

Benefits of using Lean IPD as a Strategy for Better Project Management^{1, 2}

Saimon Satyanathan

ABSTRACT

The construction industry sees tremendous potential to improve the effectiveness and performance of projects. Thus, there is much wisdom in adopting Lean IPD which offers lean principles and a focus on collaboration and work flow reliability. In this paper, the benefits and restrictions experienced by participants in implementing Lean IPD are analysed. The paper eventually focuses on demonstrating that Lean IPD provides a better approach much effective towards Project Management.

The author will identify various project delivery methods including Lean IPD and then make a comparative study using the Multi-Attribute Decision-Making (MADM) analysis to illustrate the coherence with respect to some attributes. Further utilising these attributes and some selection criteria, the best possible alternative for businesses to consider for their project strategies is convincingly proved to be Lean IPD.

Keywords: Integrated Project Delivery (IPD), Lean Management, Lean IPD, Project Management, Business Strategy, Collaborative Contracting, Trust based Collaboration

INTRODUCTION

Motivation: A 2017 McKinsey study about capital-intensive Infrastructure Projects reported that only 2% of construction projects worldwide are completed and delivered within the estimated time and budget frames and to the satisfaction of all stakeholders!³ Why do we still continue to see this unsettling lack of positive results, and such bad Project Management outcomes?

¹ Editor's note: Student papers are authored by graduate or undergraduate students based on coursework at accredited universities or training programs. This paper was prepared for the course "International Contract Management" facilitated by Dr Paul D. Giammalvo of PT Mitratata Citragraha, Jakarta, Indonesia as an Adjunct Professor under contract to SKEMA Business School for the program Master of Science in Project and Programme Management and Business Development. <http://www.skema.edu/programmes/masters-of-science>. For more information on this global program (Lille and Paris in France; Belo Horizonte in Brazil), contact Dr Paul Gardiner, Global Programme Director, at paul.gardiner@skema.edu.

² How to cite this paper: Satyanathan, S. (2019). Benefits of using Lean IPD as a Strategy for Better Project Management, *PM World Journal*, Vol. VIII, Issue I (January).

³ Banaszak, J., Palter, R., Parsons, M. (2017). Stopping the insanity: Three ways to improve contractor-owner relationships on capital projects. *Voices on Infrastructure: McKinsey & Company*. (p. 8-12).

One way to see a feasible answer to this issue is by **adopting Integrated Project Delivery (IPD) in combination with a Lean approach** to be executed **as a part of the Business Strategy** itself.

The AIA’s Centre for Integrated Practice (CIP) defines Integrated Project Delivery (IPD) as:

“IPD is a method of project delivery distinguished by a contractual arrangement among a minimum of owner, constructor and design professional that aligns business interests of all parties.”⁴

It contains the following contractual and behavioural principles:

Principles of IPD	
Key Participants	Implementation
Mutual Respect and Trust	Shared Risks and Rewards
Collaborative Innovation and Decision Making	Early Involvement of Key Participants
Early Involvement of Key Participants	Early Goal Definition
Open Communication	Intensified Planning
Multiparty Agreement	Organization and Leadership

Table 1: Principles of IPD⁵

According to the Guild of Project Controls Compendium and References (GPCCaR), “IPD is a unique collaboration of people, systems, business structures and practices as a method that utilises the best skills of all participants to achieve the result, increase value to the owner, minimise waste, and maximise efficiency throughout all stages of project management, which can be distinguished into 8 main Phases as mentioned below:

- Conceptualization
- Criteria Design
- Detailed Designing
- Implementation Documentation
- Agency Review
- Buyout
- Construction
- Closeout”⁶

This project delivery method was formulated just about two decades back. The objective of such a venture is to increase value (efficiency in terms of cost-time-quality-stakeholder and customer satisfaction factors) and reduce waste while ensuring that productivity improves.

4 Cohen, J. (2010). Integrated Project Experiences in Collaboration: On the Path to IPD Delivery: Case (January) 4.

5 Fish, A. (2011). IPD - The obstacles of Implementation, 9.

6 Integrated Project Delivery (IPD) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.), 12.6.3.2.

When continued to apply the Lean Principles to maintain focus on Customer Value, Streamlined Processes and Continuous Improvement, we can also approach all IPD Projects for waste elimination.^{7,8} [A huge opportunity: Figure A (Appendix) shows that only around 19% time is currently spent on lean execution.⁹]

A detailed work on the similarities between the philosophy approach of Lean and IPD (reduce waste, maximise efficiency); for good Project Management, can be studied from Table A (Appendix): 'Comparative Analysis of Lean & IPD Principles'. It is safe to agree on the fact that both eventually promulgate a change in mindsets from 'individual' to 'collective'.¹⁰

Lean IPD towards good Project Management:

A Lean IPD method employs all Project Management processes through all its phases, with unique benefits to Stakeholder Management, Risk Management, Communication Management, Change Management, etc. This effort of a collaborative approach to bring project stakeholders: the owner, design team, construction team, contractors, facilities management, and others, together, right from the early design/initiation stages, leads to a Multi-Party Agreement (MPA), where all those involved in the project execute one single contract specifying their own roles, responsibilities, and liabilities, which in turn could help maximise operational efficiency and optimise performance.¹¹ This kind of an integration intertwined with project-based decision making and compensation promotes team performance, as better transparency and understanding of the role of other participants would prevail. Such an agreement requires trust and collaboration, and the 'Shared financial risk and Shared Rewards' strategy promotes a continuous and reliable workflow, that enhances team's commitment to project goals while Lean implementation would mean minimising cost and time also.

IPD exists through an alliance contract that ties the project members in concurrence, boosting participation and collaboration. Example, Facility Managers too will ordinarily assume a functioning job in the IPD procedure, informing design choices that would affect operations, and Data Management also results with the advent of Project Management Information Systems (PMIS), Building Information Modelling (BIM), etc. Design and Construction experts are chosen dependent on unadulterated Qualifications Based Selection. The usual pricing structure is objective, with 100% repayment for direct costs, benefits at risk, and shared incentives for savings under the target cost.¹² This contract structure is therefore exceptionally based on transparency in pricing, communication, and exchange of project data.

⁷ Create a Lean, Construction Building Machine with Integrated Project Management. (2018, May 8).

⁸ Pease, J. (n.d.). What is Integrated Project Delivery Part 2: Lean Operating System.

⁹ Lean, I. (2017). Lean Construction & Integrated Project Delivery (IPD) Overview, 33.

¹⁰ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING.

¹¹ AIA, & AIACC. (2007). Integrated Project Delivery: A Guide. *American Institute of Architects*, 32.

¹² Efficient Project Delivery: BIM, IPD, JOC, Cloud Computing and More. (n.d.).

IPD motivates teams to collaborate and Lean provides the means to achieve it. The way IPD and Lean works is that IPD provides a contractual environment and motivation for collaboration through the sharing of risks and rewards, early involvement and equality of stakeholders, project-first mindset, liability limitations, and some basis for trust (development of the contract, open-book transparent finances, shared understanding of each other’s goals and business objectives). Lean provides the means to align the team’s focus towards collaborating efficiently for cost (Target Value Design), schedule (Last Planner System, plan percent complete), and other goals possible using Lean tools such as A3, Plus/Delta, or plan-do-check-act.¹³

All this could mean higher probability of business continuity: There is clear alignment of everyone’s goals, and for a successful execution of projects as per schedule and within budget, much greater than through traditional delivery methods, which could mean attainment of business goals too and thus clearing the roads to future growth.

The following 3 figures below clearly illustrate the relevance of IPD to Project (and concurrently to Programme and Portfolio Management, by considering IPD as the business’ Contracting Strategy for all/most projects):

