

# Maximizing Success on Integrated Projects: An Owner's Guide

An Owner's Only Presentation

September 9, 2016

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# What is COLLABORATION?



**col·lab·o·rate**

kəˈlabəˌrāt/

verb: **collaborate**;

- work jointly on an activity, especially to produce or create something.



# What is Integration?

## **in·te·grate**

'in(t)ə,grāt/

verb: **integrate**

- combine (one thing) with another so that they become a whole.
- bring (people or groups with particular characteristics or needs) into equal participation



# INTEGRATION IS A TEAM SPORT

## *POETRY IN MOTION*



# Group Cohesion

**co•he•sion**

kō'hēZHən/

noun: **cohesion**

1. the action or fact of forming a united whole.

# What is an integrated project?

# What is Project success?





# Success

For the Owner?  
For the Architect?  
For the Engineer?  
For the Builder?  
For the Trade?  
For the user?





## A man in a dark suit stands with his back to the camera, looking at a large wall covered in hand-drawn business sketches. The sketches include a bar chart, a pie chart, a line graph, a lightbulb, a car, a house, a laptop, a cloud, a city skyline, and various icons representing business concepts like 'idea', 'sale', 'team', 'marketing', 'internet', 'cloud', and 'success'. The word 'TEAM' is circled in red.

# Project Delivery Research

- In 1997-1998 the Construction Industry Institute in collaboration with Penn State University published seminal research indicating Design Build out performed CM at Risk or Design Bid Build in terms of

- Lower cost,
- Improved schedule
- Better quality

- ***The more integrated, the better the performance***
- ***Singular vs multiple contracts***

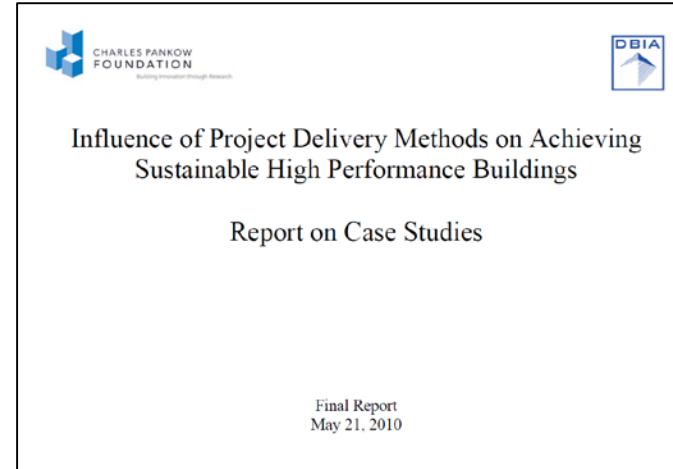
Metric	DB vs. DBB	CM@R vs. DBB	DB vs. CM@R
Unit Cost	6.1% lower	1.6% lower	4.5% lower
Construction Speed	12% faster	5.8% faster	7% faster
Delivery Speed	33.5% faster	13.3% faster	23.5% faster
Cost Growth	5.2% less	7.8% more	12.6% less
Schedule Growth	11.4% less	9.2% less	2.2% less

1998 CII RT 133 Research

# Team Integration and Sustainability

When sustainability is a goal –

- The higher the level of team integration the higher the performance of the building
- The greater the Owner involvement, the better the opportunity to achieve sustainable goals



[https://www.dbia.org/resource-center/Documents/CPF\\_ThrustII\\_05212010\\_Final.pdf](https://www.dbia.org/resource-center/Documents/CPF_ThrustII_05212010_Final.pdf)



# Impacts of the Previous Research

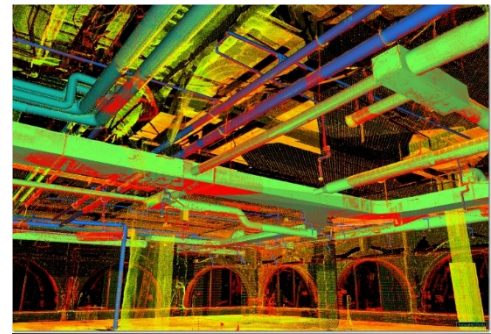
- Many State and Federal agencies changed procurement laws to permit alternate forms of project delivery
- Owner's turned to Design Build and CMR to increase potential for project success
- Demand for sustainability has driven demand for integrated approaches





# What has Changed?

- Is the previous research still relevant?
- What has changed?
  - Technology
  - Building Information Modeling
  - IPD, Progressive DB, P3
  - Construction technologies
  - Economy
  - Level of sophistication
- What are the factors that improve outcomes in any project delivery strategy?



- How can an Owner best structure the project for a successful outcome?



# Maximizing Success in Integrated Projects: An Owner's Guide

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- Mark Konchar (co-chair), *Balfour Beatty Construction*
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- Spencer Brott, *Trammell Crow Real Estate Services, Inc.*
- Bill Dean, *M.C. Dean, Inc.*
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- Behzad Esmaeili, *University of Nebraska-Lincoln*
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- Diana Hoag, *Xcelsi Group, LLC*
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- John Messner, *Penn State University*
- John Miller, *Barchan Foundation, Inc.*
- Keith Molenaar, *Univ. of Colorado*
- Brendan Robinson, *U.S. Architect of the Capitol*
- Victor Sanvido, *Southland Industries*
- Ronald Smith, *Kaiser Permanente*
- David P. Thorman, *Former California State Architect*

## Team

Integration

Group Cohesion



## Integration

*Degree to which team members from separate organizations and disciplines are engaged in collaborative activities*

- Participation in:
  - Joint Goal Setting
  - Cross Disciplinary design charrettes
  - BIM Execution Planning
- Increased sharing of information and analysis through BIM
- Increased team interaction through colocation

Higher levels of integration led to:

- Reduced ***schedule growth***
- Enabled ***more intense schedules***
- Led to ***more cohesive teams***



## Team

Integration

Group Cohesion



## Group Cohesion

*Degree to which team, as individuals, have shared, task commitment, group pride, and interpersonal alignment*

- Commitment to shared goals
- High levels of team chemistry
- Communication is timely and effective

Higher group cohesiveness led to:

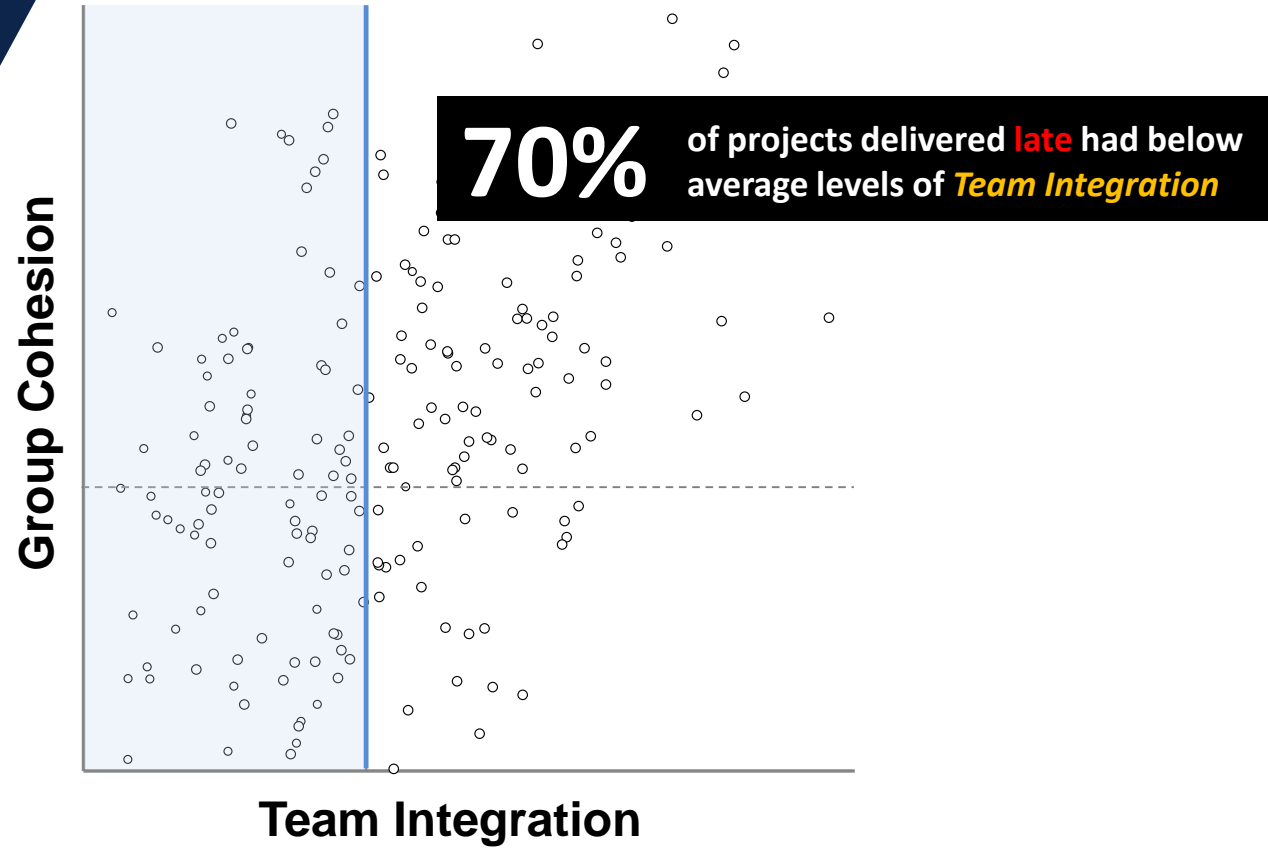
- Reduced **cost growth**
- Higher **system quality**
- Improved **turnover experience**

