How and Why does Integrated Lean succeed?

Andrea J. Johnson, AIA LEED, University of Minnesota
The construction industry lost productivity from 1964-2003...

...while all other non-farm industries more than doubled
Did You Know?

In a traditional process, the majority of design activities...

...occur when they are too late to optimize cost savings
**INTEGRATED PROJECT DELIVERY (IPD)**

The contractual project delivery method that creates shared risk/reward structures, fiscal transparency, and release of liability.

**LEAN**

Tools and processes intended to maximize value by reducing wasted time, wasted movement, and wasted human potential.

**INTEGRATED PROJECT DELIVERY + LEAN**

For many owners and teams, the choice to use Lean tools and processes is seen as an integral decision in choosing to pursue IPD. Lean and IPD are complementary.
Research Included...

- 10 Case Studies
- 151 Survey responses
- 86 Interviews
- 2 Cases from two countries (US and Canada)
- 10 Researchers
- 23 Citations in literature review
- 200+ Documents Reviewed
- 16 Months
INNOVATIVE PROJECT DELIVERY...

+ Shared risk/reward
+ Early involvement of all parties

Other project delivery modes (Esmaelli et al. 2013, Korkmaz et al 2010, Chan et al. 2001)

+ Project stakeholders’ level of experience

Molenaar et al. 2015, Esmaelli et al. 2013; AIA 2012;
Kent and Becerik-Gerber 2010; Korkmaz et al. 2010, Chan et al. 2001

+ Team tools and processes (ex. BIM, Lean)

Cheng 2015; Molenaar et al. 2015; Esmaelli et al. 2013; AIA 2012;
Cho and Ballard 2011; Kent and Becerik-Gerber 2010; Cohen 2010

...HELP PRODUCE BETTER TEAM AND PROJECT OUTCOMES
Assumptions

1) Integrated delivery is superior to other more conventional delivery types

2) Lean tools and processes increase the likelihood of success
Research Question

How and Why does Integrated Lean succeed?
**Research Methodology**

**NUMBER OF INTERVIEWS OF PROJECT PARTICIPANTS BY ROLE**

* for this project, owner category includes owner and owner consultants

^ for this project, the builders category includes general contractors and trade partners

<table>
<thead>
<tr>
<th>Project</th>
<th>Architects</th>
<th>Engineers, Consultants</th>
<th>Builders</th>
<th>Owner, Owner Consultants</th>
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**NUMBER OF SURVEY RESPONSES**

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^ for all projects, the builders category includes general contractors and trade partners

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<td>31</td>
<td>65</td>
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</table>
All teams provided documentation in each of these categories, though the specific artifacts varied:

**Commercial and legal**  
- Request for proposal (RFP)  
- Request for qualifications (RFQ) and criteria for selection  
- IPD agreement and contract exhibits, such as risk/reward distribution, milestone payouts  
- Budget and other financial documents

**Decision-making**  
- Protocols for decisions  
- Sample documents related to major decisions by the core team  
- Sample communication of decisions to the larger team  
- Documentation of goals  
- Protocols for meetings  
- Meeting schedules and agendas  
- Sample meeting minutes

**Lean, other tools and metrics**  
- Samples of A3s and, pull plans  
- Samples of customized tools, screen shots  
- Protocols on how tools were used, including dashboards  
- Metrics, including key-performance indicators and other metrics tracked  
- RFI logs  
- Risk registries

**BIM**  
- Execution plan  
- Sample snap shots of models

**Workspace environment**  
- Plans and photographs of shared workspaces

**Project personnel**  
- Project directories  
- Personnel lists  
- Organizational charts
Research Team

RESEARCH SPONSORS

Integrated Project Delivery Alliance (IPDA)

www.ipda.ca

IPDA explores and supports emergent practices demonstrating enhanced industry outcomes and provides a forum for the exchange of knowledge.

Lean Construction Institute (LCI)

www.leanconstruction.org

LCI operates as a catalyst to transform the industry through Lean project delivery using an operating system centered on a common language, fundamental principles, and basic practices.

RESEARCH TEAM

University of Minnesota, University of Washington, University of British Columbia, Scan Consulting

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Siddharth Chhabra, University of Washington

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Michael B. Lapicola, Partner, Faegre Baker Daniels
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Craig Webber, Principal, Group2 Architecture Interior Design

COPY EDITOR

Linda Lee

GRAPHIC DESIGN

mgmt. design

GRAPHIC LAYOUT

Dustin Hartford
Approximately half of the team members were new to IPD, and half had some or extensive IPD experience. A majority had some experience in Lean, with the remaining having either no previous experience or substantial experience. Some of the national team members had worked together on prior projects, as well as the local team members with each other, but overall, the national and local teams did not have prior relationships with each other.