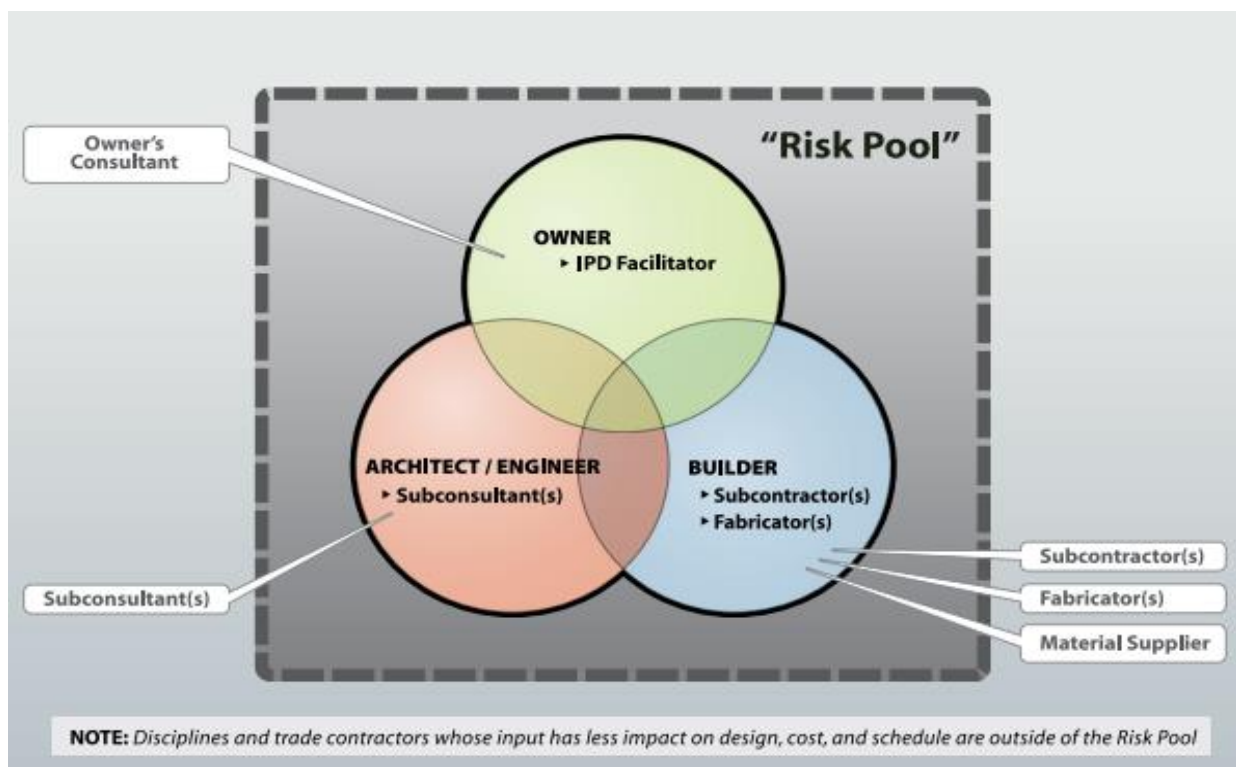
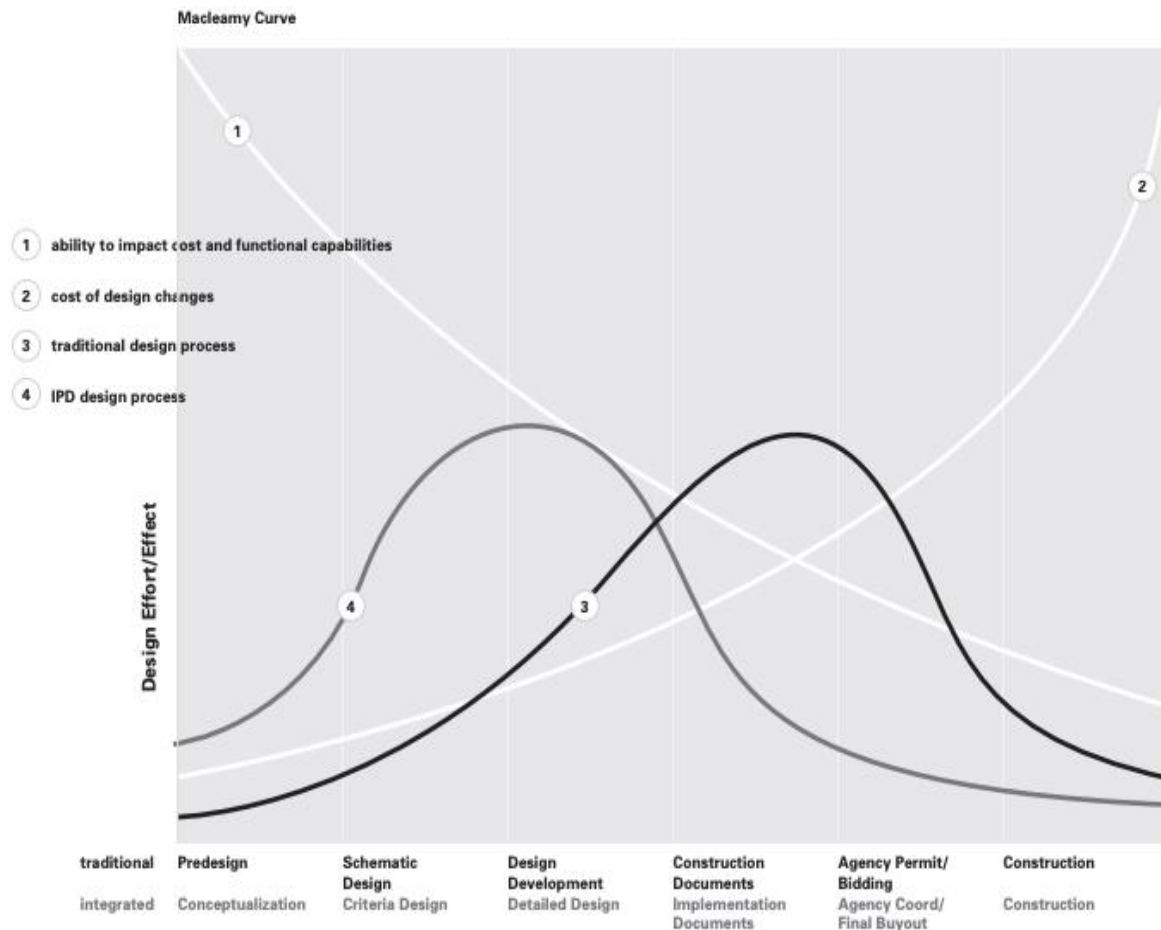


Figure 1: IPD Organisation Illustration¹⁴

¹³ Cheng, R., & Johnson, A. J. (2016). Motivation and Means: How and Why IPD and Lean Lead to Success. *Spring Owners Leadership Conference, May 17-19, 2017*, (November), 2.

¹⁴ Idaho Transportation Department. (2010). *Project Delivery Methods*, (September).

Figure 1 depicts how this collaborative set-up necessitates and fosters excellent Stakeholder engagement while having a clear assessment of the Risk responsibilities of each key participant.



Introduced in the Construction Users Roundtable's "Collaboration, Integrated Information, and the Project Lifecycle in Building Design and Construction and Operation" (WP-1202, August, 2004)", the "MacLeamy Curve" illustrates the concept of making design decisions earlier in the project when opportunity to influence positive outcomes is maximized and the cost of changes minimized, especially as regards the designer and design consultant roles.

Figure 2: MacLeamy Curve - Comparison of IPD vs. non-integrated Projects' Phases¹⁵

Figure 2 represents the comparison of Traditional vs. IPD approaches with regards to the escalating cost of design changes throughout progression of the project's phases.

¹⁵ AIA, & AIACC. (2007). Integrated Project Delivery: A Guide. *American Institute of Architects*, 21.

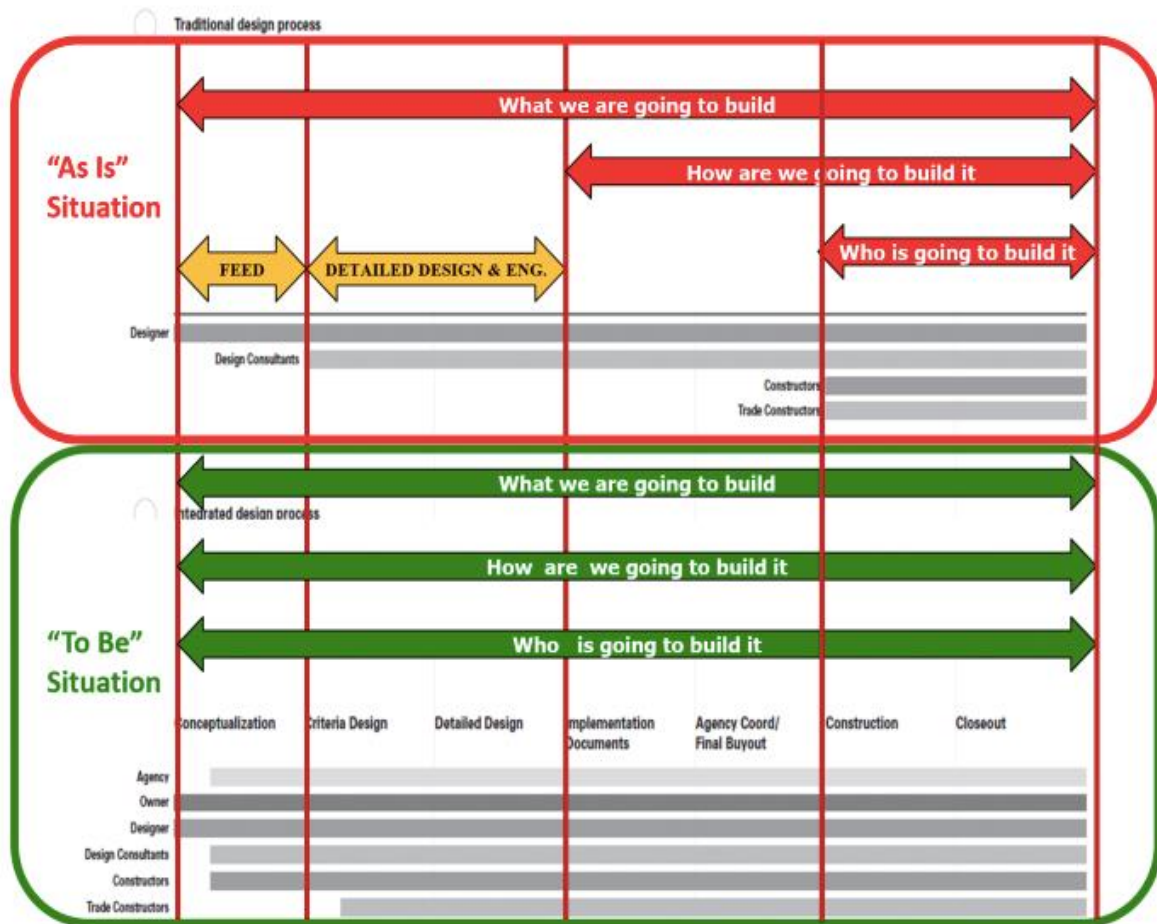


Figure 3: IPD Approach's Left Shift¹⁶

Figure 3 is an excellent depiction of evidence of early scope definition in IPD approach (the Left-shift). As much of the decision-making for fixing the scope baseline is made before execution, the Project Manager can focus on better planning and execution, rather than having to deal with onerous Project Controls, thus leading to fewer disputes from changes, if any.

We will henceforth review the IPD strategy and the fundamental obstructions that are keeping it from being routinely received. It will also align the method with Lean strategies to cover such advantages and disservices contrasted with other construction strategies, in order to better recognise the biggest snags to its usage. The reason for this report is to give answers to 'why must we implement Lean IPD' so that industry experts can see manners by which this technique can be all the more practised.

¹⁶ Giammalvo, D., P. GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (2015), 10.3.2.2.

Problem

IPD implies the contractual aspect with multi-party agreements' context and Lean provides the route to achieving it. Therefore obviously, it's uncommon to implement IPD without Lean.¹⁷

However, even though owners and all other major project stakeholders might generally agree that Lean IPD is a nuanced and balanced approach, it hasn't really grown beyond its nascent stage in implementation anywhere in the world, barring some major projects in mostly Hong Kong and Northern America to highlight.

