

Assessing Collaborative Relationships in Healthcare Construction

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Collaboration amongst designers, contractors, and owners can assist with scope development, and increase project efficiencies. The extent of collaboration for commercial construction projects utilizing an Integrated Project Delivery (IPD) method varies based on experience, company culture, and the sophistication of project participants. This research performs a follow-on study to previous survey research, and reviews and compares analysis across two concurrent hospital construction projects, now near (75-95%) completion in Colorado's Denver metro region. Representative team members were surveyed on both projects near the start (10-20%) of construction and, again, more recently, near completion. Perceptions over time and across projects are analyzed and compared. Metrics for comparison include: productivity, trust, collaboration, additional effort and labor resources, impacts on profit, and design/construction productivity. Preliminary findings suggest that differences in contracting methodology and contractual relationships have an impact on perceptions over time and with regard to the amount of resources and effort required to reach financial goals and completion.

Key Words: Integrated Project Delivery, Healthcare, Effort, Collaboration

Introduction

As project delivery has evolved, roles and relationships between contracted parties (owner, architect, engineer, and contractor) have progressed to incorporate more collaboration. Since the 1970's delivery models for large complex commercial construction projects have progressed from less collaborative models such as Design-Bid-Build (DBB), to more involved models like Construction Manager at Risk (CMR), and finally to delivery models like Integrated Project Delivery (IPD) that encourage earlier and more inclusive involvement of contractors and designers (Bilbo, Bigelow, Escamilla, & Lockwood, 2015). DBB has been critiqued as being fragmented with less integration due to disjointed communication and adherence to contractual hierarchy (Pishdad-Bozorgi & Beliveau, 2016). IPD has become attractive to owners because of its enhanced collaboration, shared risk/incentives approach, and early participation of contractors and vendors (Franz, Leicht, & Asce, 2012). This method supports unique contractual arrangements that can be implemented between project team members (e.g. owner, designers, consultants, contractors, sub-contractors, etc.) that bind a company's success to that of the project's success, instead of an individual's or company's performance alone. This delivery method comes with the expectation that it will enhance team performance and improve team trust, leading to better project outcomes (Garcia, Manata, Mollaoglu, Miller, & Dossick, 2015).

The aim of this research is to explore i) what influence, if any, does contract type have on a IPD project team's perceptions and/or project outcomes, and ii) how do these perceptions change over the course of construction. This research focuses on two previously studied hospital projects, where the lead author worked on each project at different times. Both projects implemented IPD as the delivery method and are described in more detail in (Mulholland and Clevenger, 2018). One project used a Modified American Institute of Architects' contract (hereafter referred to as the Modified AIA Project) as the contract method for a 275,000sf new build, including a patient tower, an emergency department, operating rooms, neonatal intensive care unit, and sterile processing. The design and construction phases cost roughly \$110 million. The other project used a ConsensusDoc Tri-Party agreement (hereafter referred to as the ConsensusDoc Project) for a 128,000sf horizontal expansion project including a new emergency department, expanded operating rooms, a neonatal intensive care unit, and

a cafeteria expansion. The design and construction phases of the second project was valued at roughly \$70 million. Of note, both projects were constructed under similar timelines on adjacent sites. However, the two contract types implemented distinct risk/reward strategies. The Modified AIA Project had a bonus structure based on final cost of completion with risk/incentive split between owner and project. Overages were capped at 50% of project team's profit with the owner, after which pay/risk reverted to a guaranteed maximum price (GMP). The ConsensusDoc Project had an incentive structure that included multiple milestones based on cost and schedule, with the bonus amount based on a set amount at risk.

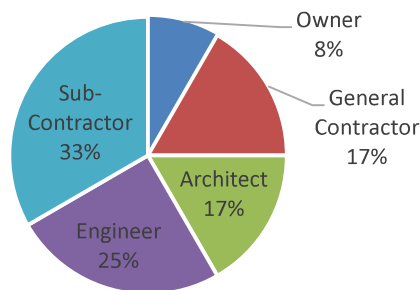
Methods

This research compares findings from two on-line surveys sent to representative project team members working on each project. (Mulholland and Clevenger, 2018) documents findings from Survey 1, where 22 professionals responded (92% response rate) with 8 individuals working on both projects. The second survey was sent to 26 representative project members. 17 responded (65% response rate) with four individuals working on both projects. Survey questions utilized a five point Likert Scale with additional space for comment. Survey questions were intended to solicit feedback regarding individual perceptions about participation, resource allocation, and magnitude of allocated risk across designers and contractors. Percent complete of both projects at the time of each survey were based on owner estimates. One delimitation of the study is that the follow-up survey was limited to previous survey participants, and their project involvement may have changed between surveys.

