



# IPD & Collaborative Approaches

## industry trends and recent research results

SEPTEMBER 21, 2016

BCCR CONSTRUCTION ROUNDTABLE

**Sheryl Staub-French**, PhD, PEng

Associate Professor

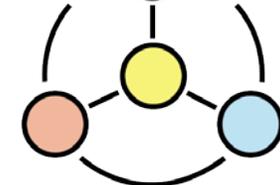
Goldcorp Professor for Women in Engineering

Department of Civil Engineering

University of British Columbia

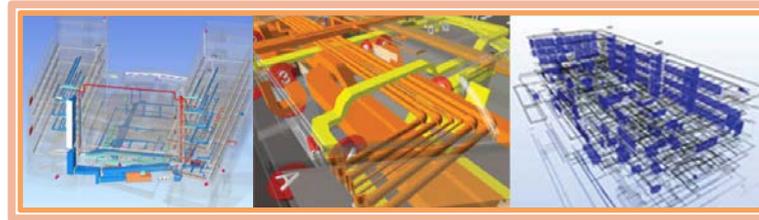
[www.bimtopics.civil.ubc.ca](http://www.bimtopics.civil.ubc.ca), [ssf@civil.ubc.ca](mailto:ssf@civil.ubc.ca)

BIM TOPICS LAB



# Our Research Focus

## Technology



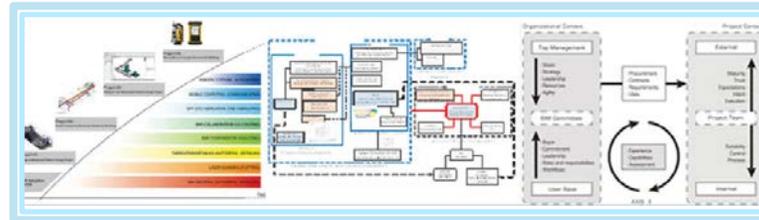
Tools used  
Model uses  
Level of detail  
etc.

## Organization



Procurement mode  
Supply chain  
Contracts  
etc.

## Process

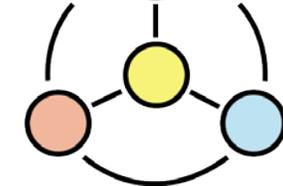


PxP  
Work flow  
Planning  
etc.

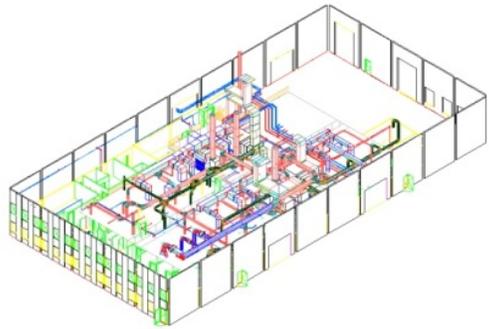
## In Context



Contracts  
Requirements  
Capabilities  
etc.