In sharp contrast to other forms of project contracting's usage, why has IPD not been properly and wilfully utilised as yet, even though it's called the new 'disruptive innovative' method with benefits too good to ignore?

Mustn't businesses consider using this method as part of their Strategy for Projects and Project Management itself?

To get to the root of the problem further, let us interpret the Cause & Effect Diagram/Fishbone Analysis, also called the Ishikawa Diagram, illustrated below. This tool will help us further understand why such an apparent lack in implementation of Lean IPD exists.

¹⁷ integrated-project-delivery @ www.smartsheet.com. (n.d.). Retrieved from <https://www.smartsheet.com/integrated-project-delivery>

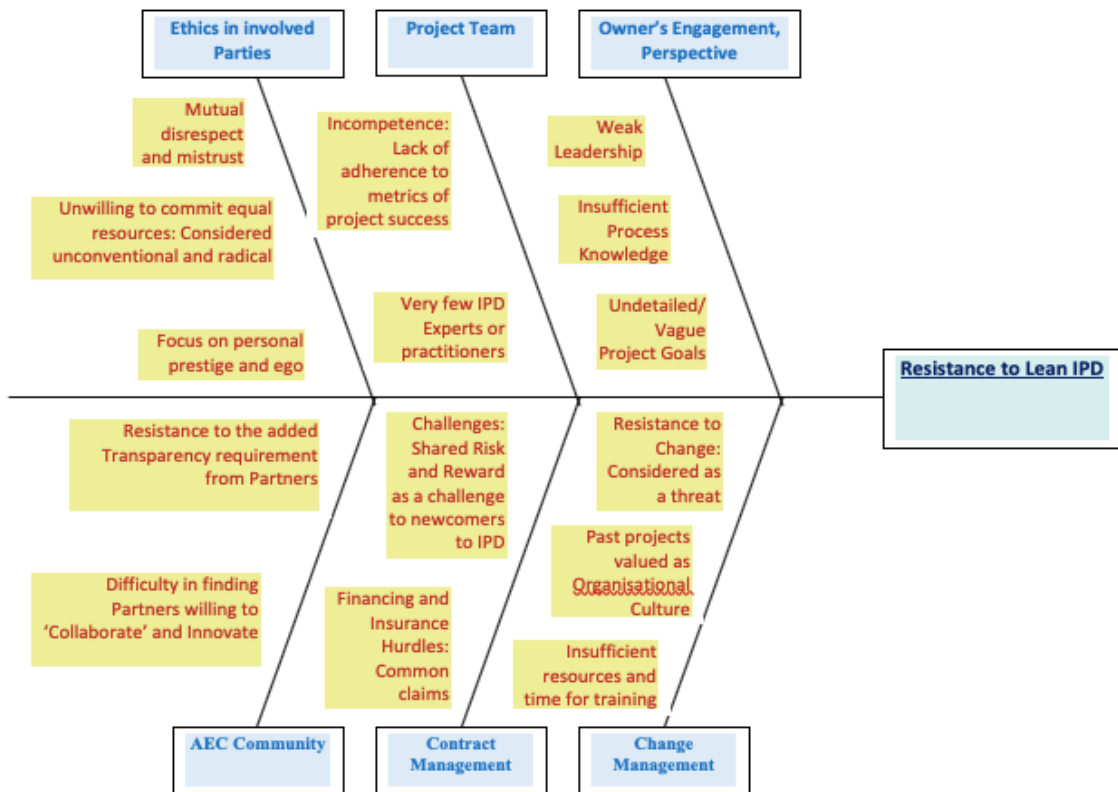


Figure 4: Root Cause Analysis¹⁸

The remainder of this paper will be based around these premises, to help justify our recommended solution of Lean IPD for the AEC industry's problems with project management in general, and demonstrate it through our objectives listed below.

The Objectives

Based on the above background, some amongst the major questions that we will see answers to, through this paper are:

1. How do we deal with the obvious and hidden challenges or cons with adopting Lean IPD as part of a firm's project strategy, especially considering the method is relatively new and evolving with fewer literature resources to back it currently, and not largely completely tested worldwide?

¹⁸ Create a Lean, Construction Building Machine with Integrated Project Management. (2018, May 8). Figure by Author.

¹⁸ Ashcraft, H. W. (n.d.). Integrated Project Delivery: The Owner's Perspective. Figure by Author.

2. Why must it be a model for consideration by most, if not all, firms for their projects?
(What benefits compared to conventional methods would we see?)

3. What effect would it have on eventual technicalities in Project Management in Architecture-Engineering-Construction (AEC) industry, like on Team Management, Stakeholder Management, Communication Management, Change Management, Risk Management, etc.?

METHODOLOGY

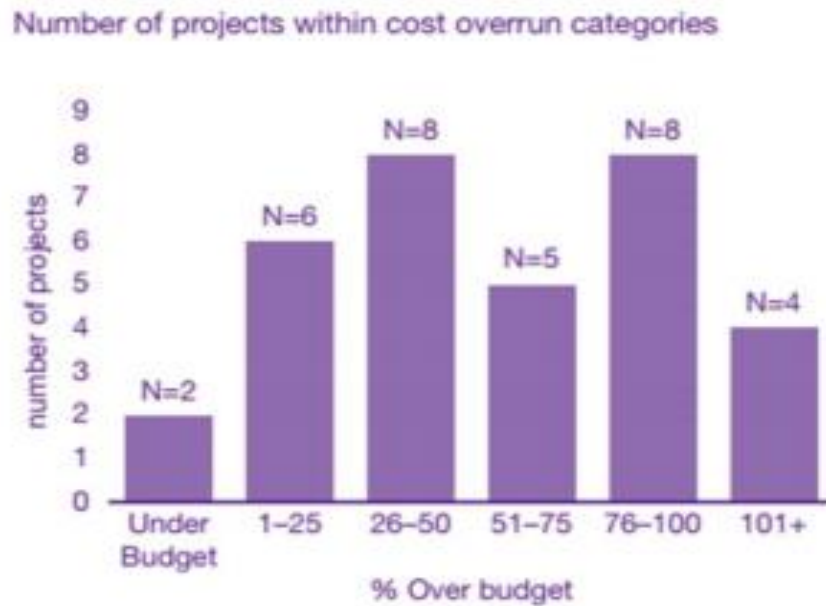
With the end goal of characterizing the benefits of IPD over other delivery methods and strategies, it is first important to survey these major existing methods in presence now, since that will form the premise of comparison. The analysis will be exhaustive and performed using the Multi-Attribute Decision-Making Methodology (MADM). Based on this and concurrent to our reading above about the coherence of Lean IPD with Project Management, we can finally base our conclusions on facts to help implement Lean IPD for better Project Management in businesses' projects worldwide. Our Methodology is primarily based on a Research Study¹⁹ [Mounir El Asmar, Ph.D., M.ASCE, Awad S. Hanna, Ph.D., F.ASCE, Wei-Yin Loh, Ph.D.: Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. (Figures E to J in Appendix.)]²⁰, the first major one of its kind on comparison of Project Delivery Methods, and several other qualitative research findings' based interpretations. The results of the above mentioned research paper can be extremely valuable for decision makers to help choose the appropriate delivery system for their projects.

➤ **Step 1: Problem Statement**

A PWC Industry-wide survey Study reported the following about the Construction industry's dismal Project outcomes:

¹⁹ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 6-12.

²⁰ quantifying-performance-for-the-integrated-project-delivery-syste @ asu.pure.elsevier.com. (n.d.). Retrieved from <https://asu.pure.elsevier.com/en/publications/quantifying-performance-for-the-integrated-project-delivery-syste>



Source: PwC analysis, based on industry research

Figure 5: Number of Projects with Cost-Overruns²¹

Also, Construction Productivity Has Been Lagging Since 1964, according to a Stanford University Research: Greater than 50 percent of construction time is determined to be wasted ²² (non value-added).²³ Only 2% of Construction projects worldwide are completed and delivered within the estimated time and budget frames and to the satisfaction of all stakeholders.²⁴

These bring us to our problem: Construction Projects worldwide have quite often grossly underperformed, to dismal extents even. But even with the existence of an innovative collaborative approach of project delivery like Lean IPD, why do owners not see the reality of implementing it, with its visible benefits, but continue to use traditional methods?

- Compared to traditional methods, what are Lean IPD's advantages?
- What are possible difficulties/challenges in implementing the Lean IPD, compared to the ease and difficulty of using the other methods?

²¹ Lean, I. (2017). Lean Construction & Integrated Project Delivery (IPD) Overview, 5.

²² integrated-project-delivery @ www.smartsheet.com. (n.d.). Retrieved from <https://www.smartsheet.com/integrated-project-delivery>

²³ Create a Lean, Construction Building Machine with Integrated Project Management. (2018, May 8).

²⁴ Banaszak, J., Palter, R., Parsons, M. (2017). Stopping the insanity: Three ways to improve contractor-owner relationships on capital projects. *Voices on Infrastructure: McKinsey & Company*. (p. 8-12).

- Thus, what could be the best solutions to help implement this approach and inculcate it as a firm's Project Management Strategy?

With answers to these questions and based on the comparison and analyses, we will conclude that Lean IPD amply serves the purpose of good and innovative project management.

➤ Step 2: Identification of feasible Alternatives

2.1: Alternative Solutions

There exists several other Project Delivery Methods (previously collectively referred to as 'Traditional methods') that have been used mostly, since a long time in construction projects, and other newer ones including a 'hybrid IPD' Model newly. We will list these major alternatives and compare to interpret the most effective.

- Design-Bid-Build (DBB)²⁵
- Design-Build (DB)/Engineer-Procure-Construct (EPC)²⁶
- Bridging Design-Build ²⁷
- Construction Management at Risk (CM)²⁸
- Bridging CM at Risk ²⁹
- Construction Management Agency ³⁰
- IPD Lite/IPD-ish^{31 32}
- IPD [Used alone without Lean] ³³
- Lean IPD^{34 35}

²⁵ AIA, & AIACC. (2007). Integrated Project Delivery: A Guide. *American Institute of Architects*, 49.