Demographics of Survey Respondents

Survey 2 respondents included individuals from the owner, architect, engineer, and contracting team from each project. Figure 1 shows the breakdowns of the survey participants by role for the respondents from the two projects.

Modified AIA Survey Respondents



ConsensusDocs Survey Respondents

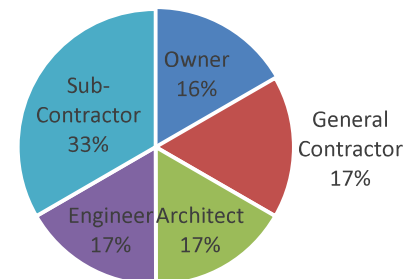


Figure 1: Project Role of Survey Respondents

Objectives

The objectives for this research were to test and motivate further research with regard to:

- i) *Satisfaction levels experienced using different contract types as projects progress;*
- ii) *Construction delivery methods impact on a project team's ability to collaborate and expend effort.*

To address these objectives, results from the two rounds of surveys are presented below in two parts. Part 1 summarizes results over time for each project, comparing perceptions near the beginning and end of the projects. Part 2 summarizes and compares the perceptions of team members with regard to collaboration and level effort for each project near completion.

Results

Figure 2 summarizes project team member perceptions over time for both projects. The results show average responses using the 5-point Likert scale.

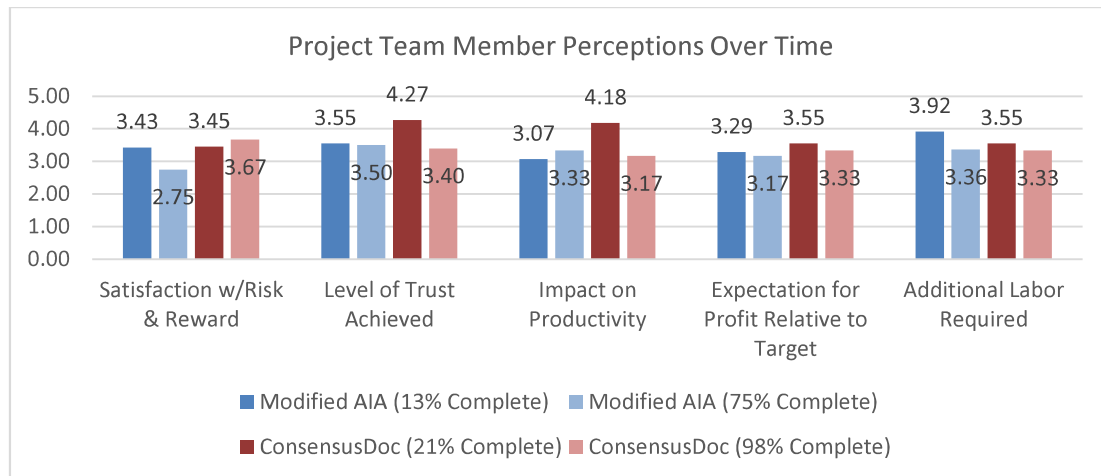


Figure 2: Comparison of team member perceptions over-time for Modified AIA and ConsensusDoc Projects

Part 1

Modified AIA Project

The survey results illustrate that the Modified AIA Project team members' perceptions changed between Survey 1 (project was approximately 13% complete) to Survey 2 (project was approximately 75% complete). A comparison suggests that, as the project progressed, levels decreased with regard to satisfaction surrounding risk/reward (20% decrease), expectation for profit relative to target (4% decrease), and, slightly, with regard to the level of trust achieved (1% decrease). Respondents were also allowed to provide additional comment or qualitative feedback. Representative comments providing context for the decreased level of satisfaction measured include:

- "Concept [of risk/reward] is good, but difficult to implement expectations with all team members".
- "Very hard to control the cost associated with delays from one partner/ non-partner".
- "It's interesting that the majority of partners totally buy into the IPD environment however we have had a couple of transitions back to traditional behavior".
- "Now having the benefit of hindsight, it was confusing and I don't believe this language [of the contract] drove the intended behaviors. Ultimately the various disciplines were still locked into their own contractual silo that has its own boundaries and goals. Designers avoided responsibility for costs, schedule or means and methods and the contractors avoided responsibility for design. The true IFOA [Integrated Form of Agreement] is about the only way to truly drive alignment of all teams toward overall project outcomes

- “There are big field issues that have come to light in the past 30 days that put our at-risk dollars in jeopardy”.

