

# **Construction Industry Institute**

**Northwest Construction**

**Consumer Council**

**Construction Conference & Exposition**

**October 23 & 24, 2000**

**Ned Givens**

**CII Associate Director**

# CII ...

- a unique consortium of owners, designers, builders, vendors, and universities formed to improve the capital project delivery process

# **CII Mission**

**To improve the safety, quality, schedule, and cost effectiveness of the capital investment process through research and implementation support for the purpose of providing a competitive advantage to its members in the global marketplace**

# CII Owner Members

**3M**

**Abbott Labs**

**Air Products & Chemicals**

**Alcoa**

**Anheuser-Busch**

**Aramco Services**

**Atlantic Richfield**

**BP Amoco**

**Bayer**

**Celanese**

**Champion International**

**Chevron**

**CITGO**

**Dow Chemical**

**DuPont**

**Eastman Chemical**

**Exxon Research & Engineering**

**FPL Energy**

**General Motors**

**General Services Administration**

**Intel**

**Eli Lilly and Company**

# **CII Owner Members**

**(continued)**

**LTV Steel**

**Mobil**

**NASA**

**NAVFAC**

**Ontario Power Generation**

**Phillips Petroleum**

**Procter & Gamble**

**Reliant Energy**

**Rohm and Haas**

**Shell Oil**

**Solutia**

**Tennessee Valley Authority**

**Texaco**

**U.S. Air Force Research Laboratory**

**U.S. Army Corps of Engineers**

**U.S. Department of Commerce**

**U.S. Department of State**

**U.S. Steel**

**Union Carbide Corporation**

**The University of Texas System**

**Weyerhaeuser Company**

# **CII Contractor Members**

**ABB Lummus Global**

**BE&K**

**BMW Constructors**

**Bechtel Group**

**Black & Veatch**

**Burns and Roe**

**Butler Manufacturing**

**CDI Engineering**

**Chemtex International**

**Cherne Contracting**

**Chicago Bridge & Iron**

**Cianbro**

**Day & Zimmermann International**

**Dick Corporation**

**Dillingham Construction Holdings**

**Eichleay Holdings**

**Fisher Controls International**

**Fluor Daniel**

**Foster Wheeler USA**

**Fru-Con Construction**

**James N. Gray Company**

**Graycor**

# **CII Contractor Members**

**(continued)**

**H+M Construction**

**Hilti**

**Honeywell**

**International Technology**

**Jacobs Engineering Group**

**J. A. Jones**

**Kellogg Brown & Root**

**Kiewit Construction**

**Kværner**

**Morrison Knudsen**

**M. A. Mortenson**

**Murphy Company**

**The Parsons Corporation**

**Praxair**

**Raytheon Engineers & Constructors**

**S&B Engineers and Constructors**

**SAP America**

**Stone & Webster Engineering**

**Walbridge Aldinger**

**H. B. Zachry**

# Participating Universities

Arizona State

Auburn

Cal-Berkeley

Carnegie Mellon

Clemson

Colorado

Columbia

Georgia Tech

Florida

Iowa State

Kentucky

Lehigh

MIT

New Mexico

North Carolina State

Oklahoma State

Oregon State

Pennsylvania State

Polytechnic University NY

Purdue

Stanford

Texas

Texas A&M

Virginia Tech

Washington

Wisconsin

Worcester Polytechnic

Xavier



# **Construction Industry Institute**

## **Impacts of Design/Information Technology on Project Outcomes**

# **Construction Industry Institute**

## **Performance Parameters**

- Project Cost Growth**
- Project Schedule Growth**
- Recordable Incident Rate (RIR)**
- Lost Workday Case Incident Rate (LWCIR)**
- Field Rework Cost Factor**