²⁶ AIA, & AIACC. (2007). Integrated Project Delivery: A Guide. *American Institute of Architects*, 47.

²⁷ Giammalvo, D., P. GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.). 05.3.3.2.

²⁸ AIA, & AIACC. (2007). Integrated Project Delivery: A Guide. *American Institute of Architects*, 51.

²⁹ Giammalvo, D., P. GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.). 05.3.3.2.

³⁰ Giammalvo, D., P. GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.). 05.3.3.2.

³¹ Kim, Y.-W., Rezaqallah, K., Lee, H. W., & Angeley, J. (2016). Integrated project delivery in public projects: Limitations and opportunity. *IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction*, 95.

³² Nasfa; Coaa; (2010). Integrated Project Delivery For Public and Private Owners, 28-32.

³³ Giammalvo, D., P. GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.). 05.3.3.2.

³⁴ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 6-12

³⁵ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 48.

2.2: Attributes to Assess Each Alternative^{36 37 38}

- **Integration of Teams:** Extent of collaboration, also considering time of assembly and decision-making powers of project participants.³⁹
- **Process Concurrences:** Low:- Packets or Segregated Knowledge, to High:- Concurrent, Multi-Level Information sharing.⁴⁰
- **Managing Costs:** Detail of estimation, and Stage of Commitment (High: Early, to Low).⁴¹
- **Risks' Management Profiling:** Low:- Individually managed/ maximum transferred, to High:- Collectively managed and Shared.⁴²
- **Compensation(s)/Reward(s) Basis :** Low:- Individual goals alone, to High:- Tied to Project Success also.⁴³
- **Communication Performance Metrics:** Requests for Information [RFI] per Million Dollars. (Paper-based, IT Tools, BIM, etc.) [Low RFI/- \$ MM. desired for probable best alternative's 'High.']^{44 45}
- **Agreements Agenda:** Low:- Transactional, to High:- Relational, Shared.⁴⁶

³⁶ Adapting Contracts to the IPD Model. (2018, February 8).

³⁷ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 50.

³⁸ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 6-12

³⁹ Fish, A. (2011). IPD - The obstacles of Implementation, 16.

⁴⁰ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 50.

⁴¹ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 50.

⁴² Giammalvo, D., P. GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.). 05.3.3.2.

⁴³ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 50.

⁴⁴ Dale Munhall, B. (2014). If We Keep On Doing What We've Always Done..., (January), 2.

⁴⁵ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 10.

⁴⁶ Nasfa; Coaa; (2010). Integrated Project Delivery For Public and Private Owners, 33.

- **Quality Metrics:** Deficiency Issues per Million Dollars. [Low Deficiencies/- \$ MM. desired for probable best alternative's 'High'.]⁴⁷
- **Schedule Metrics:** Delivery Speed, from design start date to occupancy date. [Fast Delivery Speed desired for probable best alternative's 'High'.]⁴⁸
- **Project Change Performance Metrics:** Change Order Processing Time. [Low Processing Time of Change Orders desired for probable best alternative's 'High'.]⁴⁹
- **Labour Performance Metrics:** Extra Labour:- Overtime/Overmanning/Second Shift work. [Low Extra Labour desired for probable best alternative's 'High'.]⁵⁰
- **Business Performance Metrics:** Job Overhead & Profit, Potential for Return Business. [Low OH, High Profit, High Potential for Return Businesses desired for probable best alternative's 'High'.]⁵¹

➤ **Step 3: Analysis & Development of Feasible Alternatives - The MADM Analysis**

⁴⁷ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 7.

⁴⁸ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 8.

⁴⁹ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 9.

⁵⁰ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 11.

⁵¹ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 12.

	Design-Bid-Build	Engineer-Procure-Construct	Bridging Design-Build	Construction Management at Risk	Bridging CM @ Risk	Construction Management Agency	IPD-ish/IPD Lite	IPD (highly improbable to use without Lean)	Lean IPD
Integration of Teams	Low	Medium	Medium	Low	Low	Low	Medium	High	High
Process Concurrences	Low	Medium	Medium	Low	Medium	Medium	Medium	Medium	High
Managing Costs	Low	Medium	Medium	Low	Low	Medium	Medium	High	High
Risks' Management Profiling	Low	Medium	Medium	Medium	Medium	Medium	Medium	High	High
Compensation(s)/Reward(s) Basis	Low	Low	Low	Low	Low	Low	Medium	High	High
Communication Performance Metrics	Low	Medium	Medium	Low	Medium	Low	Medium	High	High
Quality Metrics	Low	Low	Low	Low	Low	Low	Low	Medium	High
Schedule Metrics	Low	Low	Medium	Low	Low	Low	Medium	High	High
Project Change Performance	Low	Low	Medium	Low	Medium	Medium	Medium	High	High
Labour Performance Metrics	High	High	Medium	High	High	High	Medium	Low	Medium
Business Performance Metrics	Low	Low	Low	Low	Low	Low	Low	Medium	Medium
Agreements Agenda	Low	Low	Medium	Low	Medium	Low	Medium	Medium	High

Table 2: Multi-Attribute Decision-Making Analysis^{52 53 54 55}

➤ **Step 4: Selection Criteria of Feasible Alternatives**

We now execute a ‘Pair-wise comparison’ to give ordinal rankings to each attribute and thereby classify the most and least important attributes, for consideration while choosing the best feasible alternative:

⁵² Nasfa; Coaa; (2010). Integrated Project Delivery For Public and Private Owners, 33.

⁵² AIA, & AIACC. (2007). Integrated Project Delivery: A Guide. *American Institute of Architects*, 47-50.

⁵² Kim, Y.-W., Rezqallah, K., Lee, H. W., & Angeley, J. (2016). Integrated project delivery in public projects: Limitations and opportunity. *IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction*, 93–102.

⁵² By Author

⁵³ Garvin, M. J., & Mccoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING.

⁵⁴ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 6-12.

⁵⁵ GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (2015), 05.3.3.2.

	Integration of Teams (A)	Process Concurrences (B)	Managing Costs (C)	Risks' Management (D)	Compensations Basis (E)	Communication Performance (F)	Quality Metrics (G)	Schedule (H)	Project Change (I)	Labour (J)	Business Performance (K)	Agreements' Agenda (L)	Ordinal Ranking
Integration of Teams (A)	x	A	A	D	A	F	A	H	A	A	A	A	8
Process Concurrences (B)	x	x	C	D	B	F	B	B	I	B	B	B	7
Managing Costs (C)	x	x	x	C	C	B	G	H	I	J	C	L	4
Risks' Management (D)	x	x	x	x	D	F	D	H	D	D	K	L	6
Compensations/Rewards Basis (E)	x	x	x	x	x	F	E	E	I	E	E	E	5
Communications' Performance (F)	x	x	x	x	x	x	F	H	I	F	F	L	7
Quality Metrics (G)	x	x	x	x	x	x	x	H	G	J	G	G	4
Schedule (H)	x	x	x	x	x	x	x	x	H	J	K	H	5
Project Change (I)	x	x	x	x	x	x	x	x	x	I	K	L	5
Labour (J)	x	x	x	x	x	x	x	x	x	x	K	J	4
Business Performance (K)	x	x	x	x	x	x	x	x	x	x	x	L	4
Agreements' Agenda (L)	x	x	x	x	x	x	x	x	x	x	x	x	5

Table 3: Pair-wise Analysis of Attributes⁵⁶

Now since we have established 12 attributes, for an easy elimination process: to identify the strongest attributes/elements of the best Project Delivery Methods, we presume these top required attributes to be scored at least 5 in this Pair-wise analysis (on a maximum 11 and minimum 0).

FINDINGS

➤ Step 5: Analysis and Comparison of preferred Alternatives

Since we have positioned our initial comparisons well, let us move further to add a value to each attribute's relevance w.r.t. to the alternatives. We can thus obtain a total value for each of them, for better comparison purposes of all alternatives.

⁵⁶ By Author

Quality of Attribute	Score Allotted
High	3
Medium	2
Low	1

Table 4: Scorecard Mechanism⁵⁷

Using the above Scorecard metrics, we modify our MADM table such that it is possible to obtain total scores for all the alternatives. With this infusion, the MADM now changes to:

	Design-Bid-Build	Engineer-Procure-Construct	Bridging Design-Build	Construction Management at Risk	Bridging CM @ Risk	Construction Management Agency	IPD-ish/IPD Lite	IPD (highly improbable to use without Lean)	Lean IPD
Integration of Teams	1	2	2	1	1	1	2	3	3
Process Concurrences	1	2	2	1	2	2	2	2	3
Managing Costs	1	2	2	1	1	2	2	3	3
Risks' Management Profiling	1	2	2	2	2	2	2	3	3
Compensation(s)/Reward(s) Basis	1	1	1	1	1	1	2	3	3
Communication Performance Metrics	1	2	2	1	2	1	2	3	3
Quality Metrics	1	1	1	1	1	1	1	2	3
Schedule Metrics	1	1	2	1	1	1	2	3	3
Project Change Performance	1	1	2	1	2	2	2	3	3
Labour Performance Metrics	3	3	2	3	3	3	2	1	2
Business Performance Metrics	1	1	1	1	1	1	1	2	2
Agreements Agenda	1	1	2	1	2	1	2	2	3
TOTAL SCORE OF ALTERNATIVE	14	19	21	15	19	18	22	30	34

Table 5: MADM Analysis with Scoring⁵⁸

⁵⁷ By author

⁵⁸ By Author

➤ **Step 6: Selection of preferred Alternative**

Using the above modified MADM Table and the Pairwise Attributes' Analysis performed in Step 4, it is possible to identify the most important and least important (only relatively, not unimportant!) attributes, and the alternative with the probability for most outcome delivery. (We will base the selection of our alternatives through the compilation of weightages from the Pairwise attributes and MADM analyses compared.)