# Factor Value

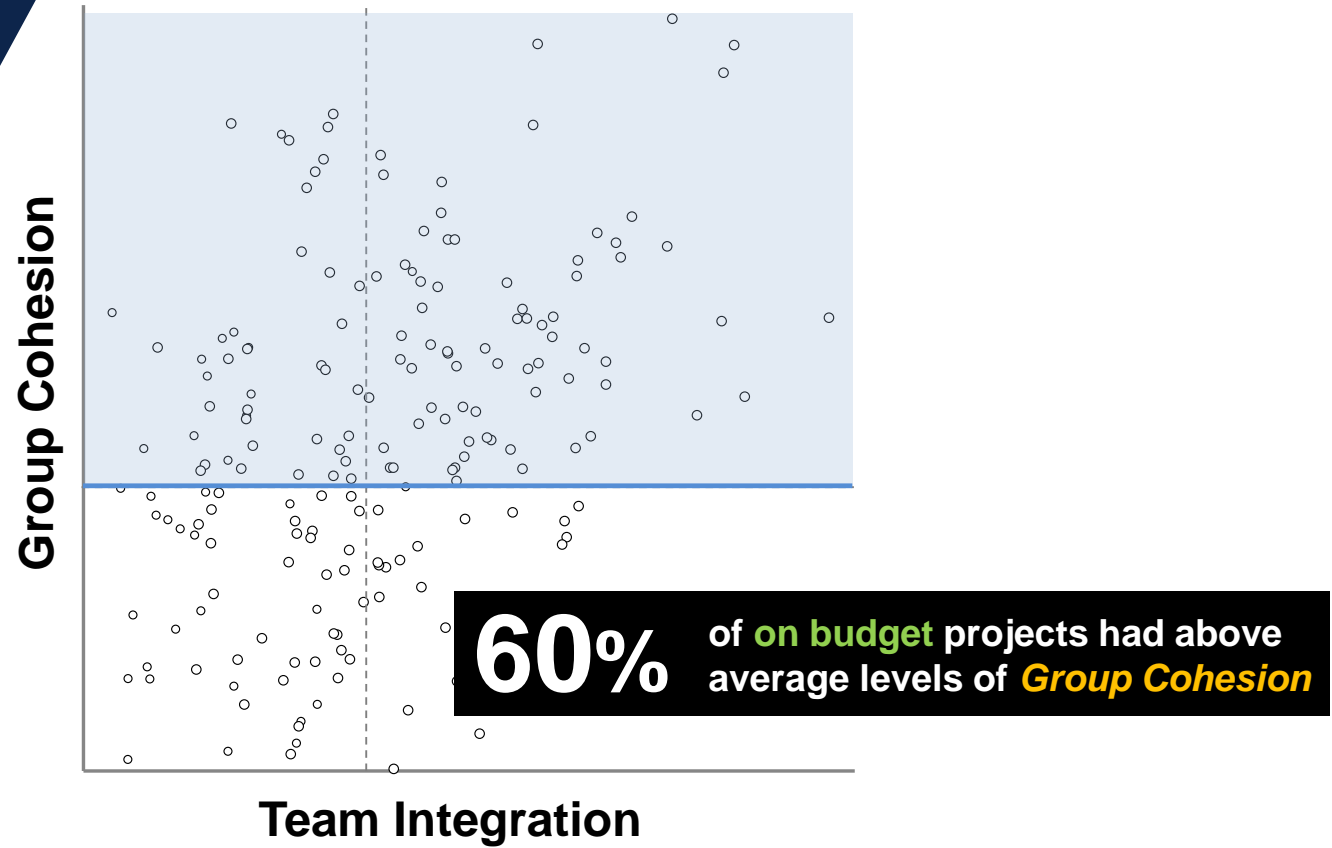
Group Cohesion

Team Integration

# Factor Value

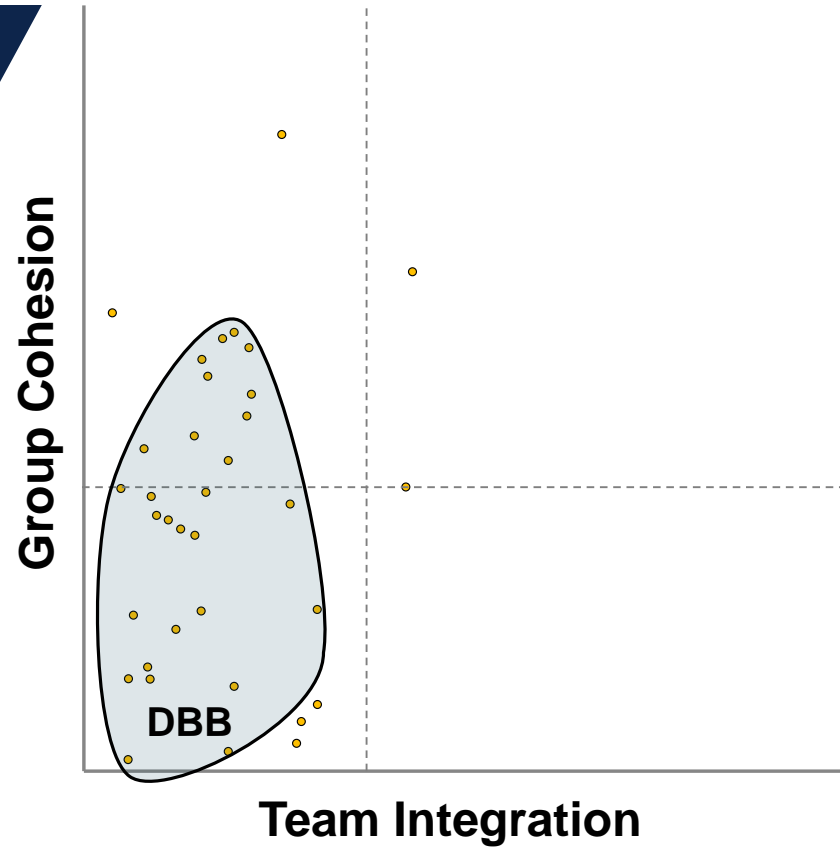


# Factor Value

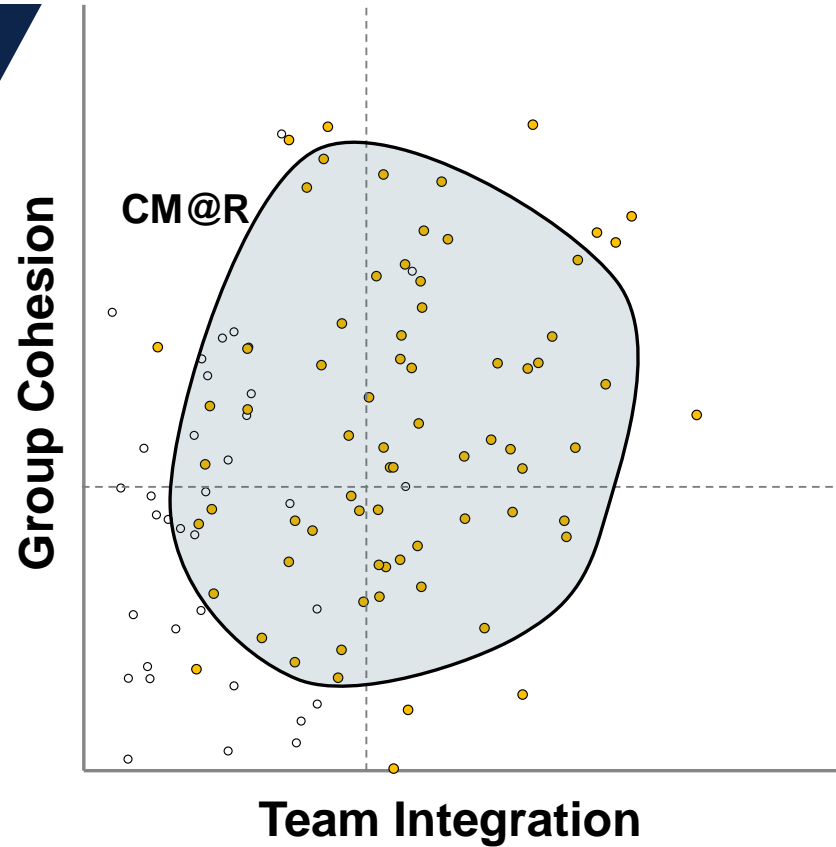




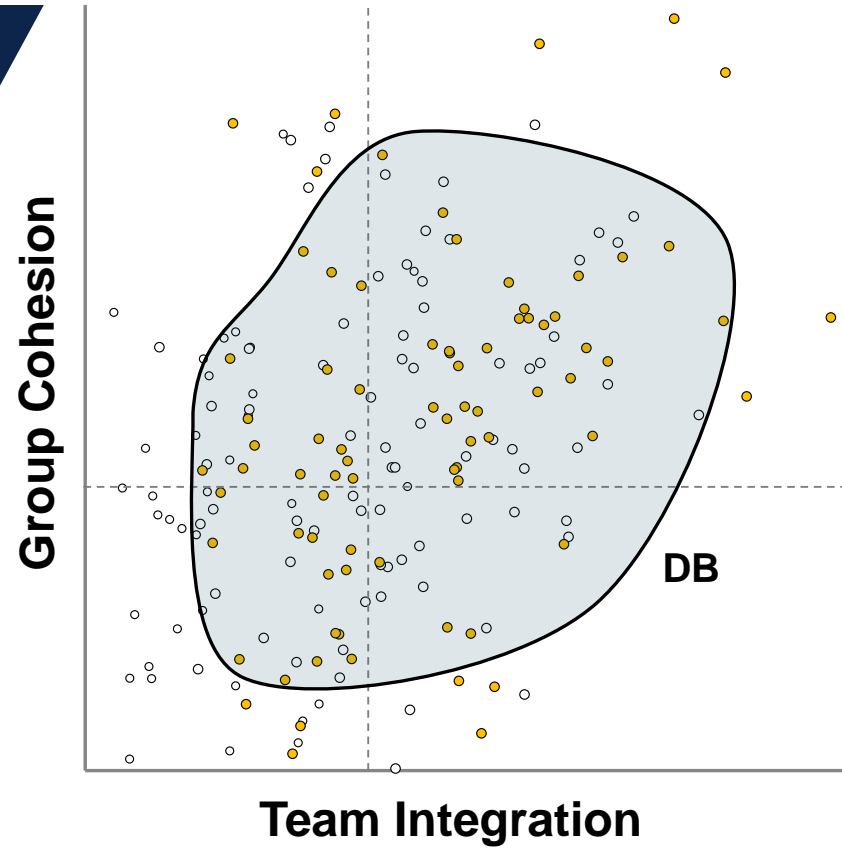
# Delivery Method



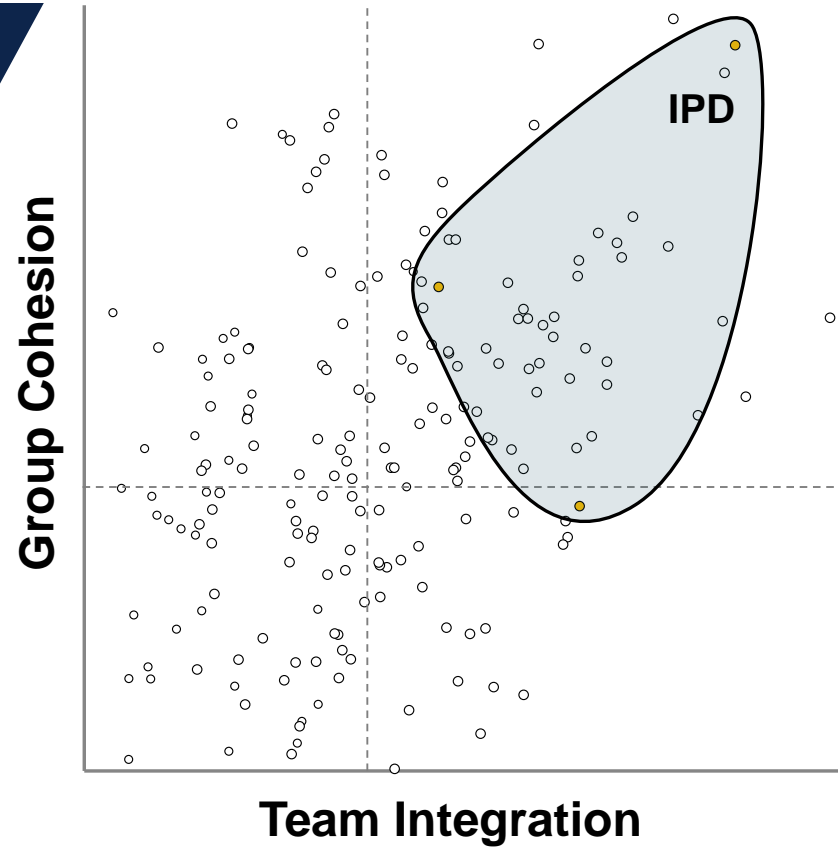
# Delivery Method



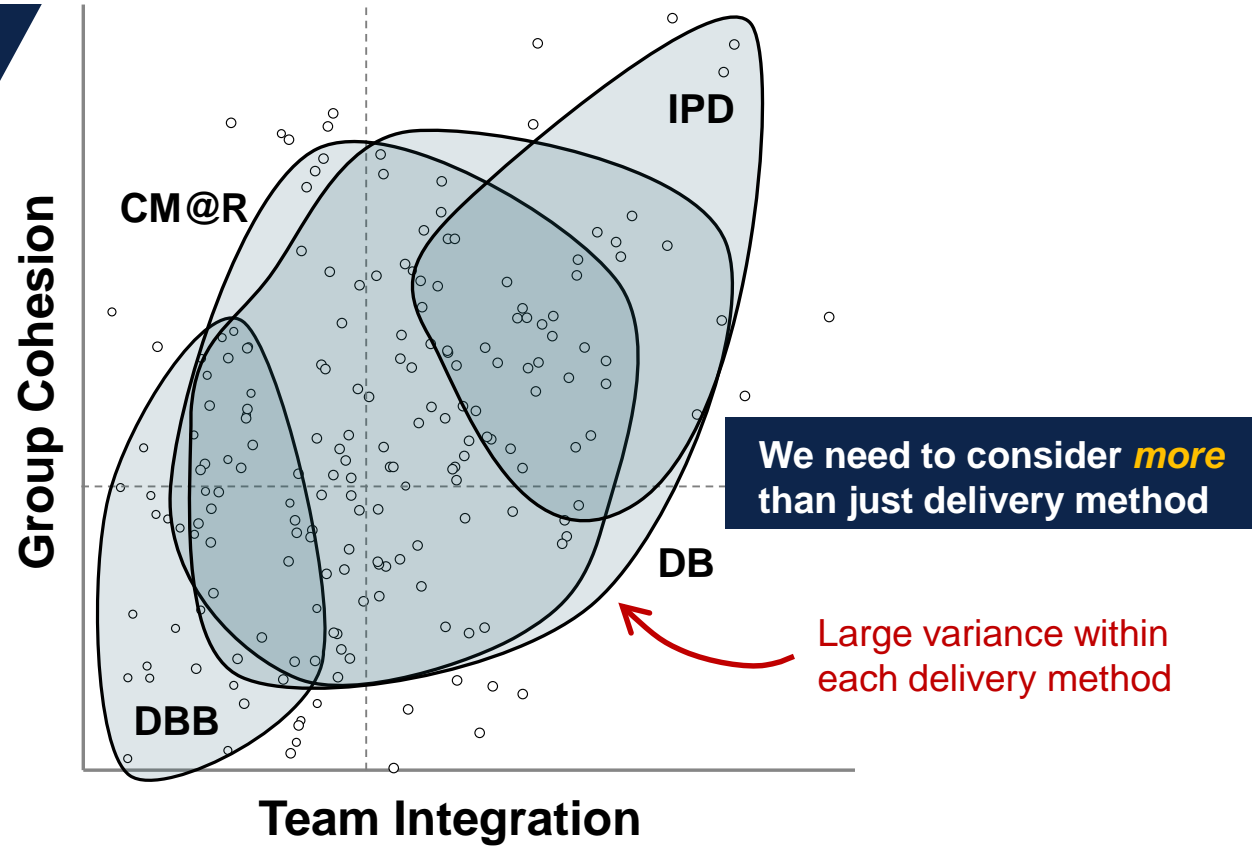
# Delivery Method



# Delivery Method

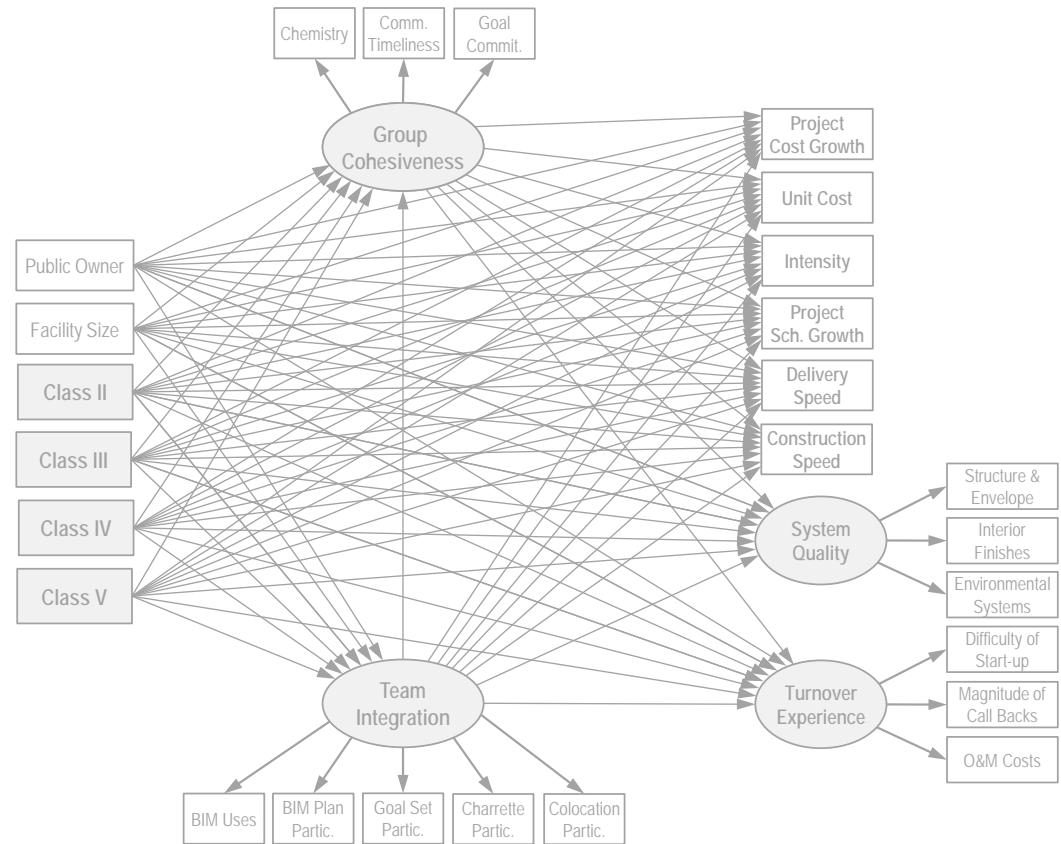


# Delivery Method





# How did we come to these findings?



# Study Background

## Research Charrette

- A structured 2-day workshop that combined surveys and focus group discussion
- Attendees: CM/GCs, specialty contractors, owners, lawyers, architects



# Study Background

## The Role of Team Integration in Project Performance

### Methodology: Empirical Study

- Large-sample data collection
- Latent variable analysis
- Structural modeling of relationships

### Sponsors:

Charles Pankow Foundation  
Construction Industry Institute (CII)

**SECTION 6: PROJECT SAFETY**

If you are the builder, please complete this section. If not, please provide the builder's name or point of contact, phone number or email address.

Specify when each project participant was on located or during a workshop with other team members (check all that apply).

Architect/Designer: \_\_\_\_\_ MEP/Structural: \_\_\_\_\_  
Owner: \_\_\_\_\_ CM/OC: \_\_\_\_\_ Contractors: \_\_\_\_\_

Project Name: \_\_\_\_\_

**PROJECT PERFORMANCE QUESTIONNAIRE**

**Purpose:** The University of Colorado at Boulder and Pennsylvania State University are conducting a survey to investigate the role of project delivery methods, contracting terms, procurement, team behavior and technology in project success. Please help us by completing