While anecdotal and subject to interpretation, such comments suggest that the dissatisfaction experienced as the project progressed may, in part, be due to concerns by the project participants that the contract failed to clearly define collaborative expectations between contracting partners and properly allocate risks, since the basis of the contract was a traditional Construction Manager at Risk template with a shared risk/incentive clause.

Further comparison of results suggests that, as the Modified AIA project progressed, levels increased with regard to perceived productivity (9% increase) and decreased (14%) with regard to how much additional labor was required. Representative comments providing context for the increased level of productivity and effort include:

- “For the majority of trade partners this contract format has really helped production”.
- “Helps the team work together”.
- “The team bonded early and the relationships built have proven to be of great value. This chemistry continues to make this one of the most enjoyable projects to work in in our office”.

In sum, results suggest that project team members experienced increased levels of productivity and efficiencies as the project progressed, while experiencing decreased levels of trust and satisfaction with shared risk/reward.

ConsensusDoc Project

Survey results also illustrate that ConsensusDoc Project team member perceptions changed between Survey 1 (project was approximately 21% complete) to Survey 2 (project was approximately 98% complete). A comparison of results for the ConsensusDoc Project suggests that, as the project progressed, levels decreased with regard to perceived level of trust (20% decrease), and perceived impact on productivity (24% decrease). Representative comments providing context for these decreased level of satisfaction include:

- “Strong until deadlines and labor overruns eroded some of the trust that was established”.
- “The collaborative environment has increased productivity overall; however, some trades have not seen notable improvements in productivity in part to the behaviors of non-trade partners and client vendors who behave as they always do”.
- “There was continuous collaboration with some erosion when completion schedule and missed pull plan commitments resulted in labor overruns for some trade partners”.

Further comparison of results suggests that, as the project progressed, levels increased with regard to perceived satisfaction with risk/reward (6% increase) and decreased with regard to perceived need for additional labor required, (6% decrease). Representative comments providing context for this increased level of satisfaction include:

- “The risk/reward systems set in place have been very fair and practical based on milestone schedule dates and target costs at strategic points throughout the process”.
- “Went well for design phases, construction related incentive seems to be in jeopardy as completion gets closer”.
- “[As an engineer] our construction services were limited to coordination and site meeting attendance, [resulting in more resources than expected]”.

Similar to the Modified AIA project, the project team for the ConsensusDoc project identified missed commitments as having a negative impact to schedule, productivity, and possibly the profit at risk.

Direct comparison of the two projects shows a higher level of satisfaction, overall, with the ConsensusDoc project, specifically in regard to the risk/reward language and expectation of achieving or exceeding planned profit. However, changes in satisfaction for both contract types varied as the projects progressed. Notably, differences in satisfaction for items other than the risk/reward component tended to converge as the two projects progressed.

Part 2

A secondary objective of the research was to compare satisfaction, potential impact on productivity, effort, and required resources on project teams using IPD contracts for the two projects near the end of construction. Figure 3 is a summary of average project satisfaction responses using the 5-point Likert scale for the two projects. Findings suggest a generally elevated level of satisfaction with IPD for both projects.

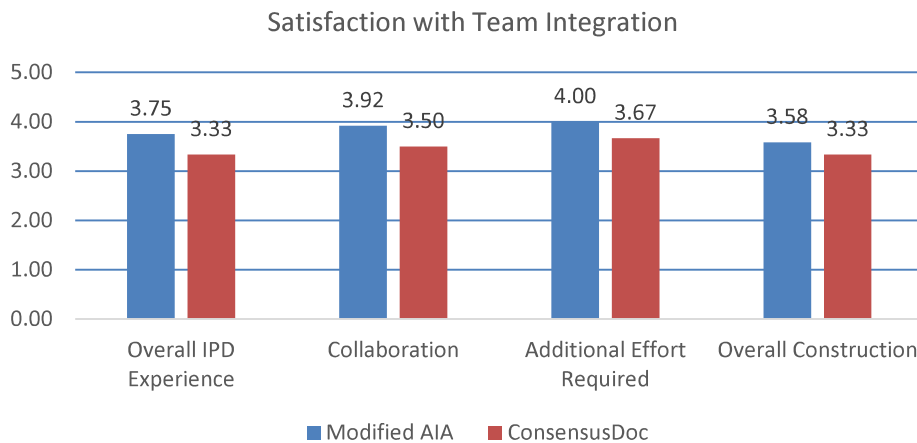


Figure 3: Satisfaction with Team Integration on IPD Projects by Contracting Method