Hence, we will now clearly order (in a descending fashion: Most preferred > Least preferred) the feasible alternatives based on the attributes' rankings, and finally a compiled balanced sum:

Attributes' Ranking based on Ordinal Ranks Sum	Attributes	Final/Relative basis sum Ranking of Project Delivery Methods (All Alternatives)
1	Integration of Teams	Lean IPD > IPD > IPD-ish > BDB > Bridging CM @ Risk > EPC > CM Agency > CM @ Risk > DBB
2	Communications' Performance	
3	Processes' Concurrences	
4	Risks' Management	
5	Agreements' Agenda	
6	Compensations/Rewards	
7	Project Schedule	
8	Project Change Performance	
9	Managing Costs	
10	Labour	
11	Business Performance	
12	Quality	

Table 6: Best Alternative Solution⁵⁹

Thus, we can establish that our best-preferred alternative according to our previous analyses is Lean IPD. It sticks to the fact that in future, Lean IPD can grow in prominence as a preferred Project Delivery Method, considering its benefits in Project Excellence and for better Project Management vis-à-vis the other Methods. These much needed attributes for every Project's

⁵⁹ By Author

success, that are well catered to by Lean IPD, must be attractive enough for business owners to look forward to implementing this method.

➤ **Step 7: Performance Evaluation and Post Evaluation**

Some of the biggest challenges to the AEC industry come with its terrible record of project cost overruns, delays, and disputes. We have seen, after thorough studies and analyses, that Lean IPD is the best possible alternative solution to deal with such difficulties effectively. Infact, if its use spreads globally and on more projects, in the near future, it could pave roads to further disruptive innovations that would reorganise the way projects are managed. Considering better integration of existing technologies such as BIM (Building Information Modelling) and TVD to the Lean IPD methodology is one such instance that when found worthwhile, will promulgate its advent.

For example, to measure its worth for all kinds of projects, there is a possibility to carry out evaluations to investigate the point at which IPD becomes financially feasible and thus also conclude about what project sizes best justify its usage, if not all.⁶⁰

Also, BIM, which can deliver very high savings in terms of cost, time, and therefore, increased productivity, hasn't been able to make realise its full potential in the market as yet. So, BIM could be used collaboratively by the project stakeholders, which doesn't exist in the current linear contract delivery methods.⁶¹

Similarly, TVD, which enables each stakeholder to collaborate on initial design aspects, can prove to be a benchmark in studying how better to shift the managerial target costing from the traditional methods to collaborative management practices.^{62 63}

CONCLUSIONS

'A great project starts with culture – not the contract – if the potential of the project is to be maximized.'⁶⁴

An owner's decision to choose a project delivery method largely depends on relationships, and answers to such concerns as reliability of partners, availability of resources, actual process of contracting, industry situation, and even social scenario.⁶⁵

⁶⁰ Suttie, J. B. A. (2013). The impacts and effects of Integrated Project Delivery on participating organisations with a focus on organisational culture. *Iglc-21*, 1(415), 275.

⁶¹ IPD and BIM: A new dimension to collaboration | Mills Oakley. (n.d.).

⁶² Jung, W., Ballard, G., Kim, Y., Han, S. Understanding of Target Value Design for Integrated Project Delivery with the Context of Game Theory (n.d.)

⁶³ Target Value Design (TVD) – P2SL Project Production Systems Laboratory. (n.d.).

⁶⁴ Kotubey, M. (n.d.). Lean IPD: Start with the Culture, not the Contract.

⁶⁵ Idaho Transportation Department. (2010). Project Delivery Methods, (September).

The influence of Lean IPD as an apt decision as a strategy for better Project Management comes from the following conclusions, explained in context to our Objectives stated earlier:⁶⁶

1. Presently, the industry's slow response to this innovative method comes from the following 'philosophical' or 'mindset' problems and more 'practical' concerns, arising primarily from the lack of information or many quantitative studies on Lean IPD:
 - A lack of understanding about IPD and Lean IPD: The unwillingness to understand the IPD shared risks/rewards models, difficulty finding Lean IPD experts, and a resistance (from within the project team and the AEC community) to change and to training/learn and adapt.
 - The high-level Trust required for collaboration (Trust based Collaboration - A new, disruptive, rather unconventional setting): The exposure to a higher risk considering the higher exposure/transparency is a problem of integrity.
 - Lack of a solid contingency packaging structure to support risks/rewards sharing, and dispute-free characteristics: All projects possess some amount of contingency to cover unpredictable events. Unfortunately, there is significant confusion regarding contingencies when negotiating IPD agreements.
 - Lack of suitable insurance products for specialised IPD projects: Conventional Insurance products and packages are not very appropriate for the risk sharing models propagated by the Lean IPD approach, which requires customized insurance suitable for its business model.
2. With a Lean IPD approach, stakeholders contribute their expertise right from the initiation stage through the final turnover to the owner.⁶⁷ By accepting more responsibility, participants would infuse constructability-thinking into the final outcome and this could help eliminate changes, which means, improvements in the schedule and construction efficiency. The Lean tools yield metrics on better accountability to strengthen the measures of tangible progress tracking, while the IPD method sets the stage for high motivation through intensive collaboration which results in a positive culture.
3. A culture of learning and adaptability, significant integration amongst all participants (better Team Management and Communication Management), a leadership with focus on innovation and a stronger project team focussed on optimisation to cater to change

⁶⁶ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 35-37.

⁶⁷ Kotubey, M. (n.d.). Lean IPD: Start with the Culture, not the Contract.

can thus be created (better Stakeholder Management)⁶⁸. Across all three measures of time, cost and quality, a higher Return in Investment is possible, while also definitively reducing the probability of Disputes due to better negotiations and performance from the beginning (better Change Management and Risk Management). (As illustrated through Figures 1, 2, 3 also.) All this would mean a 'better' or 'stronger' Project Management considering all the principles of more ethical business working also.

We can thus conclude that Lean IPD as a business strategy for projects would anchor the shared goal mindset of project excellence and success to an all-inclusive 'project first' and 'team first' attitude.

BIBLIOGRAPHY

- Banaszak, J., Palter, R., Parsons, M. (2017). Stopping the insanity: Three ways to improve contractor-owner relationships on capital projects. *Voices on Infrastructure: McKinsey & Company*. (p. 8-12).
- Raisbeck, P., Millie, R., Maher, A. (2010). Assessing integrated project delivery: A comparative analysis of IPD and alliance contracting procurement routes. *Association of Researchers in Construction Management*, 1019-1028.
- AIA, & AIACC. (2007). *Integrated Project Delivery: A Guide*. American Institute of Architects, 1–62. <https://doi.org/10.1016/j.autcon.2010.09.002>
- Cohen, W. J. (2010). *Integrated Project Delivery: Case Studies*. The American Institute of Architects, California Council.
- McCurley, T., Powell, S. (2014). Power of IPD: Is integrated project delivery truly a transformative delivery model? *Building Design + Construction*.
- Koskela, L. (1992). *Application of the New Production Philosophy to the Construction Industry*. Center for Integrated Facilities Engineering, Dept. of Civil Engineering, Stanford University, CA, Technical Report No. 72.
- Yeung, J. F. Y., Chan, A., Chan, D. W. M. (2007). The definition of alliancing in construction as a Wittgenstein family-resemblance concept. *International Journal of Project Management*, 25 (2007), 219-231.
- Lichtig, W. A. (2005). Sutter Health: Developing a Contracting Model to Support Lean Project Delivery. *Lean Construction Journal*, 2(1), 105-112.
- Matthews, O., Howell, G. A. (2005). An Integrated Project Delivery: An Example of Relational Contracting. *Lean Construction Journal*, 2(1).
- Ashcraft, H. W. (n.d.). *Integrated Project Delivery: The Owner's Perspective*. Retrieved from <https://www.bi.no/globalassets/forskning/senter-for-byggenaringen/lc-arrangement/integrated-project-delivery---the-owners-perspective.pdf?fbclid=IwAR23I7IS3->

⁶⁸ Ortiz, V. (n.d.). Resistance to Lean & Integrated Project Delivery Part I: Three Root Causes.

[rjD1hCdGHWboCA3VjFqZRwhP9SeYAjCrzzy9SIWQ4ti2tpk4M](https://www.smartsheet.com/integrated-project-delivery?fbclid=IwAR08kRhIInvJ6II9_jV1p0eKa2wWYBPiyXnAgELTR080R9wQTyo1p7wCrnk)

Create a Lean, Construction Building Machine with Integrated Project Management. (2018, May 8).

Retrieved from https://www.smartsheet.com/integrated-project-delivery?fbclid=IwAR08kRhIInvJ6II9_jV1p0eKa2wWYBPiyXnAgELTR080R9wQTyo1p7wCrnk

Efficient Project Delivery: BIM, IPD, JOC, Cloud Computing and More. (n.d.). Retrieved from

<https://www.omicsonline.org/open-access/efficient-project-delivery-bim-ipd-joc-cloud-computing-and-more-2168-9717.1000107.php?aid=15639>

Cheng, R. (n.d.). IPD + Lean, A Marriage Made in Heaven. Retrieved from

<https://leanconstructionblog.com/IPD-Lean-a-marriage-made-in-heaven.html>

Cheng, R., & Johnson, A. J. (2016). Motivation and Means: How and Why IPD and Lean Lead to Success.

Spring Owners Leadership Conference, May 17-19, 2017, (November), 1–255. Retrieved from http://arch.design.umn.edu/directory/chengr/documents/motivation_means2016.pdf

Seed, W. et al, 2016. Transforming Design and Construction, Lean Construction Institute, Arlington VA

Womack, J., Jones, D., 1996. Lean Thinking, Simon & Schuster, New York

Lareau, W., 2000. Lean Leadership, Midland Press, Davenport, IA

Kotubey, M. (n.d.). Lean IPD: Start with the Culture, not the Contract. Retrieved from

<https://leanconstructionblog.com/lean-ipd-start-with-the-culture-not-the-contract.html>

Ortiz, V. (n.d.). Resistance to Lean & Integrated Project Delivery Part I: Three Root Causes. Retrieved

from <https://leanconstructionblog.com/Resistance-to-Lean&Integrated-Project-Delivery-Part-I-Three-Root-Causes.html>

Integrated Project Delivery (IPD) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.). Retrieved from

<http://www.planningplanet.com/wiki/505560/integrated-project-delivery-ipd>

Integrated project delivery saves time, cuts costs, shares rewards - BuiltWorlds. (2017, May 5).