the survey for at least one project you have completed in the last 5 years in the United States. The questionnaire should take between 20-30 minutes to complete. If needed, any follow-up interviews with the respondent will take approximately 15-20 minutes to conduct.

**Confidentiality:** The project information you provide will be kept in strict confidentiality, within a password protected database. Only the primary investigators and their research assistants will see and have access to your information. In the event of a publication or presentation based on the results of this study, no personal or company identifiable information will be shared.

**Participation:** Your decision to participate in this research is voluntary and you may withdraw at any time. There is no direct compensation; however, participants may request a copy of the final reports. If you have any questions, complaints or concerns regarding this research, you may contact Dr. Robert Leicht at (814) 865-2080.

Completed questionnaires may be returned by mail or email to:  
Dr. Robert Leicht, Dept. of Architectural Engineering, Penn State University  
194 Engineering Unit A, University Park, PA 16802  
rleicht@engr.psu.edu

**SECTION 1: PROJECT CHARACTERISTICS**

Project name: \_\_\_\_\_  
Project location: \_\_\_\_\_  
Your name: \_\_\_\_\_  
Your company name: \_\_\_\_\_  
Phone #: \_\_\_\_\_ Email: \_\_\_\_\_

Specify your role on the project:  
☐ Owner ☐ Construction Manager (CM)/General Contractor (GC)  
☐ Architect/Designer ☐ Design-Builder ☐ Other: \_\_\_\_\_

Owner type: ☐ Public ☐ Private

Specify the project type (e.g. Office, Hospital) or describe the intended use of the project: \_\_\_\_\_

Relative to your experience with similar project types, rate the level of complexity for this project (1=Low, 6=High):  