Figure 3 is a summary of responses that compare collaboration, effort, and satisfaction with the overall construction process, and indicate increased levels of satisfaction with IPD attributes. These findings align with other research reporting higher levels of owners satisfaction with higher levels of team integration on IPD projects (Choi et al., 2018; Franz et al 2017).

In addition to the quantitative evaluation, respondents had the opportunity to provide comments. Representative comments with regard to effort and productivity for both projects include:

- “The additional meetings alone significantly increased our time commitment over a standard contract delivery type. The expense of our additional time up front and during construction is value received to the client in coordination of documents and exploring more efficient ways to detail and construct the facility”.
- “The primary savings in effort for our work was the limited redesign related to early decisions in the process...”
- “The collaborative environment has increased productivity overall; however, some trades have not seen notable improvements in productivity in part to the behaviors of non-trade partners (non-trade partners being contractors not signatory to IPD contract, and instead opted for a traditional contract) ...”.
- “The planning helped with a better team spirit in the field, a safer and more organized site, a better prefab and a better team overall”.
- “For the majority of trade partners this contract format has really helped production”.
- “While there have been some items that have complicated the project, the team generally came together as a team to overcome difficult situations. On a traditional job, trades would be posturing for a claim as opposed to trying to work through it as a group”.
- “Although nothing is perfect this project has been very enjoyable. Our trade partners (for the most part) are true trade partners and we have created a culture around the mission of our client that is very rewarding”.
- “Significantly more time is spent in meetings for planning”.
- “A lot more pre-construction involvement which is a great idea”.

Based on these comments and the results from Figures 2 and 3, findings suggest that project team members generally perceived that IPD project collaboration had a net positive affect to the project's success, but also required more than an average amount of effort and labor.

Discussion

Limitations for the study exist such as small sample size, and representation of only design and construction team members. Results, therefore, may not be generalizable. However, due to high project similarity, location, and time of construction, coupled with overlapping company/participant involvement on both projects, results likely have a high degree of reliability and provide insights into the potential role that contracts have on a team's interaction and their perceived productivity.

While each projects had different teams and distinct goals, survey results suggest that for both projects i) satisfaction with contract type generally decreased as the projects progressed towards completion, and ii) contract type did have an impact on the amount of resources and effort needed for project success. Specifically, the impacts of IPD were generally perceived as favorable on both projects, but decreased and converged over time. In addition, project team members on both projects perceived a collaborative/integrated contract as having a beneficial impact compared to a more traditional contract.

Finally, for comparison, survey participants were also asked about their general satisfaction with a range of project delivery methods. Results are shown in Figure 4. In general, survey participants favored more collaborative delivery models compared to traditional contracting and delivery types. Though a decrease in the level of satisfaction from respondents of these more collaborative contract types can be seen in, this may be due in part from the decreased level of satisfaction seen in collaborative contract elements shown in Figure 2. As previously noted, it is an expectation in an IPD project that project participants will collaborate and share risk from day one (Bilbo et al., 2015), which may be more palpable at the beginning of a project than at the end when issues and conditions arise. In contrasts, a non-IPD/CPD type contract allocates risk to individual firms, and not to the project team as whole.