Retrieved from <https://builtworlds.com/news/integrated-project-delivery-save-time-cut-costs-and-share-savings/>

GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.), 12.6.3.2.. Retrieved

from <http://www.planningplanet.com/guild/gpccar/settlement-negotiations-phase>

Idaho Transportation Department. (2010). Project Delivery Methods, (September). Retrieved from

[http://www.brookwoodgroup.com/downloads/7projdelivery_2010\(web\).pdf](http://www.brookwoodgroup.com/downloads/7projdelivery_2010(web).pdf)

GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (n.d.), 10.3.3.2. Retrieved

from <http://www.planningplanet.com/guild/gpccar/managing-change-the-owners-perspective>

Pease, J. (n.d.). What is Integrated Project Delivery Part 2: Lean Operating System. Retrieved from

<https://leanconstructionblog.com/What-is-Integrated-Project-Delivery-Part-2.html>

Fish, A. (2011). IPD - The obstacles of Implementation. Retrieved from <https://krex.k-state.edu/dspace/bitstream/handle/2097/8554/AmandaFish2011.pdf;sequence=1>

Lean, I. (2017). Lean Construction & Integrated Project Delivery (IPD) Overview. Retrieved from <https://www.nwccc.org/wp-content/uploads/2017/09/CH2M-Lean-Sept-2017.pdf>

El Asmar, M., & Hanna, A. S. (2012). Comparative Analysis of Integrated Project Delivery (IPD) Cost and Quality Performance. Proceedings of the CIB W78 2012: 29th International Conference –Beirut, Lebanon, 17-19 October, 152–161. Retrieved from <http://itc.scix.net/data/works/att/w78-2012-Paper-20.pdf>

Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING. Retrieved from https://vtechworks.lib.vt.edu/bitstream/handle/10919/77143/etd-07212012-003437_Pishdad-Bozorgi_P_D_2012.pdf?sequence=1&isAllowed=y

The growing case for lean construction. (2017, May 5). Retrieved from <https://www.tandfonline.com/doi/abs/10.1080/20450249.2011.11873820>

Adapting Contracts to the IPD Model. (2018, February 8). Retrieved from <https://www.constructionbusinessowner.com/law/law/adapting-contracts-ipd-model>

Nasfa; Coaa; (2010). Integrated Project Delivery For Public and Private Owners, 40. <https://doi.org/10.1063/1.1678819>

Beyond Design-Bid-Build: Issues to Consider in Alternative Project Delivery Systems. (n.d.). Retrieved from <http://constructionexec.com/article/beyond-design-bid-build-issues-to-consider-in-alternative-project-delivery-systems>

Cheng, R., Allison, M., & Dossick, C. S. (2015). IPD: Performance, Expectations, and Future Use A Report On Outcomes of a University of Minnesota Survey, 1–18. Retrieved from <http://www.ipda.ca/site/assets/files/1144/20150925-ipda-ipd-survey-report.pdf>

Is Integrated Project Delivery Right for You? (2018, January 27). Retrieved from <https://www.buildsteel.org/technical/bim/shared-risks-increased-profits-is-integrated-project-delivery-right-for-you/>

Kim, Y.-W., Rezaqallah, K., Lee, H. W., & Angeley, J. (2016). Integrated project delivery in public projects: Limitations and opportunity. IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction, 93–102. <https://doi.org/10.1007/s00421-009-1172-9>

Rybkowski, Z. (2014). TVD 18-Value Analysis. Retrieved from https://aahfoundation.org/wp-content/uploads/2016/02/2013_Report_NandaPati.pdf

Integrating ISO 21500 Guidance on Project Management, Lean Construction and PMBOK. (n.d.). Retrieved from https://ac.els-cdn.com/S1877705815031616/1-s2.0-S1877705815031616-main.pdf?_tid=e9d3a27f-e903-4ee9-ba7f-091524e75128&acdnat=1541636951_94552648470dc55797fee41bf2bbb448

Dale Munhall, B. (2014). If We Keep On Doing What We’ve Always Done..., (January), 1–2. Retrieved from http://www.aecbytes.com/viewpoint/2013/issue_67.html

El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. Journal of Construction Engineering

and Management, 139(11), 04013012. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0000744](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000744)

Integrated Project Delivery – Managing risk | KPMG | US. (2013). Retrieved from <http://www.kpmg.com/us/en/issuesandinsights/articlespublications/pages/integrated-project-delivery.aspx>

Jung, W., Ballard, G., Kim, Y., Han, S. Understanding of Target Value Design for Integrated Project Delivery with the Context of Game Theory (n.d.) Retrieved from <https://ascelibrary.org/doi/10.1061/9780784412329.056>

Target Value Design (TVD) – P2SL Project Production Systems Laboratory. (n.d.). Retrieved from <http://p2sl.berkeley.edu/research/initiatives/target-value-design/>

Suttie, J. B. A. (2013). The impacts and effects of Integrated Project Delivery on participating organisations with a focus on organisational culture. *Iglc-21*, 1(415), 267–276. Retrieved from <https://iglcstorage.blob.core.windows.net/papers/attachment-913f380b-f599-4df2-aeec-8b1699941103.pdf>

IPD and BIM: A new dimension to collaboration | Mills Oakley. (n.d.). Retrieved from <https://www.millsoakley.com.au/ipd-and-bim-a-new-dimension-to-collaboration/>

IPD vs. Design Build | Integrated Project Delivery. (n.d.). Retrieved from <http://ipdfl.net/processes/ipd-vs-design-build/>

IPD-Case-Study-Matrix-2012-corrected02-pdf @ www.scribd.com. (n.d.). Retrieved from <https://www.scribd.com/document/264213621/IPD-Case-Study-Matrix-2012-corrected02-pdf>

APPENDIX

Essential Features of Lean Project Delivery System according to Ballard (2000)	Integrated Project Delivery Agreement
A value generating process	IPD goal
Downstream stakeholders are involved in front end planning and design through cross functional teams	Early involvement of project participants Jointly developed project criteria Intensified early planning
Project control has the job of execution as opposed to reliance on after-the-fact variance detection	Joint control Target value design replacing value engineering associated with traditional delivery approach
Optimization efforts are focused on making work flow reliable as opposed to improving productivity	Shared risks and rewards Individual's success tied to project success
Pull techniques / Feedback loops	Depends on the core team action plan
Lean principles according to AGC (2009) & Pinch (2005)	Equivalent behavioral and contractual principles often enforced in IPD agreements:
True collaboration among all participants Establishing integrated team	IPD principle on collaboration Single multi-party contract or joining agreement
Strengthening and Aligning the relationships and interests of the parties to the project	Key participant bond together as equal Shared risks and rewards Individual's success tied to project success
Project participants making commitments to work and schedule that can be relied upon by others, and that drive out waste in the form of RFIs, changes and rework	Reliability, honoring promises, and trust
Focusing on what is best for the project as a whole and not just certain component parts	Acting in the best interest of the project Tying individual success to the project success Shared risk and rewards
Decentralizing decision making, empowering participants	Collaborative decision making, joint control
Making the process transparent	Open communication, shared information, Transparent process
A clear quick to request action and receive a response	Open communication

Table A: Comparative Analysis of Lean & IPD Principles⁶⁹

⁶⁹ Garvin, M. J., & McCoy, A. (2012). CASE-BASED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING Doctor of Philosophy in Environmental Design and Planning CASE-BAED STUDY AND ANALYSIS OF INTEGRATED PROJECT DELIVERY (IPD) APPROACH AND TRUST-BUILDING, 48.

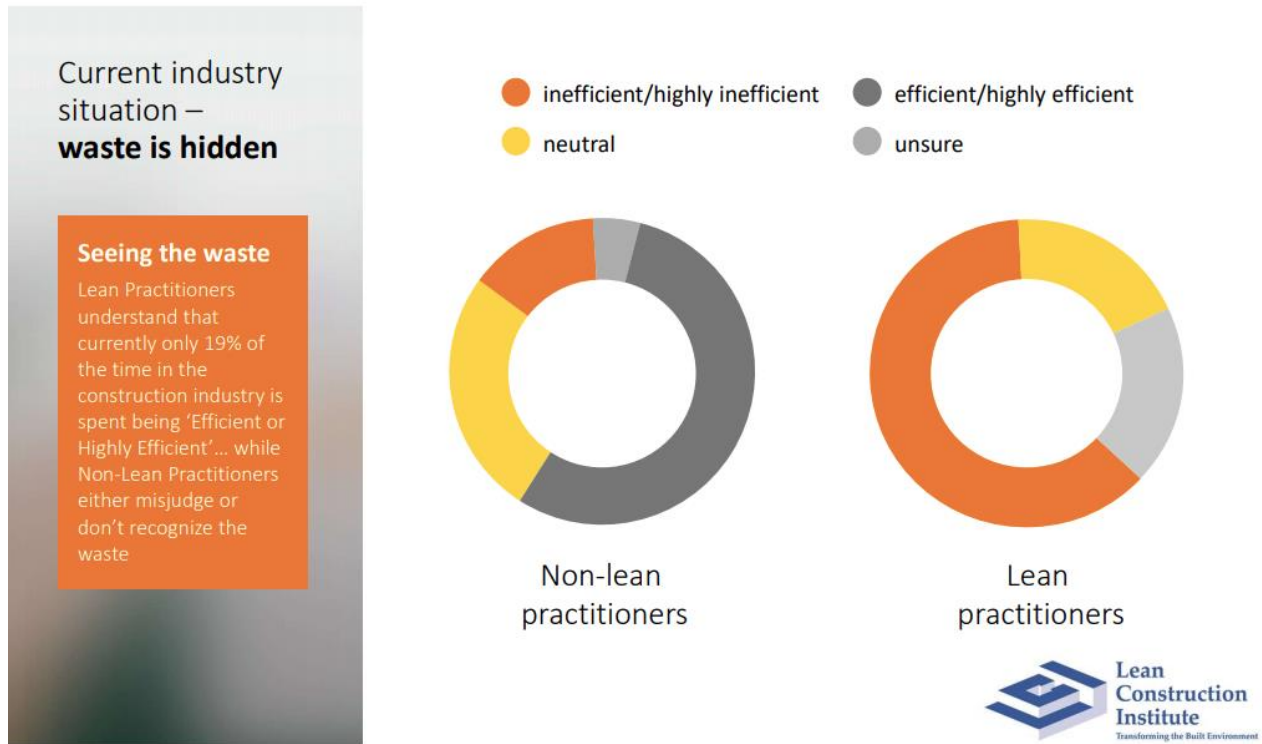


Figure A: Current Industry Situation: 81% Time unutilised for Waste Identification and Elimination⁷⁰

⁷⁰ Lean, I. (2017). Lean Construction & Integrated Project Delivery (IPD) Overview, 33.