Low 1 2 3 4 5 6 High

Building gross square footage: \_\_\_\_\_ ft<sup>2</sup>  
No. of floors above grade: \_\_\_\_\_ No. of floors below grade: \_\_\_\_\_

Percentage of the cost or area: Renovation \_\_\_\_\_ % New construction \_\_\_\_\_ %

Select the closest foundation type:  
☐ Slab on grade with spread footings ☐ Caissons, piles or shury walls  
☐ Mat foundation ☐ Other: \_\_\_\_\_

**SECTION 2: PROJECT ORGANIZATION**

Select the project delivery system best matching the delivery of your project:  
☐ Design-Bid-Build ☐ Design-Build (DB)  
☐ Construction Manager at Risk (CM/AGC) ☐ Integrated Project Delivery

Denote when each project participant was contracted for the project (timing on based on percent of overall design completion):

	Pre-Concept	SD	DD	CD	Building Design (90-100%)	Construction (100-100%)
Architect/Designer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GC, CM/AGC or DB	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MEP Contractors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Structural Contractors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**SECTION 3: PROJECT COST**

Were specialty contractors involved before being contracted? ☐ Yes ☐ No

Relative to your expectations, evaluate the administrative burden you experienced (1=Low, 6=High):  
Low 1 2 3 4 5 6 High

What were the following project costs?  
Provide separate Construction Costs if known; otherwise, enter Total Project Costs only, indicating whether the cost data provided is estimated (E) or actual (A). Please include all property costs, owner costs, cost of installed process or manufacturing equipment, furnishings, fittings and equipment, or items not a cost of the base building.