# Some BIM Projects we've been involved with...



Sequus Pharmaceuticals,  
Menlo Park, CA



Center for Interactive Research on  
Sustainability (CIRS), UBC



Pharmaceutical Sciences,  
UBC



Orchard Commons,  
UBC



Hotel Georgia,  
Downtown Vancouver



Royal Alberta Museum,  
Edmonton



Nordstrom, Downtown  
Vancouver



Brock Commons (Tall Wood Building)  
UBC

# Some of our partners

## Academic



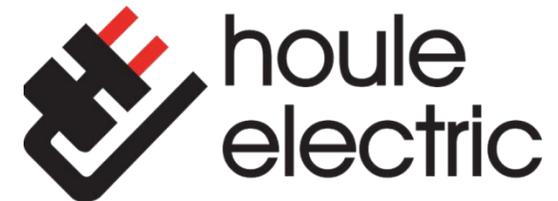
UNIVERSITY of  
WASHINGTON



UNIVERSITY OF MINNESOTA



## Industry

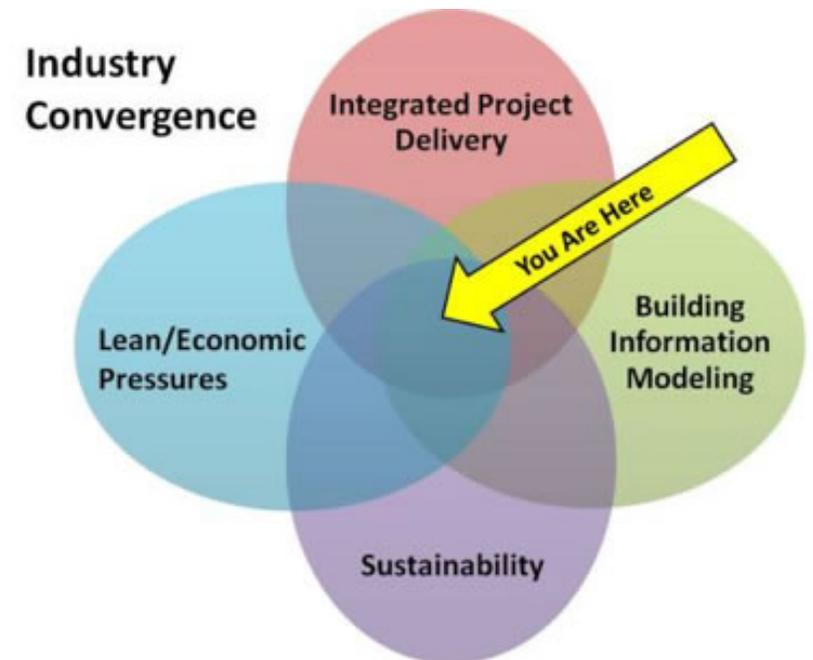


**Industry**

**TRENDS**

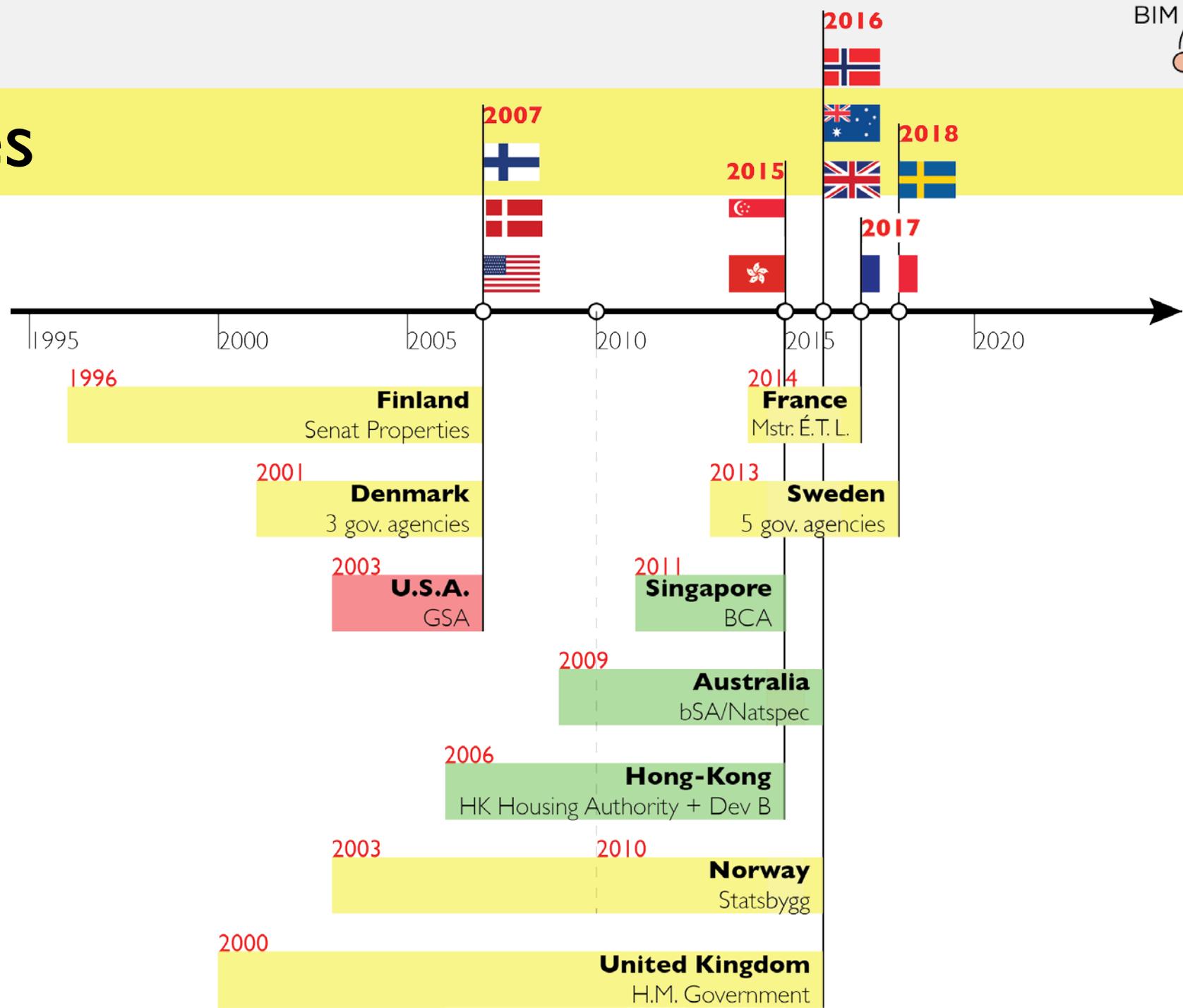
# Industry Trends

- Lean Construction / Lean Project Delivery
- Building Information Modeling (BIM)
- Integrated / Collaborative Project Delivery
- Sustainability / Low Carbon Construction



Source: "Integrated Project Delivery For Public and Private Owners" – <http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aiab085586.pdf>

# BIM Mandates



# UK Mandate: BIM/Lean/Collaborative Delivery

## Lower costs

33%

reduction in the initial cost of construction and the whole life cost of built assets

## Faster delivery

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

## Lower emissions

50%

reduction in greenhouse gas emissions in the built environment

## Improvement in exports

50%

reduction in the trade gap between total exports and total imports for construction products and materials

**IPD/Collaborative Delivery:**

**The RESEARCH**

# Some research questions:

1. Does IPD lead to better project outcomes?
2. What are the perceived benefits of IPD?
3. How and why is IPD effective?

Question 1:  
*Does IPD lead to better  
project outcomes?*

Brief highlights of some noteworthy quantitative and qualitative research

# Integrated Delivery is Superior

to other more conventional delivery types

## Shared risk and reward and early involvement

*for IPD (Molenaar et al. 2014, AIA 2012, Kent and Becerik-Gerber 2010, Cohen 2010)*

*for other project delivery modes (Esmaili et al. 2013, Korkmaz et al 2010, Chan et al. 2001)*

## Project stakeholders' level of experience

*Molenaar et al. 2014, Esmaili et al. 2013, AIA 2012,*

*Kent and Becerik-Gerber 2010, Korkmaz et al. 2010, Chan et al. 2001*

## Team tools and processes (BIM and Lean)

*Cheng 2015, Molenaar et al. 2014, Esmaili et al. 2013, AIA 2012,*

*Cho and Ballard 2011, Kent and Becerik-Gerber 2010, Cohen 2010*

# Success Metrics

## Indicators of cost, time, quality and safety

*Cheng 2015, Molenaar et al. 2014, Asmar et al, 2013, Esmaili et al. 2013, AIA 2012,  
Cho and Ballard 2011, Kent and Becerik-Gerber 2010, Korkmaz et al. 2010,  
Chan et al. 2002, Chan et al 2001, Konchar and Sanvido 1998*

## Scope change

*Asmar et al. 2013, Kent and Becerik-Gerber 2010*

## Owner satisfaction

*Cheng 2015, AIA 2012, Cha et al. 2002)*

## Sustainability and environmental performance

*Cheng 2015, Molenaar et al. 2014, Asmar et al, 2013, Korkmaz et al. 2010, Chan et al. 2002*