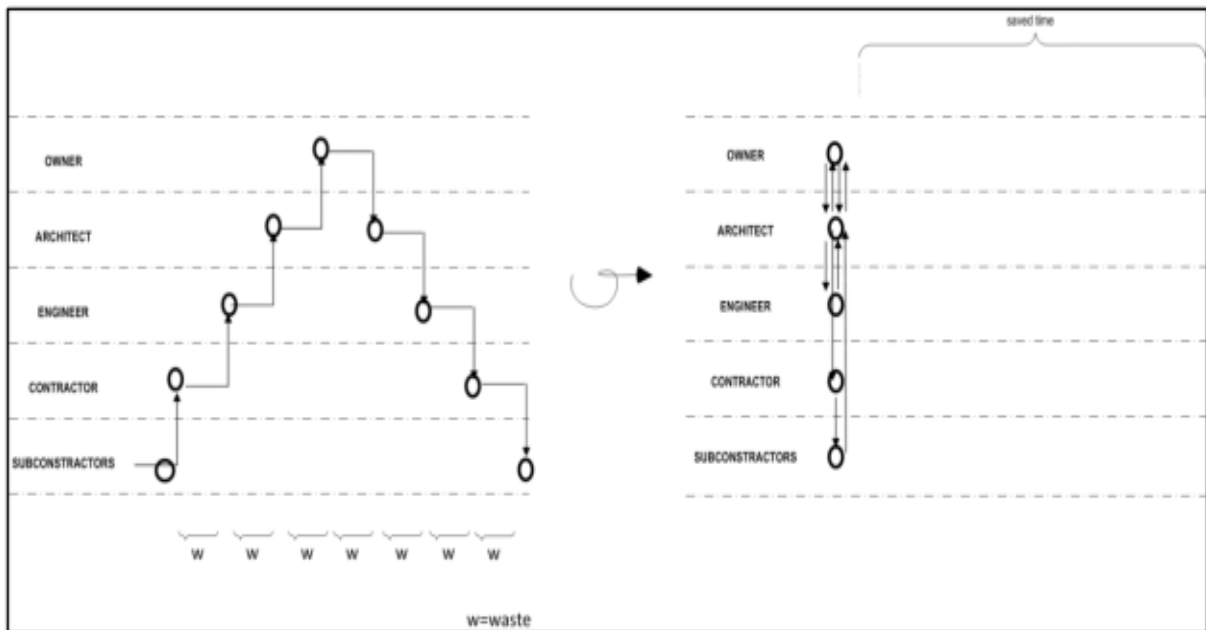


Figure 14. Swimlane diagrams compare the legally restricted communication process of traditional Design-Bid-Build projects (left) versus a typical Lean Project Delivery big room meeting (right). The horizontal axis represents time.
Adapted from Rybkowski (2012).

Figure B: Communication processes of Traditional vs. IPD Approaches⁷¹

⁷¹ Rybkowski, Z. (2014). TVD 18-Value Analysis, 29.

What's the problem with traditional approach?

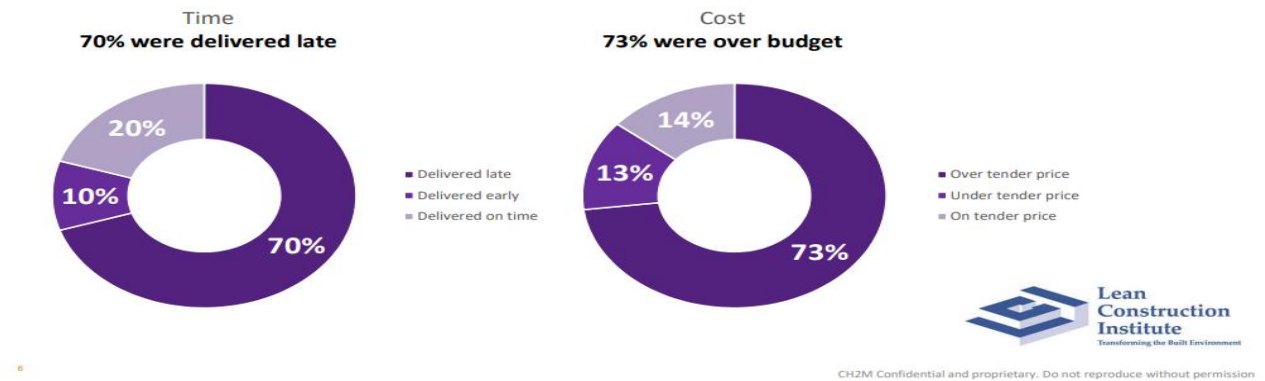


Figure C: Illustrating Schedule & Cost Issues with Traditional Methods⁷²

Why use Lean/IPD Approach ?

Correlation of lean intensity to outcomes (% likelihood on best projects)

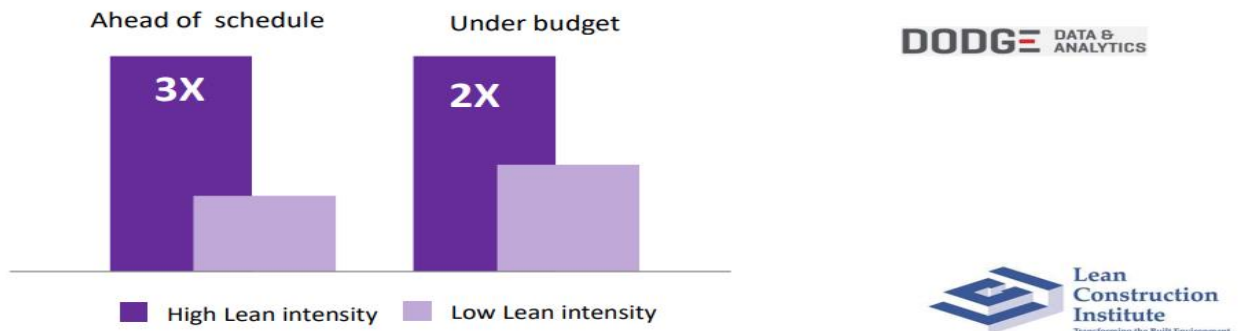


Figure D: Illustrating Schedule & Cost Benefits of Scenario using IPD⁷³

⁷² Lean, I. (2017). Lean Construction & Integrated Project Delivery (IPD) Overview, 6.

⁷³ Lean, I. (2017). Lean Construction & Integrated Project Delivery (IPD) Overview, 7.

Table 2 : Comparison of Traditional to Integrated Delivery Methods

Comparison Item	Project Delivery Methods			
	DBB	DB	CM at Risk	IPD
Contractual Relationships	<ul style="list-style-type: none"> > Owner & Designer > Owner & Constructor 	<ul style="list-style-type: none"> > Owner & Design-Build Entity > Design-Build Entity & Designer > Design-Build Entity & Constructor 	<ul style="list-style-type: none"> > Owner & Designer > Owner & Construction Manager 	<ul style="list-style-type: none"> > Owner & Designer > Owner & Constructor > Designer & Constructor
Advantages	<ul style="list-style-type: none"> > Owner gets to choose most competitive bid 	<ul style="list-style-type: none"> > Transfer risk from owner to DB entity > More parties involved earlier in project 	<ul style="list-style-type: none"> > More parties involved earlier in project 	<ul style="list-style-type: none"> > Collaborative & innovative design > Better buildings, faster, for less
Disadvantages	<ul style="list-style-type: none"> > No early collaboration > Could result in project delays, change orders, etc. 	<ul style="list-style-type: none"> > Early Cost Commitment > No competitive bid for owner 	<ul style="list-style-type: none"> > Early Cost Commitment > No competitive bid for owner 	<ul style="list-style-type: none"> > Early Cost Commitment > No competitive bid for owner > Obstacles that need to be resolved

Table B: Qualitative Analysis of IPD with Traditional Methods⁷⁴

⁷⁴ Fish, A. (2011). IPD - The obstacles of Implementation, 16.