	Construction Costs	Total Project Costs
Contract award	<input type="radio"/> E <input type="radio"/> A	<input type="radio"/> E <input type="radio"/> A
Final cost	<input type="radio"/> E <input type="radio"/> A	<input type="radio"/> E <input type="radio"/> A

Estimate the cost of site work (work performed outside the building footprint) included in the project costs listed above: \$ \_\_\_\_\_

Are there any unresolved costs or change orders? ☐ Yes ☐ No

Has the project ever been in litigation?  
☐ Yes, resolved ☐ Yes, unresolved ☐ No

If applicable, are the costs of litigation and/or claims included in the project costs listed above? ☐ N/A ☐ Yes ☐ No

**SECTION 4: PROJECT SCHEDULE**

Please provide the following schedule information:

	Planned (m/d/yyyy)	Actual (m/d/yyyy)
Design start date (Notice to proceed)		
Construction start date (Notice to proceed)		
Construction end date (Substantial completion)		

**SECTION 5: PROJECT QUALITY**

If you are the owner, please complete this section. If not, please provide the owner's name or point of contact, phone number or email address.

Relative to your expectations, evaluate the facility turnover and operation (1=Low, 6=High):  
Low 1 2 3 4 5 6 High

Difficulty of facility start-up: \_\_\_\_\_  
Number and magnitude of call backs: \_\_\_\_\_  
Operation and maintenance costs: \_\_\_\_\_

Relative to your expectations, evaluate the quality of the facility and systems (1=Low, 6=High):  
Low 1 2 3 4 5 6 High

Envelope, roof, structure, foundation: \_\_\_\_\_  
Interior finishes: \_\_\_\_\_  
Environmental systems (lighting, HVAC): \_\_\_\_\_  
Exterior aesthetic (style, proportions): \_\_\_\_\_  
Interior environment (moist, feel, image): \_\_\_\_\_

Rate your overall satisfaction with the design and construction process (1=Not satisfied, 6=Exceeded expectations):  
Not satisfied 1 2 3 4 5 6 Exceeded

# Data Set

## 204 Projects

Public: 127 (62%)

Private: 77 (38%)

Completed: 2008 - 2013

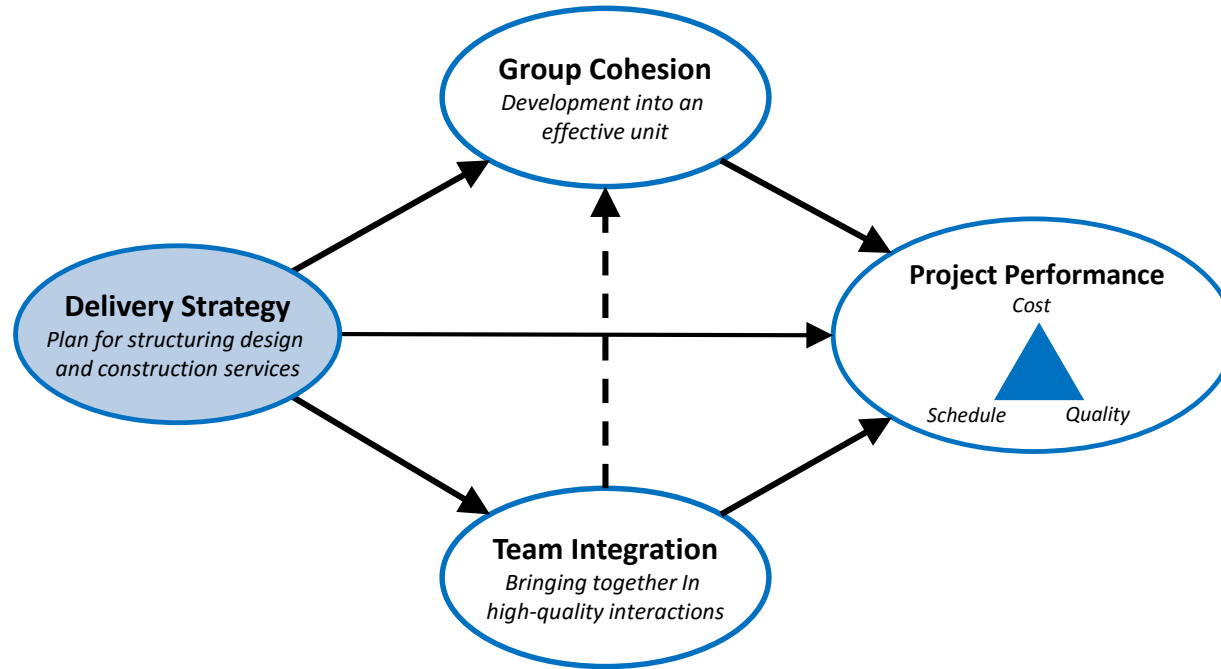
Number of Projects  
1 32

## Facility Sizes

(4%)	8	> 700,000 ft <sup>2</sup>
(3%)	7	600,000 - 699,000 ft <sup>2</sup>
(2%)	3	500,000 - 599,000 ft <sup>2</sup>
(3%)	6	400,000 - 499,000 ft <sup>2</sup>
(7%)	15	300,000 - 399,000 ft <sup>2</sup>
(13%)	26	200,000 - 299,000 ft <sup>2</sup>
(24%)	49	100,000 - 199,000 ft <sup>2</sup>
(44%)	90	0 - 99,000 ft <sup>2</sup>

## Facility Types

Educational	56	(27%)
Office	41	(20%)
Health Care	32	(16%)
Lodging	27	(13%)
Commercial	20	(10%)
Sports & Recreation	11	(5%)
Manufacturing	11	(5%)
Correctional	4	(2%)
Transportation	2	(1%)

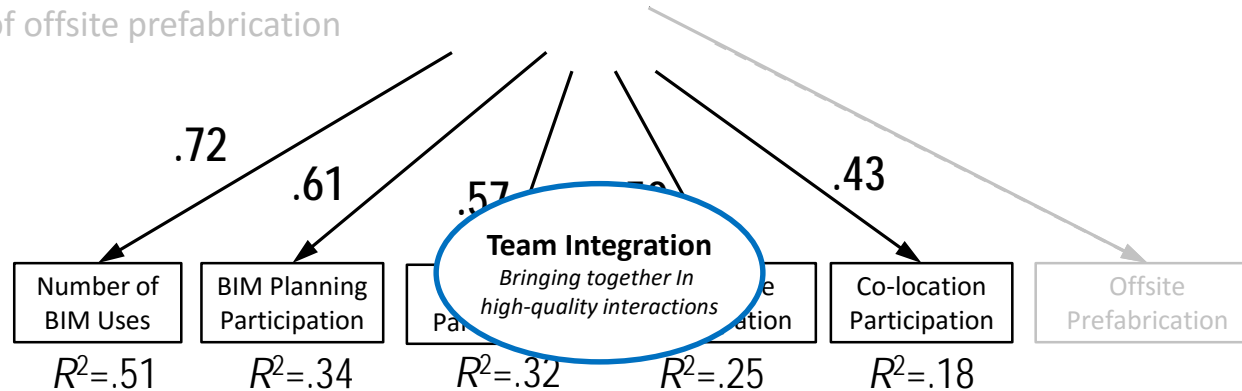


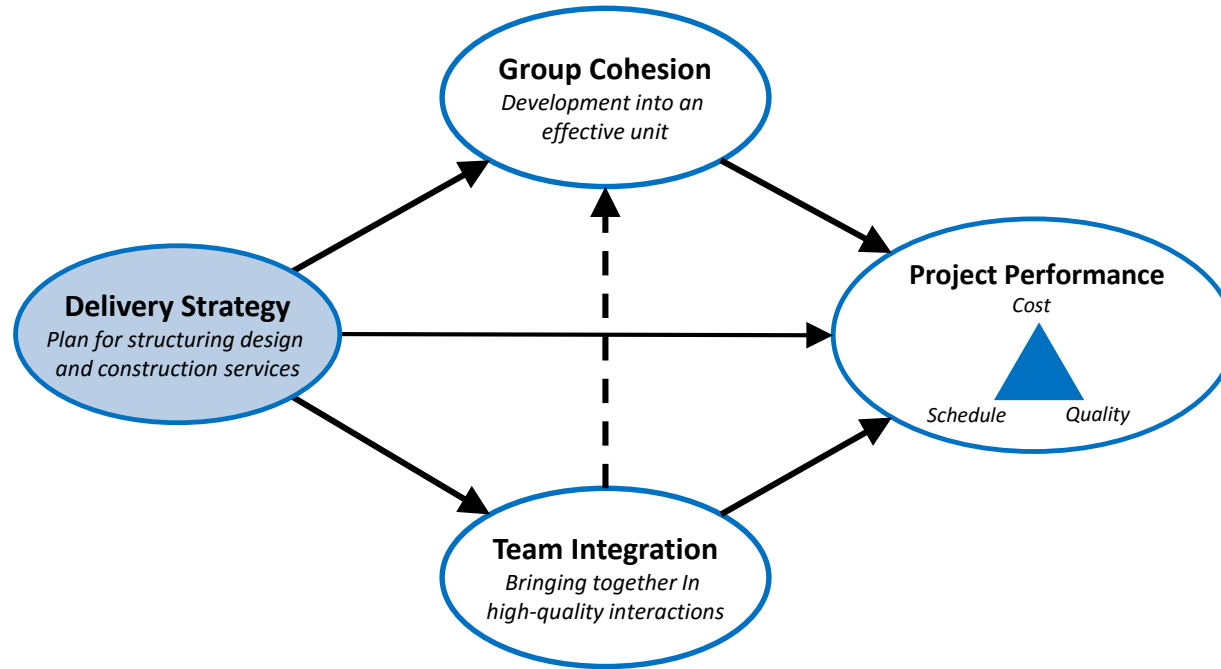


Measurements of participation in **high-quality interactions**, suspected to be driven by the level of team integration:

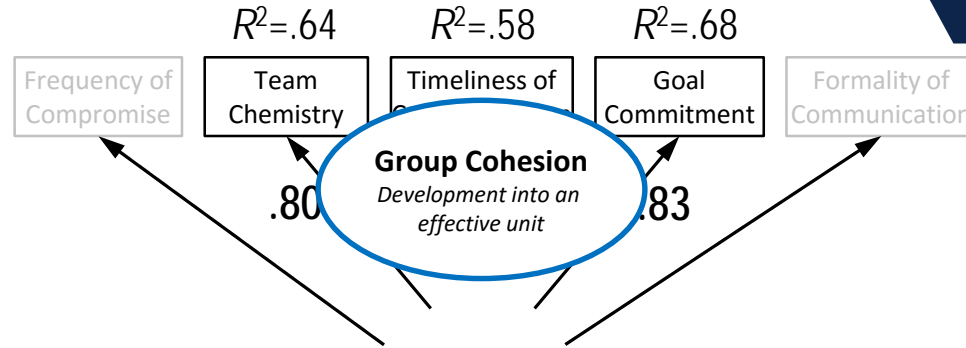
- Number of BIM uses from a predefined list
- Proportion of **core\*** project team participating in:
  - BIM planning
  - Goal setting
  - Design charrettes
  - Co-location
- Percentage of offsite prefabrication

*\*Includes owner, designer, primary contractor, MEP trades and structural trades*





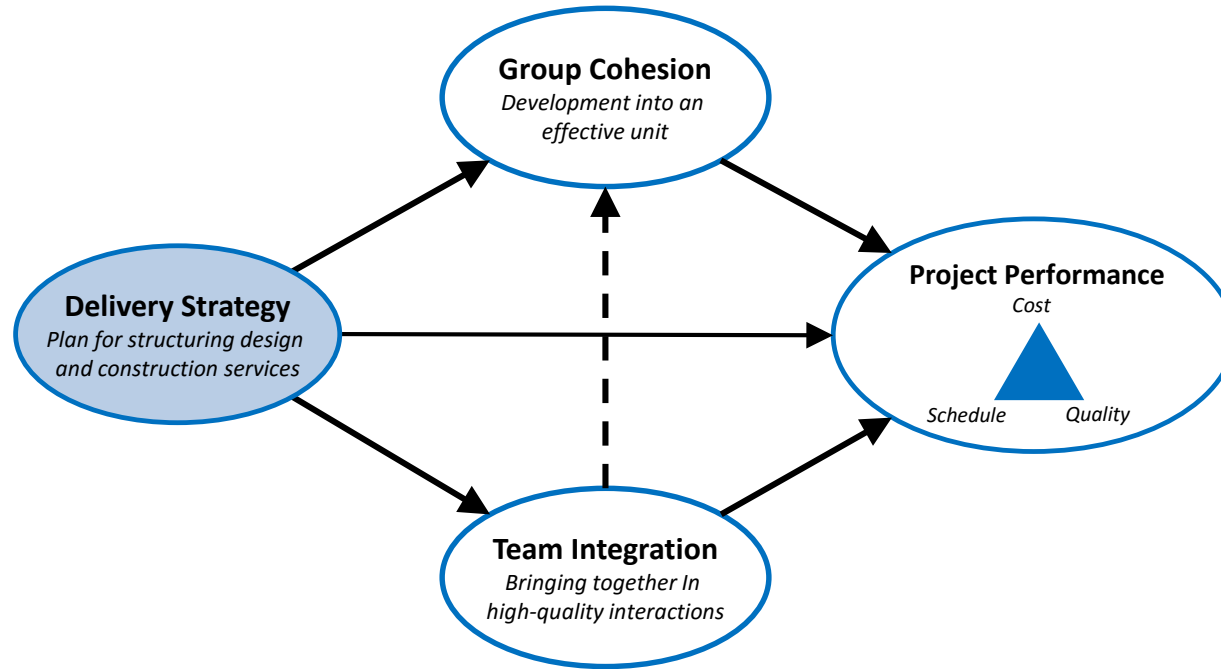
# The Factors



Measures of the **team environment**, thought to be reflective of the level of group cohesion:

- Frequency of compromise
- Team chemistry
- Timeliness of communication
- Commitment to project goals
- Formality of communication

Poor	○	○	○	○	○	○	Excellent
Never on time	○	○	○	○	○	○	Always on time
Weakly	○	○	○	○	○	○	Strongly



# The Factors

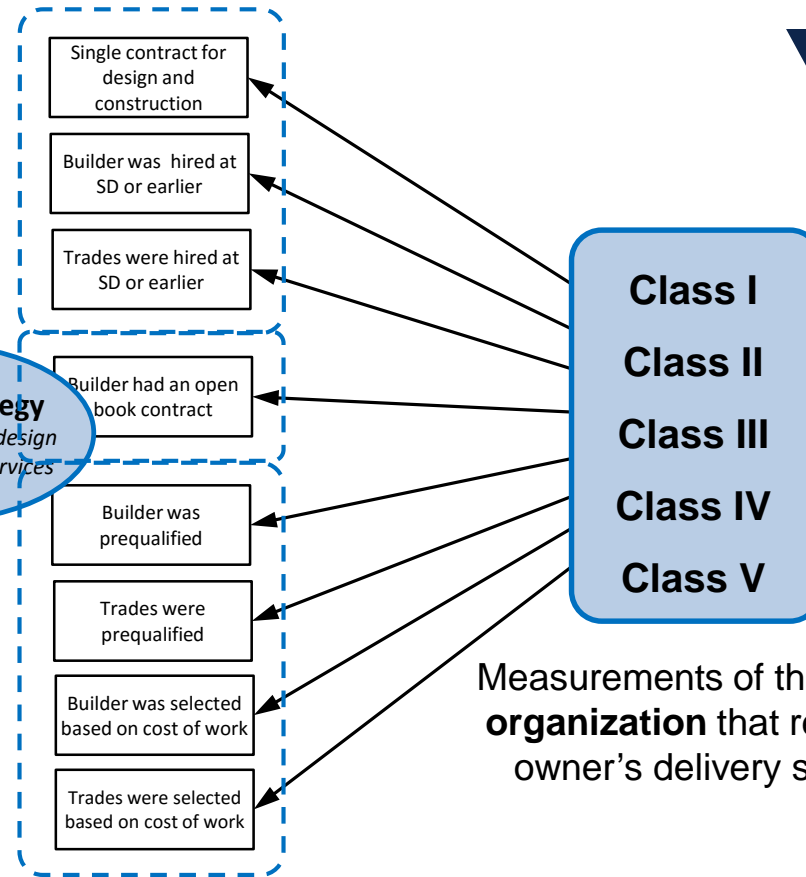
Delivery  
Method

Payment  
Terms

**Delivery Strategy**

*Plan for structuring design  
and construction services*

Procurement  
Process



Measurements of the **project organization** that reflect the owner's delivery strategy