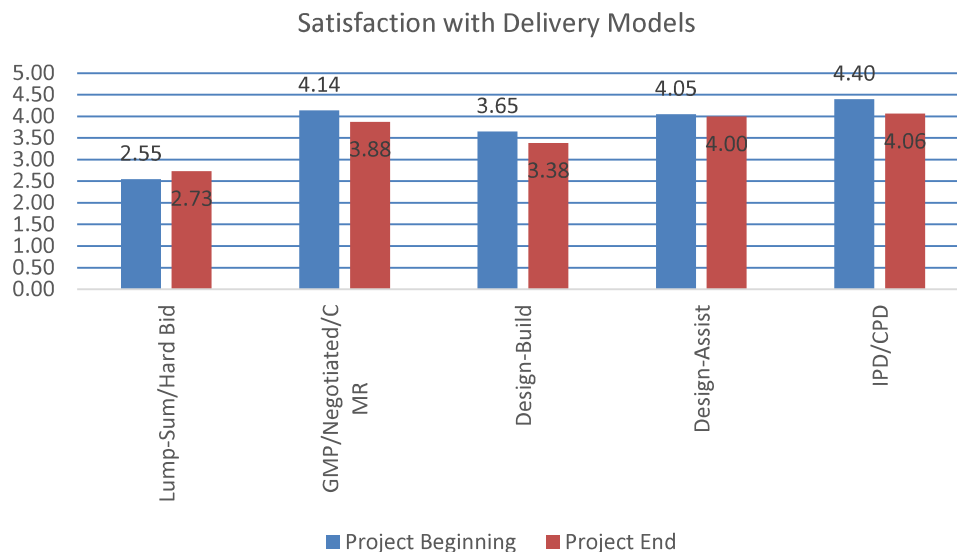


Figure 4: Changes in Perceptions regarding Delivery Methods as experience with IPD projects progresses

IPD's emphasis on collaboration comes at a cost of additional resources and effort that is needed for success, a unique arrangement in the commercial construction industry. To incentivize the additional

effort by all parties, typically a bonus structure is offered to offset the additional expense and effort that may be incurred (Poblete & Spulber, 2012). Data presented in Figure 2 and Figure 3, suggests that although additional labor and effort were required for IPD projects, the majority of respondents answered that they were on trend to exceed their financial goal by less than 5%. Further, although additional effort and labor were required, overall project satisfaction and satisfaction with productivity scored higher than average. In addition to the survey results noting the need of additional resources and effort, it is interesting to highlight a few of the comments of the respondents. These comments align with existing research which suggests efficient coordination enables better performance and promotes project success.

- “The additional meetings alone significantly increased our time commitment over a standard contract delivery type. The expense of our additional time up front and during construction is value received to the client in coordination of documents and exploring more efficient ways to detail and construct the facility”.
- “Significantly more time is spent in meetings for planning”.
- “I think the IPD contract requires more effort in the beginning but less during construction. The effort is probably similar but the savings can be achieved through the construction”.

Previously, behaviors that enhance cooperation needed for contracted relationships were reviewed by Devetag and Ortmann who identified the following as efficiency-enhancing behaviors: pre-play communication, quality and the strength of common knowledge amongst participants, and observing actions after implied intent of the actions, among others (2007). Some of these behaviors were noted by project participants in the previous comments. The definition and measure of effort, however, can vary amongst professionals and thus may have a different impact to their respective business strategies. For example, an engineer responded in the survey that the required effort was slightly less than what was typically required for a traditional project (difference being less 10% in estimated effort expended) and commented with the following, “the primary savings in effort for our work was the limited redesign related to early decisions in the process.” This is a thought-provoking comment, as the engineer is suggesting less effort was expended because of what can be assumed to be additional effort of others in providing earlier and complete information.

Pishdad-Bozorgi and Beliveau (2016) stated that IPD contracts are more relational than DBB, Design-Build, or CMR contracts. There is frequently a benefit to establishing these relationships, as previous research has noted that team behaviors, effort level, and acceptance of risk are influenced by historical actions and communication (Battalio, Samuelson, Huyck, & Huyck1, 2001; Büyükboyacı & Küçükşenel, 2017; Dubois, Willinger, & Van Nguyen, 2012) In sum, behavior norms that are expected in traditional contracts can, as the survey reflects, cause decreased levels of satisfaction and increase the needed levels of effort on IPD projects.

Conclusions and Future Work

This research provides insight into the impact that contracting methods have on effort and additional resources for IPD projects based on project team members’ perceptions. An online survey was used to collect quantitative and qualitative responses from seventeen owner, architect, engineer, and contracting project participants for two IPD projects utilizing different contract vehicles. Results highlight the additional effort and resources required on highly collaborative projects. Traditional methods, communication styles, and hierarchy can challenge participants to be fully integrated and willing to provide the additional effort that is necessary to reap the gains from broader team involvement typical of IPD projects. While results from two case studies may or may not be generalizable, they are informative and suggest that contract agreements play an important role, even within the same project delivery method. Future research opportunities include 1) studying implications of effort on traditional contract types and non-traditional contract types for complex construction projects, 2) developing definitions and metrics for effort, specific to effort’s impact on profit, and 3) expanding research on how contract types affect morale, productivity, and trust in non-IPD environments.