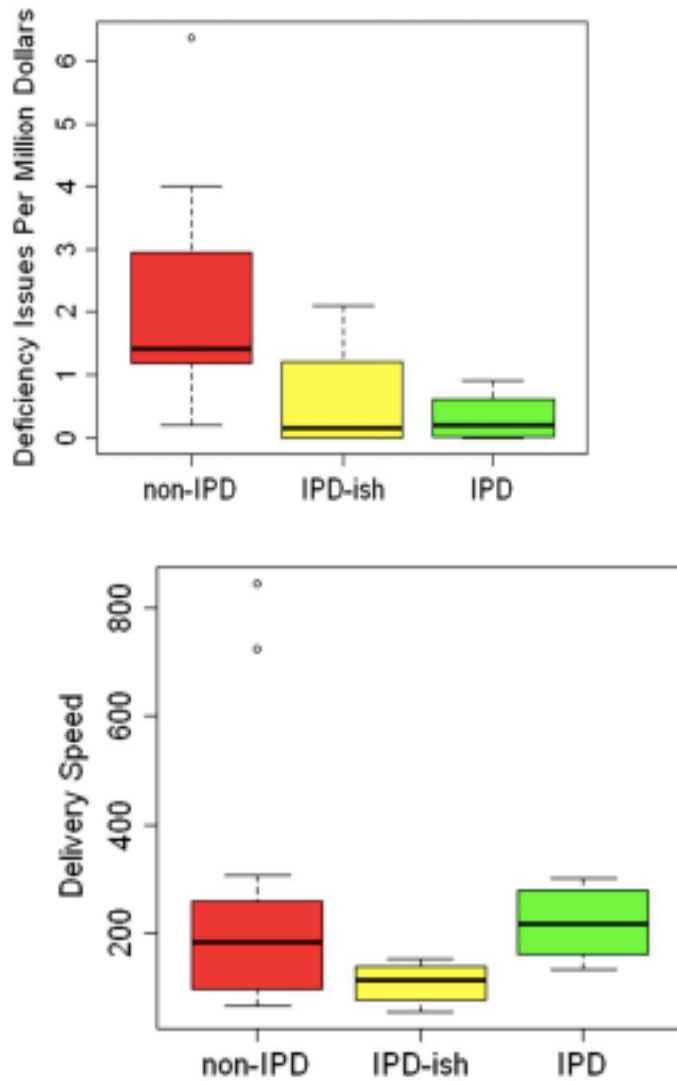
	Owner Assumes Most Risks	Owner and Contractor Share Risks						Contractor Assumes Most Risks		
Contract TYPES	CPCC	CPFF	CPAF	CPIF	CS	CR	FPIF	FFUP	FP/EPA	FFP
Project Delivery METHODS										
Design>Bid>Build (Traditional Firm Fixed Price)	1						✓	✓	✓	✓
Design>Build (Also known as Engineer, Procure, Construct (EPC))	2	✓	✓	✓			✓	✓	✓	✓
Bridging Design>Build	3	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction Management @ Risk (CM)	4						✓	✓	✓	✓
Bridging CM @ Risk	5						✓	✓	✓	✓
Construction Management Agency	6	✓	✓	✓	✓	✓	✓	✓	✓	✓
Integrated Project Delivery (IPD)	7	✓	✓	✓	✓	✓				

Table C: Project Delivery Methods and Risk Profiling – Associated Contracts generally used

(IPD using Cost Plus Incentive Fee, Cost Sharing, Cost Reimbursable, and Fixed Cost with Guaranteed Maximum or Guaranteed Not to Exceed Contracts.)⁷⁵

⁷⁵ Giammalvo, D. P., GUILD OF PROJECT CONTROLS COMPENDIUM and REFERENCE (CaR) | Project Controls - planning, scheduling, cost management and forensic analysis (Planning Planet). (2015), 05.3.3.2.

Figures E TO J: Boxplot Metrics of Attributes to compare Projects with Traditional ones compiled, IPD-ish and IPD.⁷⁶

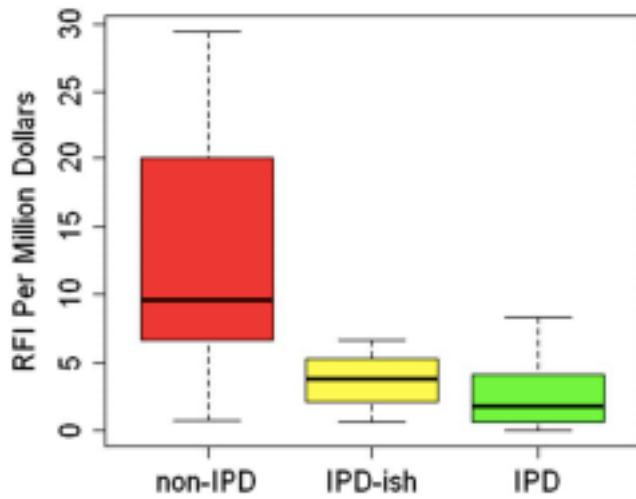
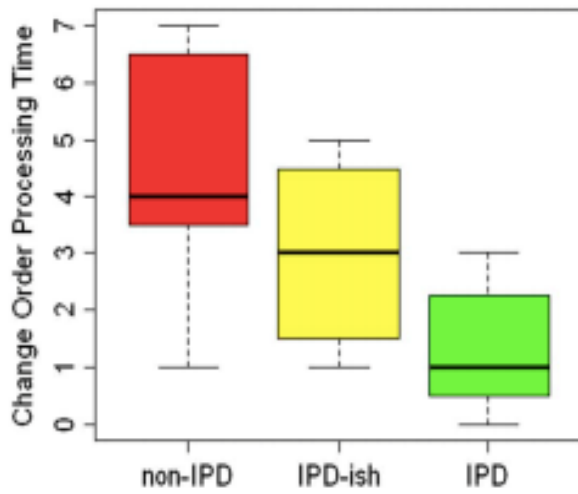


E: Quality

F:

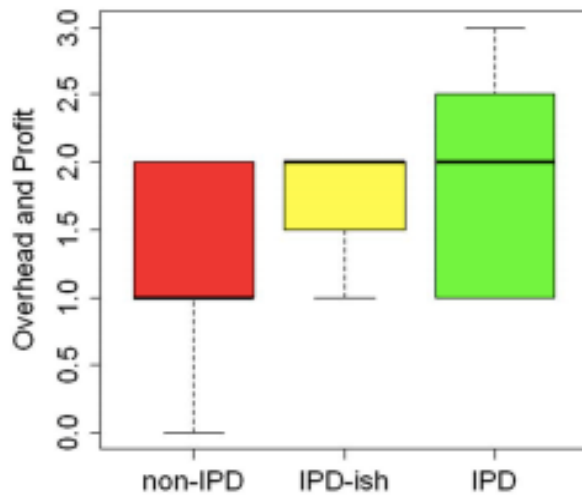
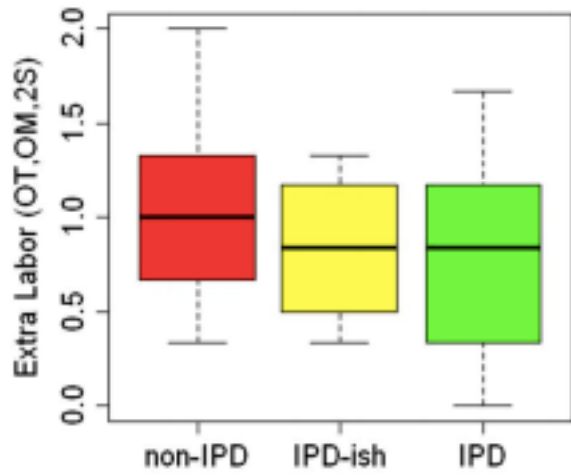
Schedule

⁷⁶ El Asmar, M., Hanna, A. S., & Loh, W.-Y. (2013). Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems. *Journal of Construction Engineering and Management*, 139(11), 04013012, 7-12.



G: Project Change Performance
Performance

H: Communication



I: Labour

J: Business

Performance

	Level One "Typical" Collaboration	Level Two "Enhanced" Collaboration	Level Three "Required" Collaboration
Level of Collaboration	lower	←————→	higher
Philosophy or delivery method?	IPD as a Philosophy	IPD as a Philosophy	IPD as a Delivery Method
Also known as...	N/A	IPD-ish; IPD Lite; Non Multi-party IPD; Technology Enhanced Collaboration; Hybrid IPD; Integrated Practice	Multi-Party Contracting; "Pure" IPD; Relational Contracting; Alliancing; Lean Project Delivery System™
Delivery Approaches	CM at-Risk or Design-Build	CM at-Risk or Design-Build	Integrated Project Delivery
Typical Selection Process	Qualifications Based Selection of all team members or Best Value Proposal	Qualifications Based Selection of all team members	Qualifications Based Selection of all team members
Nature of Agreement	Transactional	Transactional	Relational
Key Characteristics	<ul style="list-style-type: none"> • No contract language requiring collaboration • Limited team risk sharing • CM or DB share in savings 	<ul style="list-style-type: none"> • Contract language requiring collaboration • Some team risk sharing • Co-location of team 	<ul style="list-style-type: none"> • Owner-Designer-Contractor (and possibly other key team members- IPD Subs) all sign one contract that contracts collaboration • Team risk-sharing-incl. A/E • Team decision-making • Optimizing the Whole • Pain / Gain sharing • Limits on litigation • Co-location of the team
Typical Basis of Reimbursement	GMP	GMP	GMP or No GMP (some costs guaranteed)

Table D: Qualitative Rationalising of Collaboration Levels across extent of IPD usage.⁷⁷

⁷⁷ Nasfa; Coaa; (2010). Integrated Project Delivery For Public and Private Owners, 33.

About the Author



Saimon Satyanathan

Paris, France



Saimon Satyanathan is a multilingual project management and business development professional specialising in the engineering domains and related consulting sector. He holds a B.Tech. in Aerospace Engineering and is currently completing his M.Sc. in Project and Programme Management & Business Development, from SKEMA Business School, Paris. Saimon is also certified in several credentials including PRINCE2, AgilePM, Six Sigma-Green Belt, and Environmental Management Systems.

Born and raised in Mumbai, he has lived in several other cities in India including Delhi and Bangalore, and is currently residing in Paris, France to pursue his M.Sc. Saimon also possesses a wide array of professional experience of approximately 5.5 years in total, at some prestigious mechanical/industrial engineering and aerospace engineering related firms in India initially, in the capacities of Intern, Project Engineer and Assistant Manager (Projects). His last experience in France was a 2 months' Internship in Strategy & Business Development at Nexans S.A., France's biggest cable conductors manufacturing and energy company, where he conducted extensive market research (Asian markets) and developed an entry and growth/expansion strategy for the firm.

Saimon can be contacted at saimons@protonmail.com or <https://www.linkedin.com/in/saimonsatyan/>