# Example Research Project with Quantitative Evaluation

**Objective:** Evaluate the performance of IPD projects compared to other delivery systems.



Fig. 3. United States map of respondents

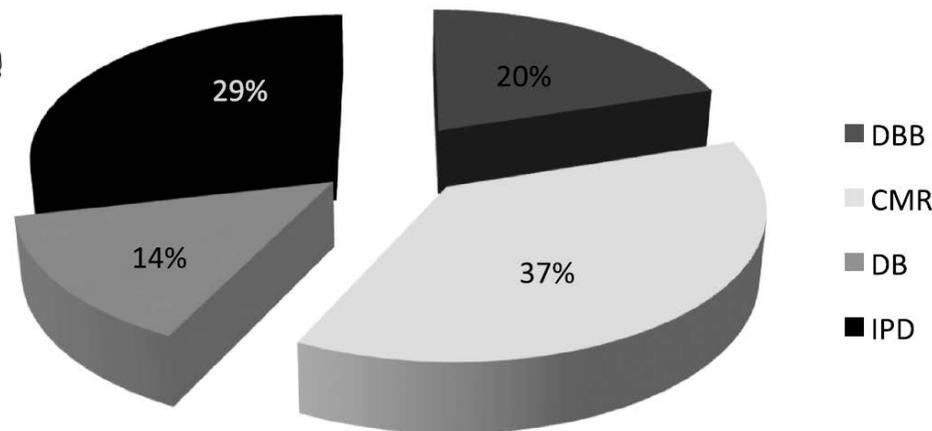
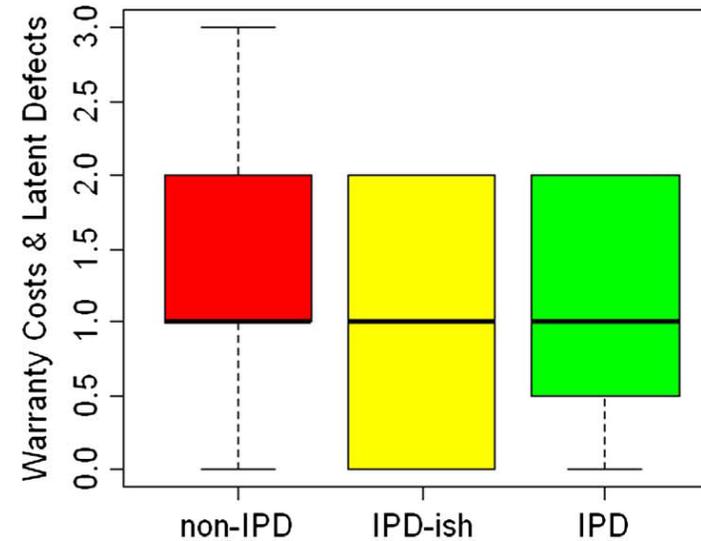
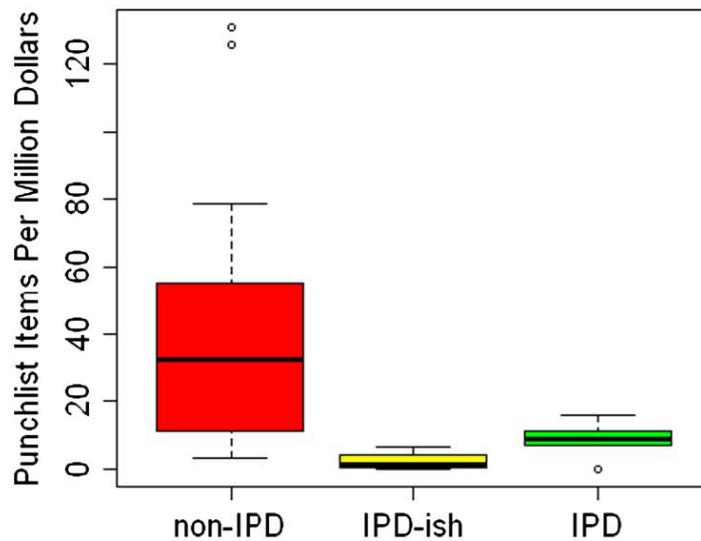
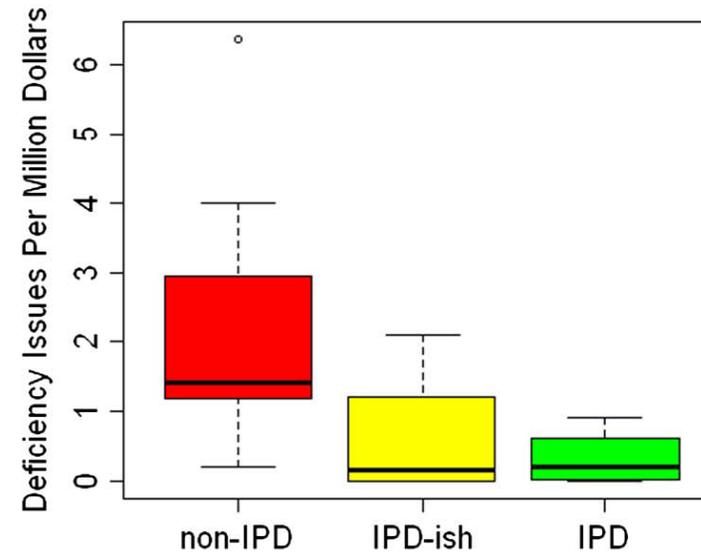
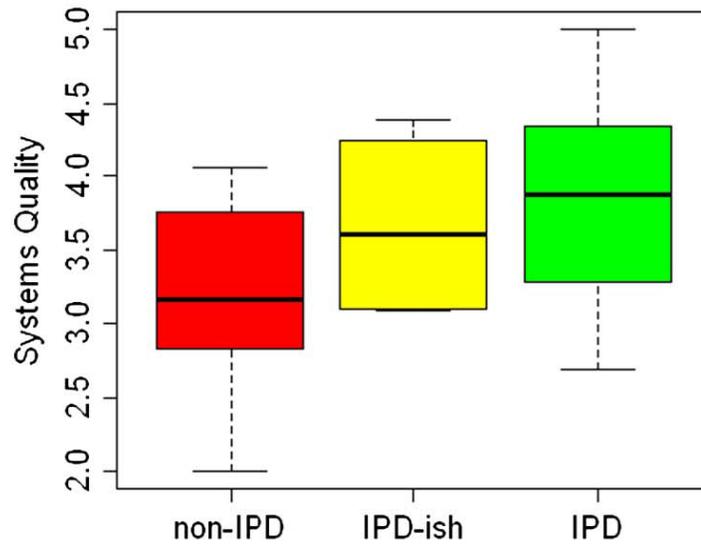


Fig. 2. Project makeup among major delivery systems

- 3 Levels of integration
  - IPD
  - IPD-ish
  - non-IPD
- Performance Metrics:
  - Quality
  - Schedule
  - Change
  - Communication
  - Labor
  - Environmental
  - Business

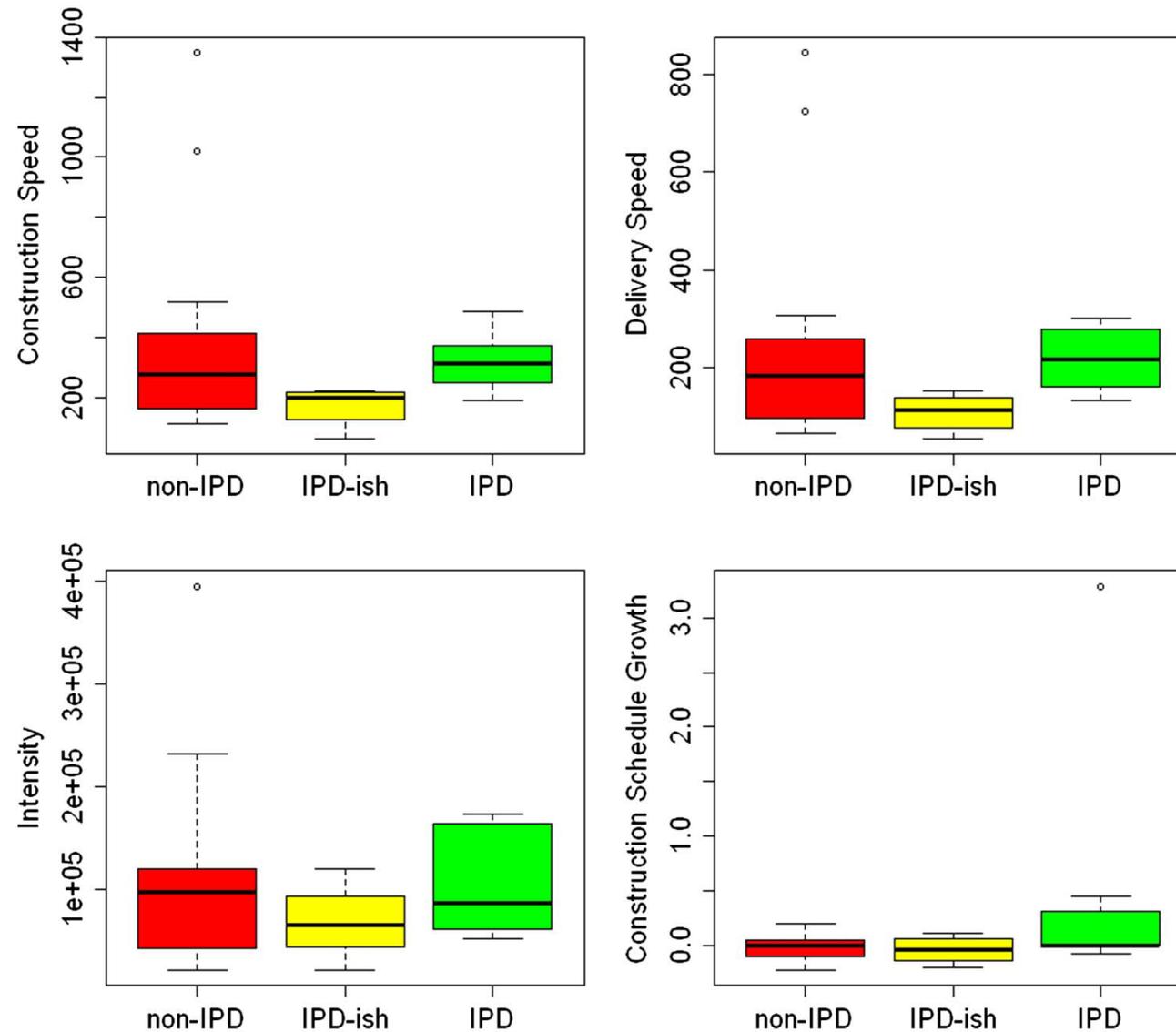
# The impact of delivery system on project performance