**Project Description**

**PROJECT**
Akron Children’s Hospital, Kay Jewelers Pavilion

**LOCATION**
Akron, OH

**BUILDING TYPE**
Healthcare

**PROJECT TYPE**
New Addition

**CONTRACT**
Custom

**OWNER**
Akron Children’s Hospital

**ARCHITECT**
HKS & Hasenstab

**CONTRACTOR**
Boldt & Welty

**PROJECT START**
November 2013

**COMPLETION**
May 2015

**Building Size**
365,000 sq. ft.

**Budget**
$175,047,595

**Schedule**
24 months design 22 months construction
How and Why:

**IPD** creates **need** to collaborate

**Lean** provides the **means**

+ All projects in the study* were highly successful
  regardless of project type, scope, geographic location, previous experience with IPD or Lean

+ IPD establishes the terms for collaboration
  financial incentives, baseline costs plus overhead, metrics of success

+ Lean tools and processes facilitate collaboration
  creates alignment around cost, schedule and other goals

*projects self-selected to respond to our request for participation and may not be representative of all IPD projects. However teams were candid about the challenges they faced and their lessons learned
5 Myths...

**BUSTED**

- Delivery matters less than choosing the right people – behaviors can’t be dictated by a contract

- IPD contracts are too complicated, Lean tools are too rigid

- IPD only works on large complex healthcare projects – Teams new to IPD and Lean are at a disadvantage

- Owners aren’t getting best value – or – Owners are getting value but the team is not making profit

- IPD and IPD-lite are essentially the same; financial incentives and release of liability are no big deal
Myth #5...

BUSTED

• Delivery matters less than choosing the right people – behaviors can’t be dictated by a contract

“A team” behaviors can be fostered through:

+ attending to the risk/reward proportions within the teams
+ on-boarding processes
+ coaching, mentoring
+ culture of accountability
+ clear off-boarding processes
Onboarding Example

Team selection of the “right people” was seen as a critical element of success.

Owners’ processes included relying heavily on previous relationships, request for proposals, structured proposal evaluations, developing new processes, Lean processes (CBA), and consideration for the local building community.
Myth #4...

**BUSTED**

- *IPD contracts are too complicated, Lean tools are too rigid*

+ In the projects studied, teams used a wide variety of Lean tools and processes to varying degrees of “purity”

+ Most projects used customized IPD contracts but some templates are beginning to emerge

+ Investing time to understand the contract and design the project-specific Lean approach is part of an effective on-boarding process
## Degree of Lean and Other Tools & Processes

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- ● Done well, used often, helpful to the team
- ○ Done but only somewhat helpful or mixed comments about effectiveness
- ● Did it but not seen as particularly effective by most of the team
- ○ Did not have it
“The sessions were very effective because, more important than hammering out the terms of the deal, it got everybody on the same page.”
Variation in Execution of Signatory Agreement

- **Akron**: Two years, three years, four years
- **Autodesk**: One year, two years, three years
- **Mosaic**: Official start, one year, two years
- **Quail Run**: Official start, one year, two years
- **Rocky Mountain**: Official start, one year
- **St. Anthony**: Official start, one year
- **Sutter Los Gatos**: Official start, one year, two years, three years
- **Sutter Sunnyvale**: Official start, one year
- **T. Rowe Price**: Official start, one year
- **Wekiva Springs**: Official start, one year, two years

**Legend**:
- **Project Startup**
- **Design**
- **Construction**
- **Move-In**
- **Signatory Agreement Executed**
Myth #3...

**BUSTED**

- *IPD only works on large complex healthcare projects – Teams new to IPD and Lean are at a disadvantage*

  + There is no evidence that IPD is any less effective on small straightforward projects compared to large complex projects

  + Perception that there is a “right size” project for IPD has so far not been substantiated

  + Teams new to IPD and/or Lean experience had equally positive outcomes compared to teams with a mix of experience and teams with predominately experienced participants
## Tools/Processes Proficiency Unrelated to Experience

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- ● Done well, used often, helpful to the team
- ● Done but only somewhat helpful or mixed comments about effectiveness
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- ○ Did not have it

50%+ of team experienced in IPD/Lean

0% of team experienced in IPD/Lean
Myth #2...

