to ensure the construction process moves quickly and concisely.

Cost Predictability

Cost predictability did not play a strong role in driving the Autodesk project because of the primary focus on "schedule and quality design as driving forces" for IPD (IPD Case Studies, 2012). Again, both delivery methods include the builder early on in design for collaboration, but the separate contracts for designer and constructor used in IDBB pose cost challenges for changes made after design is completed. IPD ensure all parties are involved until project completion through using a single multi-party contract. When applied to the SHFMOB project where cost predictability was a primary driver for IPD the firm fixed price established at production point in IDBB does promote strong cost predictability for the owner, but the contract is left to take on more risk than in IPD.

Market Position

Sutter Health being one of the first to implement IPD helped create the market for IPD and those who choose to test the method for themselves. If this delivery method proved to fair well for Sutter they can take this delivery method and apply it to future buildings. The same option is available had IDBB been implemented instead. Sutter Health and the other principle parties would have the same incentives to implement IDBB if it proved to be successful from the start.

Autodesk HQ had its own unique market position drive for wanting to implement IPD. "As the primary developer of software for the AEC industry, Autodesk was motivated to select IPD as the delivery method to showcase how their products support this emerging delivery method" (IPD Case Studies, 2012). Autodesk HQ could have supported IDBB in the same way due to its collaborative nature. IDBB has been tested even less than IPD which is still considered fairly new.

Risk Management

According to its case study, Autodesk is very experienced with office build outs similar to the Autodesk HQ project, but due to the aggressive nature of the schedule and extensive sustainable design goals risk management was a strong driver for IPD (IPD Case Studies, 2012). The application of IDBB would mean that separate contracts are held with the builder and designer which does not share risk the way IPD does through an IFOA. This causes risk management to be the responsibility of each party independently and new risk may be created as a result.

The same applies for the SHFMOB where risk management was a strong driver behind IPD dues to Sutter Health's intent to, "reduce their exposure to unforeseen risk and number of disputations" (IPD Case Studies, 2012). IDBB places greater risk on the contractor through locking them in to contract without an escape clause after their option is selected. This can leave the contractor attempting to shift some risk to the other principle parties or subcontractors during the project. Sutter Health believes, "By using a shared risk structure, they prevent risk from being shifted between contracting parties and believe it can reduce overall project risk" (Integrated Case Studies, 2012).

Analysis

IPD drivers can best be attributed to its encouragement of collaboration throughout the project and its unique method of risk management between principle parties. IDBB can mimic much of this collaboration through early integration, but without the shared risk structure of IPD this collaboration is hindered. Project drivers for IPD are specific to IPD, which is why the projects selected for this research study would have accomplished the same results through the IDBB delivery method. IDBB differences emphasize different drivers than IPD, which this study does not cover. Through collaboration in both delivery methods schedule and cost predictability is made much more accurate. IPD places these collaborative parties in to one contract, which creates a sense of responsibility for the other contractually bound parties. The separate contracts of IDBB doesn't induce this responsibility between the parties. For example, the designer does not feel the same responsibility to the schedule or budget after the production point has been reached because 100% drawings and specifications are now available. This essentially places the remaining liability for schedule and budget on the contractor. This leads in to what the greatest difference between IDBB and IPD, which is their respective abilities to manage risk between the principle parties. The contractor is forced in to taking on an unbalanced amount of risk after their bid option is selected and executed. The lack of an escape clause contractually obligates the contractor to performance regardless of what changes may occur after the firm fixed price is established.

IPD's greatest contribution is its ability to create a sense of integrity and commitment between the participants, which is built upon the trust of the parties. IDBB eliminates the joint selection of key participants selecting contracts on a best value basis, which adversely affects relationships between the parties. IPD is still regarded as one of the newer delivery methods in construction and is still creating a market position, which is slowly gaining more experienced participants as time goes on. The market for IDBB is still up and coming that leads to parties with very little experience in the field, but on the plus side leaves great room for improvement and development in to a stronger option as a delivery method.

Conclusions and Summary

The limited information on IDBB makes it challenging for evaluation and comparison to delivery methods with more accessible information and research like IPD. Just from looking at the literature reviewed, the divide between detailed case studies in IPD and application of IDBB is apparent. Information was only available for its application to a federal project and a majority of case studies covering IPD were focused around projects with private owners and thus had less strict procurement restrictions. IPD has had time to be applied to many different projects, for a variety of clients, and under a variety of circumstances. IDBB has been used far too little in to accurately understand its application to such a wide range of variables. This research paper's aim was to take case studies for projects that have been carried out using IPD and offer an evaluation to how IPD drivers motivated the integrated approach that was taken. Then two projects with different backgrounds were selected to better offer an analysis of how IDBB could be applied across a range of projects rather than one. The projects selected were an interior build out for a software company and a new construction healthcare project for Sutter. Then take IDBB, a very recently applied delivery method, and understand how its application to these projects would affect the drivers that prompted the IPD approach. The change in emphasis of these integrated drivers heavily favored the IPD approach over IDBB primarily due to risk implications for parties other than the owner. The increased risk placed upon the key participants diminished the motivations of the project to be executed using IDBB.

Future Research

The greatest limitation of this research paper was IDBB being only applied to two projects that have been documented and cases studied using the IPD approach. A larger study which covers around roughly twenty IPD projects and applies the IDBB approach could offer greater insight to which drivers really play the greatest role. Another topic of study is applying IDBB to federal projects that have been completed using integrated project delivery. IDBB also needs to be tested on more projects to better demonstrate what it can offer for a variety of projects rather than its application to federal projects with an accelerated schedule. The greatest value of future research will come from research which conclude which project drivers are specific to IDBB. The IPD drivers which IDBB was applied to for this research papers proved to strongly favor IPD as the most efficient delivery method. This could be expected due to the nature of the case studies, but the lack of application of IDBB is reason enough for future research of how it can best be applied, modified, or if it is a poor approach for projects that seek to have a more integrated approach.

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