## ○ Quality



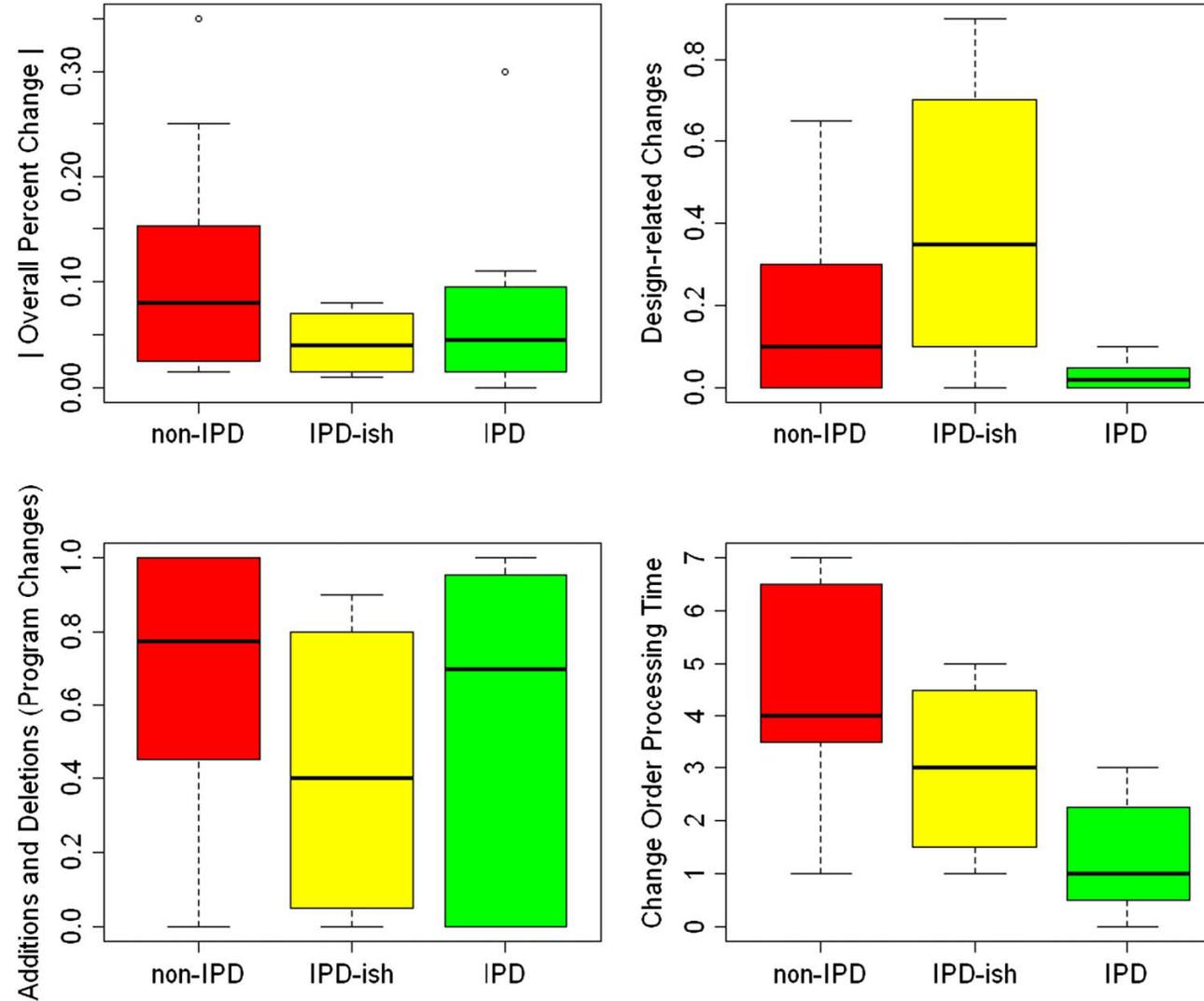
# The impact of delivery system on project performance