# Timing of Involvement

## Project Delivery Strategy

Early Involvement of the Builder and/or Trades

**Class I**

Class II

**Class III**

Class IV

**Class V**

■ Primary Contractor / CM  
■ Trade Contractors

PRE = Pre-Design

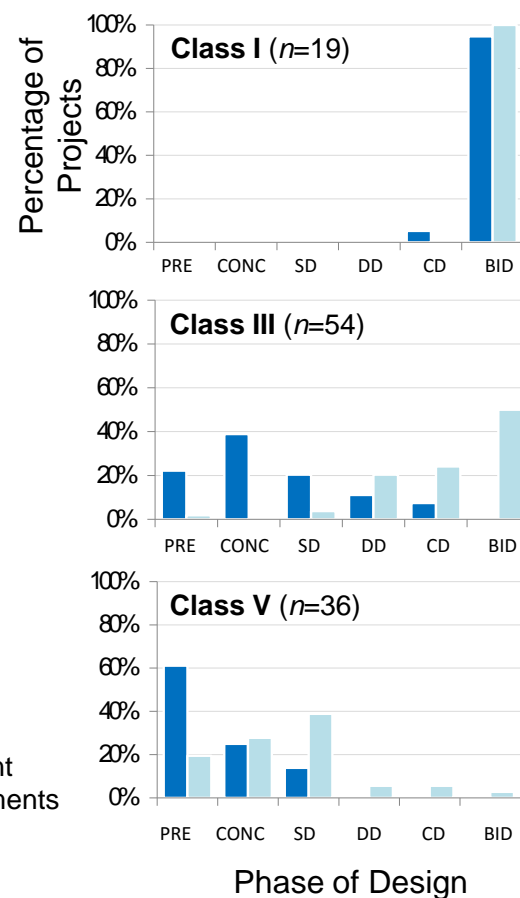
CONC = Conceptual Design

SD = Schematic Design

DD = Design Development

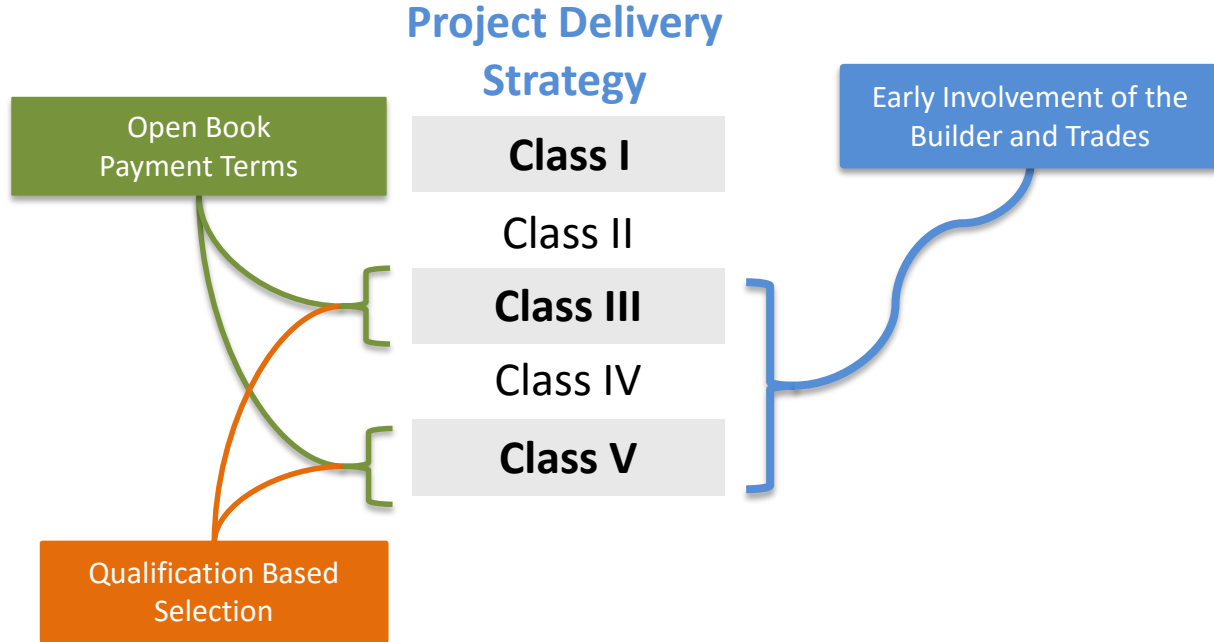
CD = Construction Documents

BID = Bidding

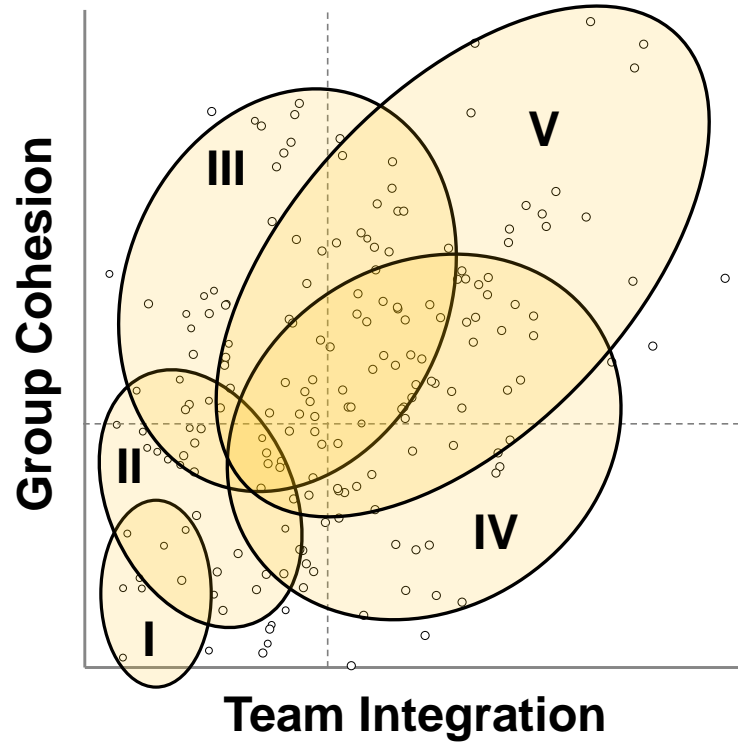




# Underlying Themes



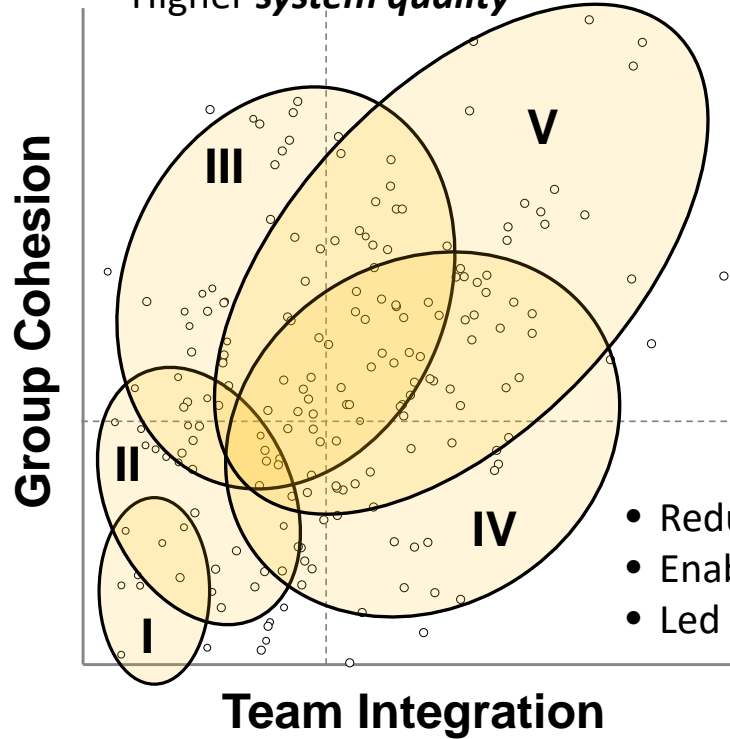
# Delivery Strategy



# The Owner's Guide

*Pulling it all together*

- Reduced **cost growth**
- Improved **turnover experience**
- Higher **system quality**



- Reduced **schedule growth**
- Enabled more **intense schedules**
- Led to **more group cohesion**

# How do I use this information for my projects?



“What if we don’t change at all ...  
and something magical just happens?”

# Maximizing Success in Integrated Projects

*An Owner's Guide*



Sponsored by the Charles Pankow Foundation and  
the Construction Industry Institute

Website: <http://bim.psu.edu/delivery>



# Workshop

## Workshop Goal

Identify the targeted delivery strategy for your project

Bring together key stakeholders ***BEFORE*** setting the strategy

## Preparation:

- Outline of project scope and goals
- Define / invite key stakeholders
- Approximate timeline / budget

### Appendix A. Project Delivery Strategy Selection Workshop

Workshop Summary	
Project Name:	
Workshop Date:	
Workshop Location:	
Facilitator:	

Workshop Participants	
Name	Email



## 1. Define Project Needs

Assess goals for management and performance

1a. Document project summary information (e.g. size, type, etc.)

1b. Determine project goals (e.g. time, cost, quality, etc.)