- Owners aren’t getting best value – or – Owners are getting value but the team is not making profit

+ In all cases, target costs and schedules were aggressive

+ In most cases, validation studies confirmed those goals were feasible

+ 100% of the owners believed the projects met or exceeded expectations for budget and schedule, even though not all projects met the initially established targets

+ Many owners were able to “value-add” or “add-back” scope that had been considered out of reach during validation
Consistent Value for Owner

<table>
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<tr>
<th>Project</th>
<th>Target Cost</th>
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<td>Mosaic</td>
<td>4 months savings on 16 month schedule</td>
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<td>Quail Run</td>
<td>1 month late on 8 month schedule</td>
</tr>
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<td>Rocky Mountain**</td>
<td>0 months savings on 12.5 month schedule</td>
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<td>St. Anthony*</td>
<td>2 months savings on 18 month schedule</td>
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<td>0 months savings on 8 month schedule</td>
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<tr>
<td>Wekiva Springs</td>
<td>0 months savings on 6 month schedule</td>
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* Significant project savings were used to increase project scope
** Target comparison to final cost not available

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* Akron
  * Significant project savings were used to increase project scope

** Rocky Mountain
  ** Target comparison to final cost not available

---

Final project cost

One month construction schedule
One month schedule savings
Over schedule by one month
Myth #2...

**BUSTED**

- *Owners aren’t getting best value – or – Owners are getting value but the team is not making profit*

  + Profit on the project teams varied: ranging from double market rates to slightly below

  + Significant majority of the team members believed their investments in the project were worthwhile

  + Significant majority of participants are seeking additional IPD and Lean experiences and would recommend it to others

  + Contingency and value-add scope additions makes financial picture hard to have precise understanding
### Akron

- **Allowable Cost**: $180,000,000 (98.76%)
- **Target Cost**: $182,225,256 (100%)
- **Final Cost**: $175,047,595 (96.06%)
- **Target Profit**: $9,707,517 (5.3% of Target Cost)
- **Final Profit**: $8,270,918 (4.72% of Final Cost)

### St. Anthony

- **Allowable Cost**: $72,000,000 (98.01%)
- **Target Cost**: $73,430,000 (100%)
- **Final Cost**: $74,180,000 (101.02%)
- **Target Profit**: Confidential
- **Final Profit**: $2,000,000 (2.7% of Final Cost)

### T. Rowe Price

- **Allowable Cost**: Confidential
- **Target Cost**: $20,241,000 (100%)
- **Final Cost**: $20,241,000 (100%)
- **Target Profit**: Confidential
- **Final Profit**: $1,614,048 (7.97% of Final Cost)

### Wekiva Springs

- **Allowable Cost**: $9,839,211 (100.87%)
- **Target Cost**: $9,760,000 (100%)
- **Final Cost**: $9,536,547 (97.77%)
- **Target Profit**: Confidential
- **Final Profit**: $597,948 (5.85% of Final Cost)
Who Has Skin in the Game?

Akron
5 Signatories
24 Risk/Reward

T. Rowe Price
7 Signatories
8 Risk/Reward

St. Anthony
4 Signatories
4 Risk/Reward

Wekiva Springs
13 Signatories
13 Risk/Reward
“They did a very good job of documenting and relaying how financial incentives were tied to project goals in real time. Everyone had a sense of what was going on, and we could make informed decisions how to move next if there was a particular problem or area of concern regarding the finances or schedule.”
Team’s connection to owner decision-makers
Myth #1...

**BUSTED**

- IPD and IPD-lite are essentially the same; financial incentives and release of liability are no big deal

+ Many teams noted a significant increase in collaborative behavior (and fun!) between those parties in the risk/reward pool compared to those that were not

+ “Team First” or “Project First” behavior was cited as critically important to success by every team

+ These projects demonstrated remarkable RESILIENCE in face of significant challenge that would likely have derailed a project delivered with typical methods
Team Quotes

“If it weren’t for the IPD agreement, I guarantee you we would all be in litigation right now instead of completing this project.”

“If it weren’t for Lean and IPD, we wouldn’t be in this building right now, on schedule and on budget.”
Conclusions and Future Research Needed

• Documenting positive case studies adds to the body of evidence on the effectiveness of Lean and IPD. But we also know that teams with more positive outcomes are more willing to participate in research.

• Rigorous comparison begins to illuminate the mechanisms and motivation that are key to success.

• Future research goals:
  • Develop rules of thumb for number, proportion and diversity of participants in the risk/reward pool.
  • Define and validate the methods for on-boarding and team building.
  • Better understand differing motivation for designers who have different financial stake and different business structures than constructors.
  • Develop shared measures and metrics of success that can drive improvement industry-wide.
Selected Tactical Takeaways

SET TARGETS
+Establish business case and define goals

BUILD THE TEAM
+Contract key stakeholders early to align and validate targets/goals

LEARN AS A TEAM
+Train and provide on-going coaching/support for key lean methods

SUPPORT THE TEAM
+Contracts should support a good team culture and adoption of lean practices
Report Findings

Our major finding was a striking uniformity of success for all the teams in this study, regardless of project type, scope, geographic location, or previous experience with IPD and Lean.

The second finding was that the powerful complementary strength of IPD and Lean supports success.
THANK YOU

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