## o Schedule



# The impact of delivery system on project performance

## ○ Change



# Question 2:

## *What are the perceived benefits of IPD?*

Brief highlights of some noteworthy quantitative and qualitative research

# Perceived impacts of IPD on project outcomes

## IPD: Performance, Expectations, and Future Use

A Report On Outcomes of a University of Minnesota Survey

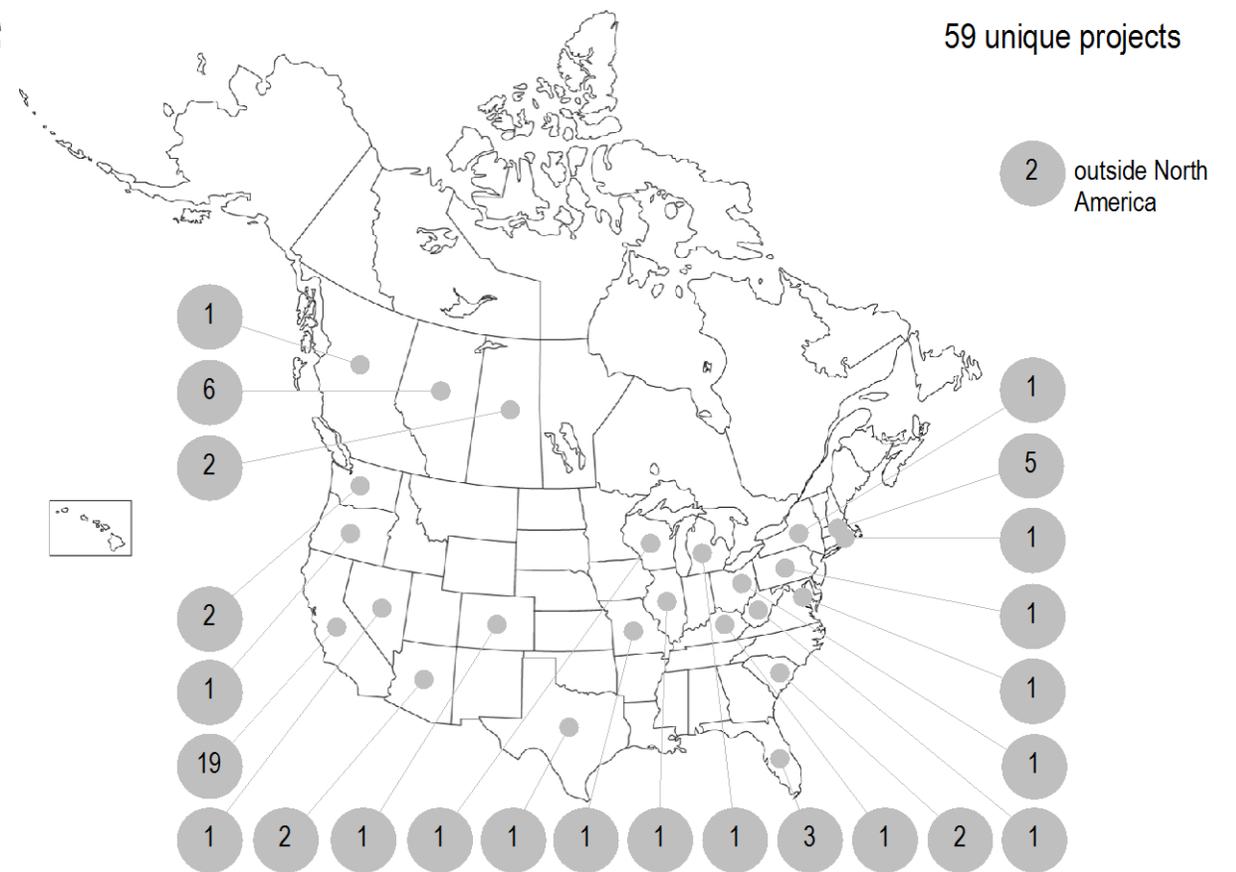
### Project Team

Renee Cheng AIA | University of Minnesota | [rcheng@umn.edu](mailto:rcheng@umn.edu)  
 Markku Allison AIA | Scan Consulting | [markkuallison@scanconsulting.us](mailto:markkuallison@scanconsulting.us)  
 Carrie Sturts Dossick PE PhD + Chris Monson RA PhD Candidate



### Projects | Distribution

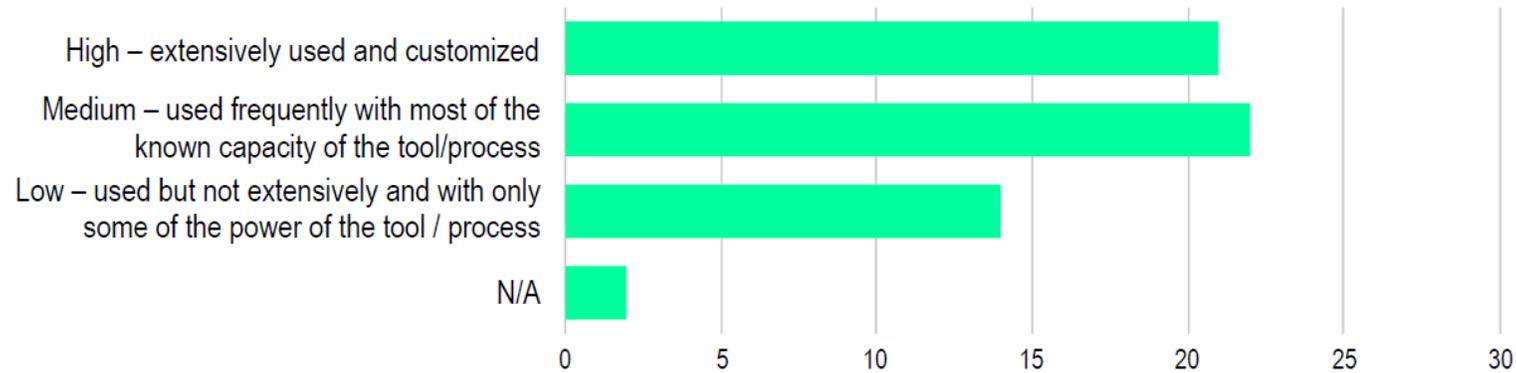
59 unique projects



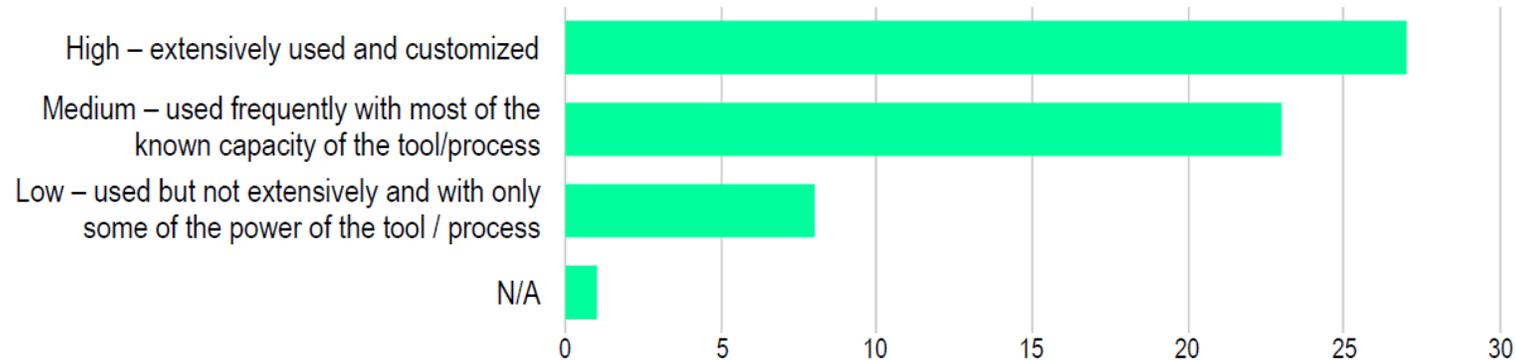
# Perceived impacts of IPD on project outcomes

## Projects | Use of BIM and Lean

BIM tools and processes utilized on this project (n=59)

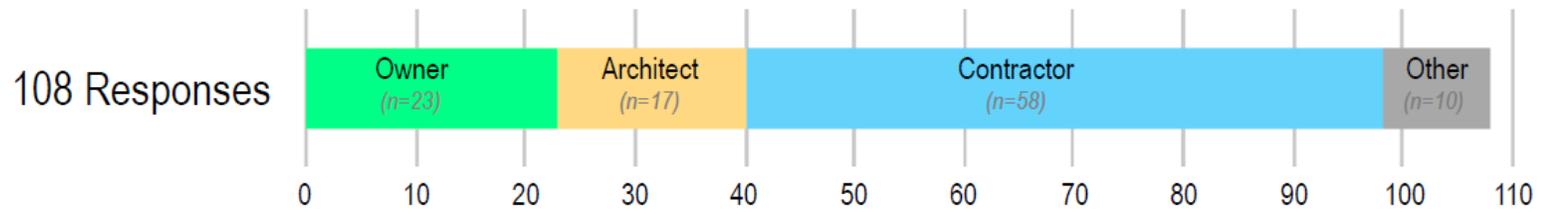


Lean tools and processes utilized on this project (n=59)