References

- Battalio, R., Samuelson, L., Huyck, J. Van, & Huyck, J. Van. (2001). Optimization Incentives and Coordination Failure in Laboratory Stag Hunt Games. *Source: Econometrica*, 69(3), 749–764. Retrieved from <http://www.jstor.org/stable/2692208>
- Bilbo, D., Bigelow, B., Escamilla, E., & Lockwood, C. (2015). Comparison of Construction Manager at Risk and Integrated Project Delivery Performance on Healthcare Projects: A Comparative Case Study. *International Journal of Construction Education and Research*. <https://doi.org/10.1080/15578771.2013.872734>
- Büyükböyük, M., & Küçükşenel, S. (2017). Costly Pre-Play Communication and Coordination in Stag-Hunt Games. *Managerial and Decision Economics*, 38(6), 845–856. <https://doi.org/10.1002/mde.2821>
- Choi, J., Asce, S. M., Yun, S., Asce, M., Leite, F., & Mulva, S. P. (2018). Team Integration and Owner Satisfaction: Comparing Integrated Project Delivery with Construction Management at Risk in Health Care Projects. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000654](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000654)
- Devetag, G., & Ortmann, A. (2007). When and why? A critical survey on coordination failure in the laboratory. *Experimental Economics*. <https://doi.org/10.1007/s10683-007-9178-9>
- Dubois, D., Willinger, M., & Van Nguyen, P. (2012). Optimization incentive and relative riskiness in experimental stag-hunt games. *Int J Game Theory*, 41, 369–380. <https://doi.org/10.1007/s00182-011-0290-x>
- Franz, B., Asce, A. M., Leicht, R., Molenaar, K., & Messner, J. (2017). Impact of Team Integration and Group Cohesion on Project Delivery Performance. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001219](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001219)
- Franz, B., Leicht, R. M., & Asce, A. M. (2012). Initiating IPD Concepts on Campus Facilities with a " Collaboration Addendum ". *61 Construction Research Congress*.
- Garcia, A. J., Manata, B., Mollaoglu, S., Miller, V., & Dossick, C. (2015). Implementing IPD Method as Innovation: Project Coordination Influence on Information Sharing and Project Team Performance IMPLEMENTING IPD METHOD AS INNOVATION: PROJECT COORDINATOR INFLUENCE ON INFORMATION SHARING AND PROJECT TEAM PERFORMANCE. In *Engineering Project Organization Conference*.
- Gordon, C. M. (1994). CHOOSING APPROPRIATE CONSTRUCTION CONTRACTING METHOD. *Journal of Construction Engineering Management*, 120(1), 196–210. Retrieved from <http://0-ascelibrary.org.skyline.ucdenver.edu/doi/pdf/10.1061/%28ASCE%290733-9364%281994%29120%3A1%28196%29>
- Hanna, A. S. (2016). Benchmark Performance Metrics for Integrated Project Delivery. *Journal of Construction Engineering Management*, 9(149). [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001151](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001151)
- Mulholland, S., Clevenger, C. (2018) Contracting Methods for Integrated Project Delivery: A Healthcare Case Study, Proceedings of the 2018 Construction Research Congress, April 2-5, 2018, New Orleans, Louisiana, pp. 191-201.
- Pishdad-Bozorgi, P., & Beliveau, Y. J. (2016). Symbiotic Relationships between Integrated Project Delivery (IPD) and Trust. *International Journal of Construction Education and Research*. <https://doi.org/10.1080/15578771.2015.1118170>
- Poblete, J., & Spulber, D. (2012). The form of incentive contracts: Agency with moral hazard, risk neutrality, and limited liability. *RAND Journal of Economics*, 43(2), 215–234. <https://doi.org/10.1111/j.1756-2171.2012.00163.x>
- Raisbeck, P., Millie, R., & Maher, A. (2010). ASSESSING INTEGRATED PROJECT DELIVERY: A COMPARATIVE ANALYSIS OF IPD AND ALLIANCE CONTRACTING PROCUREMENT ROUTES. In *Procs 26th Annual ARCOM Conference*.