## 2. Explore Delivery Options

Discuss delivery decisions with attention to integrated processes and team cohesion

2a-b. Discuss organizational structure (single vs. split D&C contracts, timing of core team involvement)

2c. Discuss contract payment terms for builder and key trades (open vs. closed book)

2d-g. Discuss team assembly (e.g. selection process and criteria, prior experience, etc.)

## 3. Select Delivery Strategy

Identify an optimal delivery strategy consistent with owner constraints

3a. Identify owner's legal and policy constraints (e.g. procurement law, staff experience, etc.)

3b. Determine strategy by comparing to research results (e.g. Classes I-V)

3c. Select and Implement Project Delivery Strategy



## Owner's Project Delivery Strategy

- Project summary
- Project goals
- Etc.

# Step 1a

## Define Project Needs

Formally document the project purpose and scope

a.

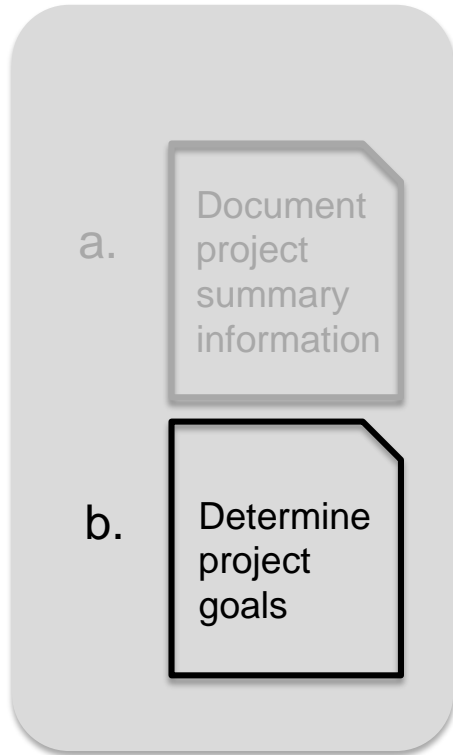
Document project summary information

b.

Determine project goals

Project Attributes
Project Name:
Location:
Estimated Budget (or range):
Estimated Project Delivery Period:
Estimated Size (or range, in square feet):
Required Delivery Date (if applicable):
Source(s) of Project Funding:
Function Project Scope (i.e., what will be delivered):
Major Schedule Milestones:
Major Project Stakeholders:

## Step 1b



# Define Project Goals

Define the specific goals for the project and functionality of the completed facility.

Project-Specific Goals
Goal #1:
Goal #2:

## Schedule

- Accelerate start of project revenue

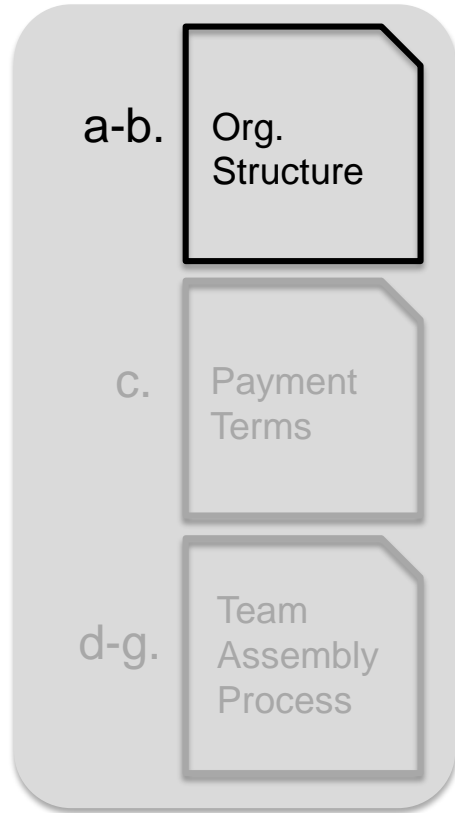
## Cost

- Maximize value for project budget
- Complete the project on budget

## Functional

- Minimize inconvenience to current facility users

## Step 2a-b



# Explore Delivery Options

Discuss the organizational structure

**Multiple Contracts:** Design and construction responsibility can be split into separate contracts. Design-bid-build contract forms have a clear separation with the builder's contract beginning after design is complete. Construction manager at risk forms of contract have separable preconstruction and construction contracts for the builder.

Opportunities	Obstacles

## Design Responsibility

- Shared contract or split

## Early Involvement

- Builder
- Specialty Trades

## Timing of Involvement

- Pre-Schematic Design
- Late Design
- Post-Design

## Step 3b

a. Identify Constraints

b. Compare delivery decisions

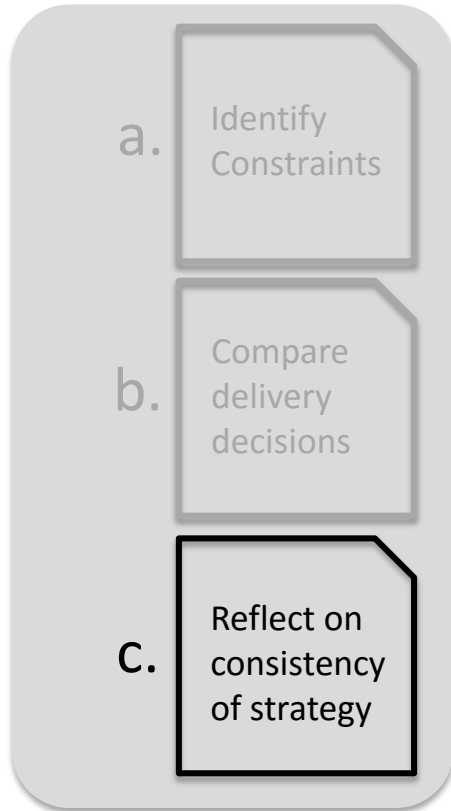
c. Reflect on consistency of strategy

# Compare by Strategy

Apply underlying themes to inform strategy decisions

Selection Factors	Delivery Strategy Selection				
	I	II	III	IV	V
<b>Box 2a. Design Responsibility</b>	Separate	Separate	Separate	Combined	Separate; Combined
<b>Box 2b. Timing of Involvement</b>					
<i>Primary Builder</i>	CD or later	DD or CD; CD or later	Pre-SD	Pre-SD	Pre-SD
<i>Key Specialty Trades</i>	CD or later	DD or CD; CD or later	DD or CD; CD or later	Pre-SD; DD or CD	Pre-SD
<b>Box 2c. Cost Transparency</b>	Closed book	Closed book; Open book	Open book	Closed book	Closed book, Open book
<b>Box 2d. Selection Criteria</b>					
<i>Primary Builder</i>	Price only; Best value	Best value	Best value; QBS	Best value	QBS
<i>Key Specialty Trades</i>	Price only	Price only; Best value	Price only; Best value	Best value	QBS
<b>Box 2e. Prequalification</b>					
<i>Primary Builder</i>	Open	Shortlist	Open; Shortlist	Shortlist	Shortlist
<i>Key Specialty Trades</i>	Open	Shortlist	Shortlist	Shortlist	Open; Shortlist
<b>Box 2f. Experience Working Together</b>	First time	First time	Repeat	First time; Repeat	Repeat
<b>Box 2g. Interview Process</b>	No interview	No interview	Interview	Interview	Interview

## Step 3c



# Reflect on Consistency

Regardless of the selected strategy, consider implementing these critical success factors:

## Integrated Processes

- Number of BIM uses from a predefined list
- Proportion of **core\*** project team participating:
  - BIM planning
  - Goal setting
  - Design charrettes
  - Co-location

## Behaviors leading to Team Cohesion

- Team chemistry
- Timeliness of communication
- Commitment to project goals

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<http://bim.psu.edu/delivery>

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Website: <http://bim.psu.edu/delivery>





# How can you help inform the process?



# GET SMART



1st THING

# MAKE THE MENTAL SHIFT



# RIGHT PERSON IN THE RIGHT SEAT ON THE BUS



# INTEGRATION IS A TEAM SPORT

POETRY IN  
MOTION







to



**Procurement**

**Contracts**

**Execution**

# educate



Contact Your  
OWNERS  
**NOW!**

# Impacts of this Research

- Federal Owners and State agencies are strategically determining best project delivery strategies to maximize success
- Maximizing success requires a holistic strategy, an integrated team and a motivated group of individuals





# What you should remember?

- Best path to project success is through building a **TEAM** – integration / cohesion
- Teams are influenced through project delivery decisions – ***early involvement, open book, qualifications driven***
- Project Delivery needs to be developed as a **strategy** across the project



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