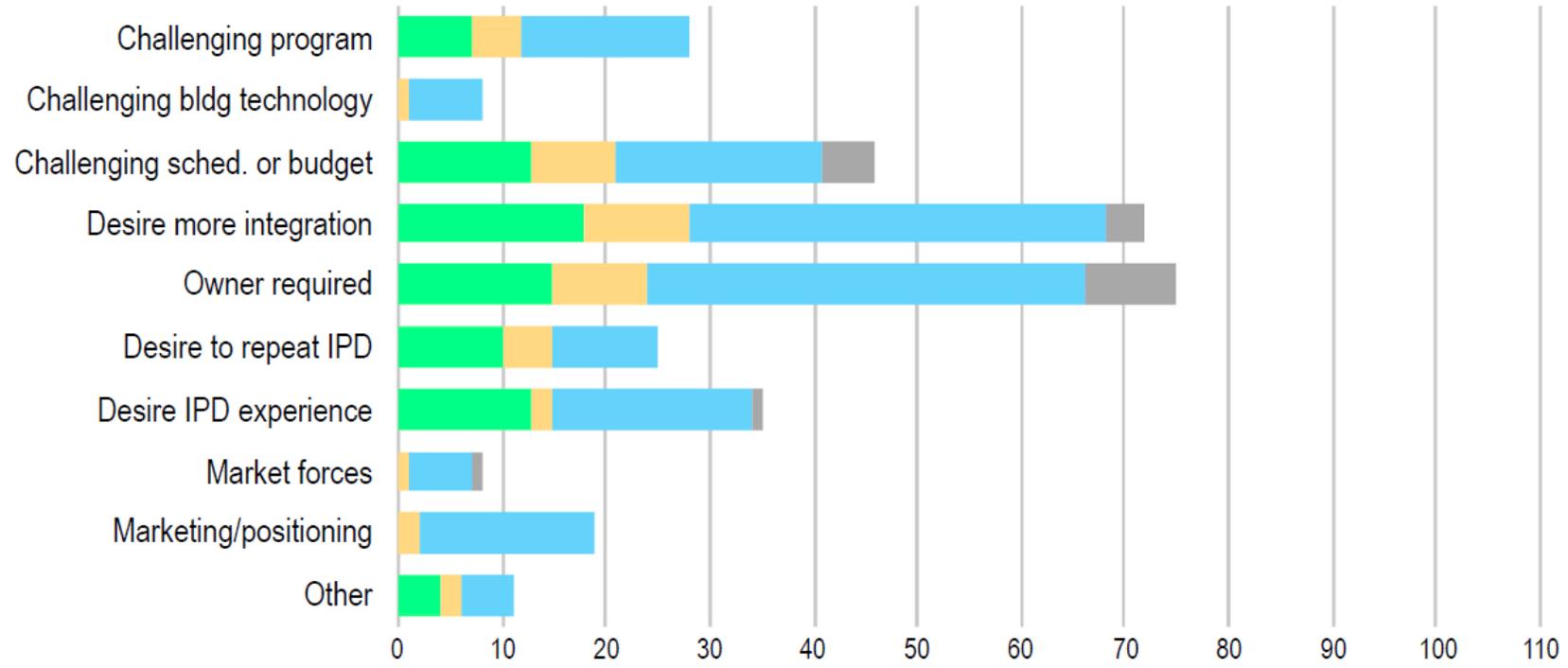


# Perceived impacts of IPD on project outcomes

## Respondents | Why IPD?



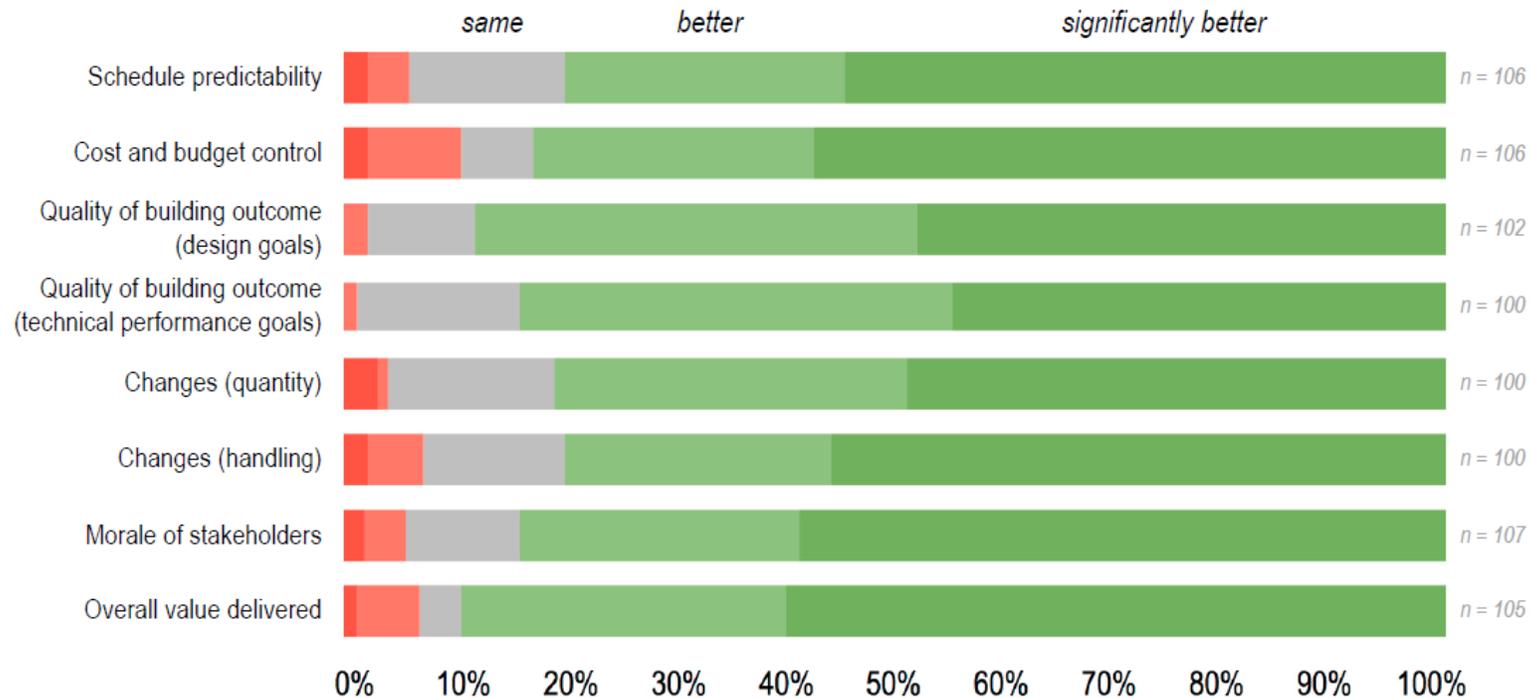
### The reason(s) we chose IPD were:



# Perceived impacts of IPD on project outcomes

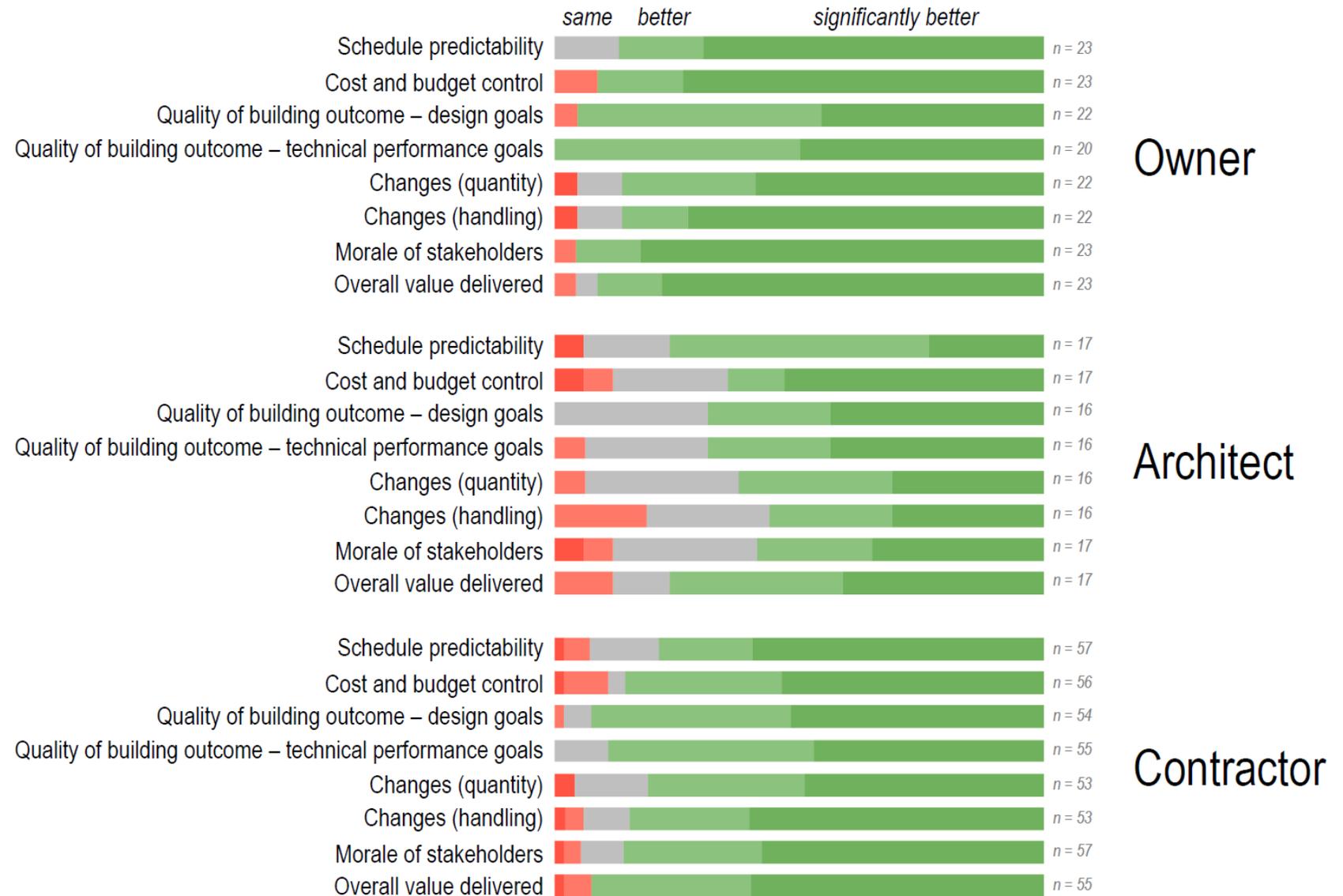
## Performance | All Responses

Compared to your experience on non-IPD projects, rate your impression of the performance of this project in each of the categories below.



# Perceived impacts of IPD on project outcomes

*Compared to your experience on non-IPD projects, rate your impression of the performance of this project in each of the categories below.*



# Perceived impacts of IPD on project outcomes

## ○ Summary of Key findings:

- Responses are significantly positive, strongly supportive of IPD as a superior delivery method.
- Distribution of responses is weighted heavily toward the most positive possible answers, not clustered around the neutral point.
- The overwhelmingly positive response is consistent across all demographics: stakeholder type, project type, project progress, project averages, and past respondent experience.

# Question 3:

## *How and why is IPD effective?*

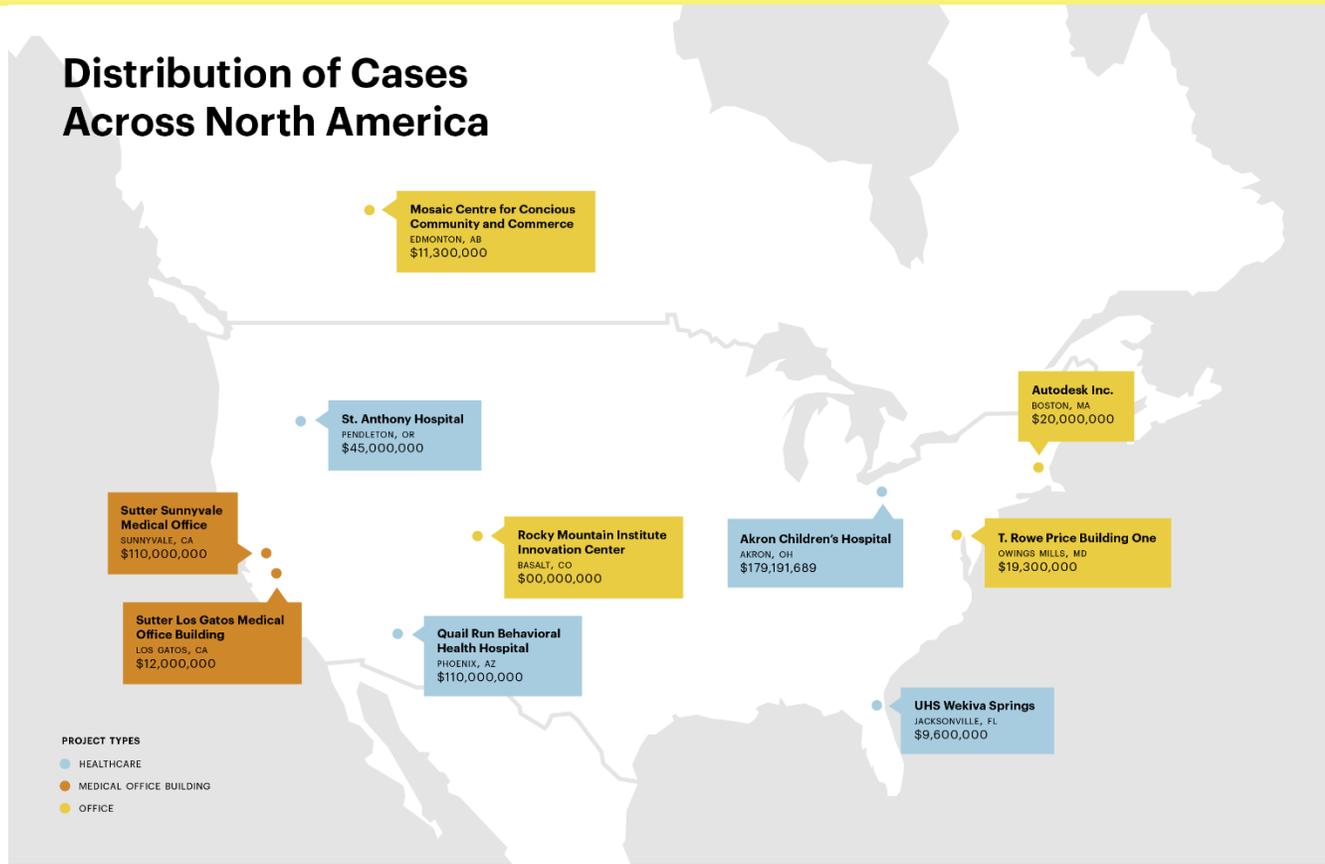
Brief highlights of emerging quantitative and qualitative research

# Lean and IPD Case Studies Project

*Why are IPD and Lean effective and how can that be measured?*



Research Team: University of Minnesota  
 University of Washington  
 University of British Columbia  
 Scan Consulting



# 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

# Myth #4.....

**BUSTED**

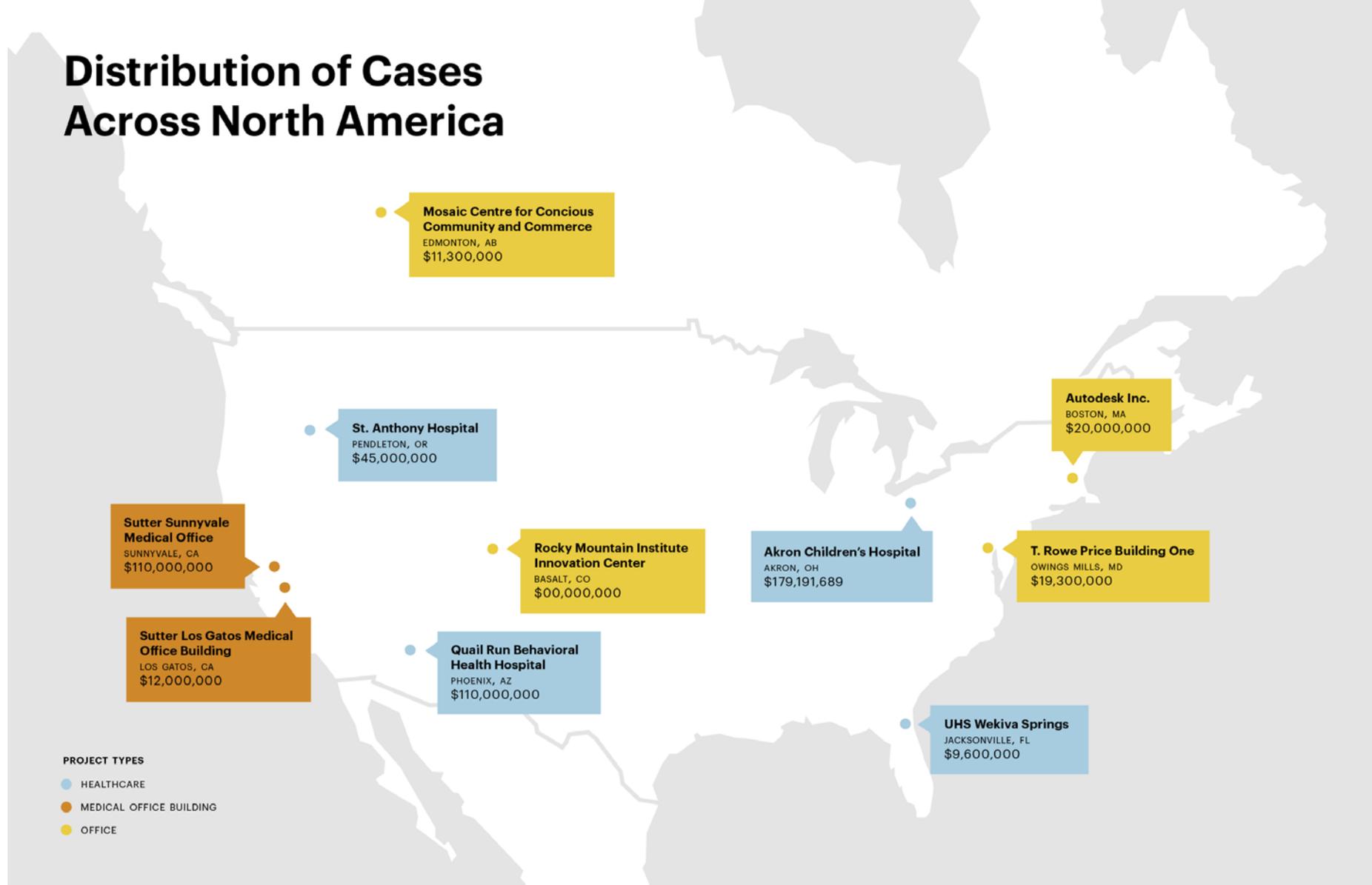
- IPD contracts are too complicated, Lean tools are too rigid
  - In the projects studied, teams used a wide variety of Lean tools and processes to varying degrees of “purity”.
  - Most projects used customized IPD contracts but some templates are beginning to emerge.
  - Investing time to understand the contract and design the project-specific Lean approach is part of an effective on-boarding process.

# 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.

# Distribution of Cases Across North America



Source: R. Cheng, Presentation to LCI Congress (2016)

# Myth #2.....

**BUSTED**

- 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

# 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

# Myth #1 . . . . .

**BUSTED**

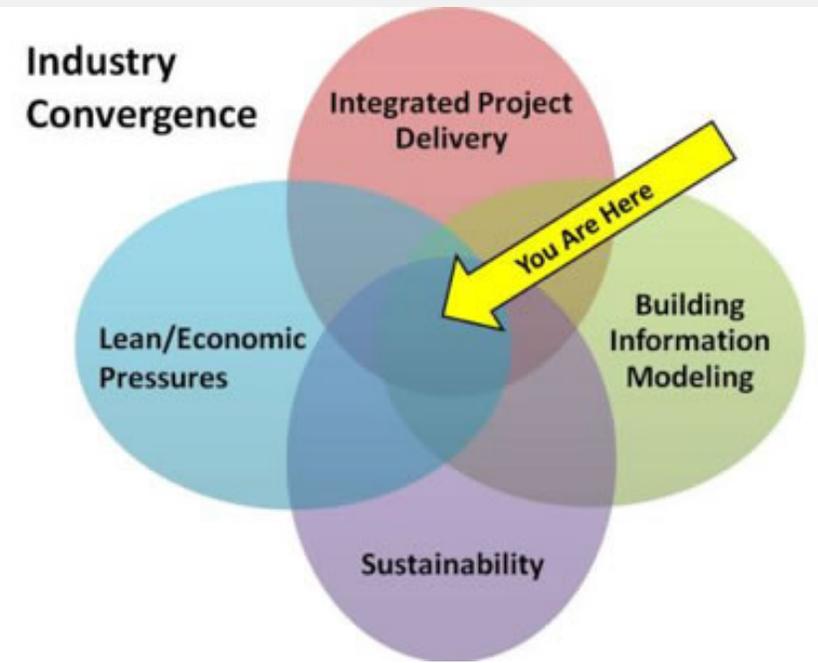
- IPD and IPD-lite are essentially the same; financial incentives and release of liability are no big deal
  - Many teams noted a significant increase in collaborative behavior (and fun!) between those parties in the risk/reward pool compared to those that were not
  - “Team First” or “Project First” 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
    - “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.

# Some final thoughts

- Current trends toward IPD, Lean, and BIM will continue to transform project delivery:
  - the way projects are organized and executed,
  - the work practices and information flows,
  - the responsibilities of the different disciplines,
  - and the way project teams are compensated.
  
- BIM/Lean/Collaborative delivery is increasingly being mandated on projects to support the creation of a low carbon construction industry.
  - US, UK, Australia, Singapore....



**Lower costs**

33%

reduction in the initial cost of construction and the whole life cost of built assets

**Faster delivery**

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

**Lower emissions**

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**Improvement in exports**

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UK Mandate

**Thank you**