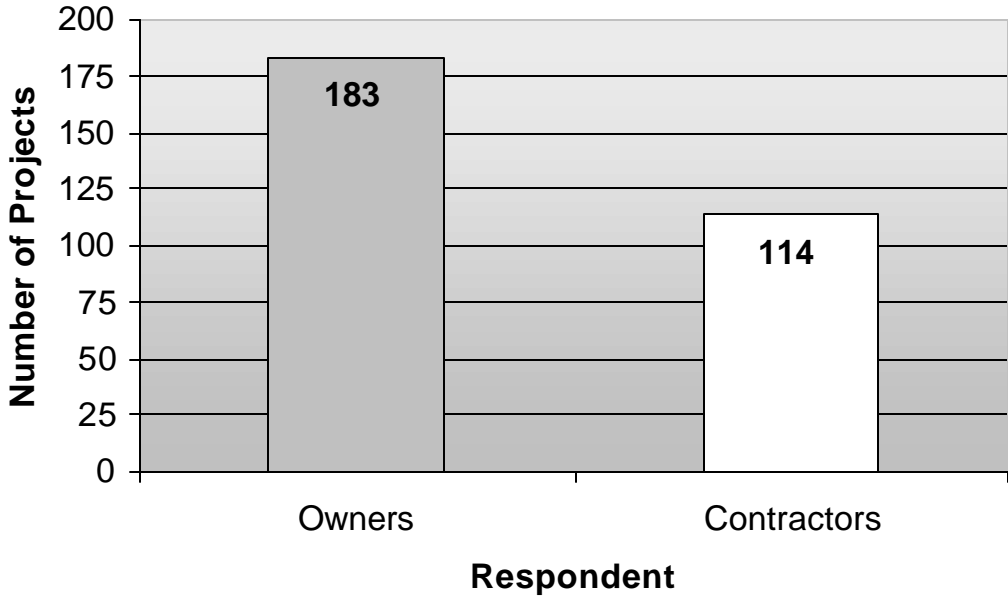
# **Construction Industry Institute**

## **Performance Metrics**

- Bar Coding**
- Integrated Database**
- 3D CAD**
- Electronic Data Interchange (EDI)**

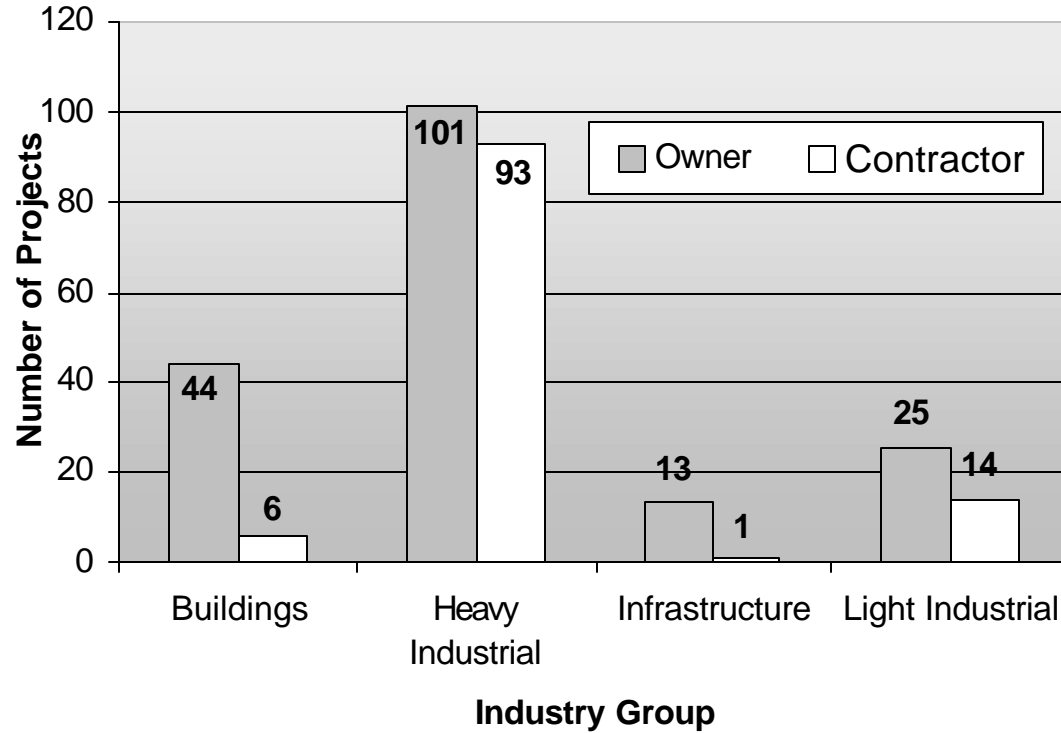
# Construction Industry Institute

---



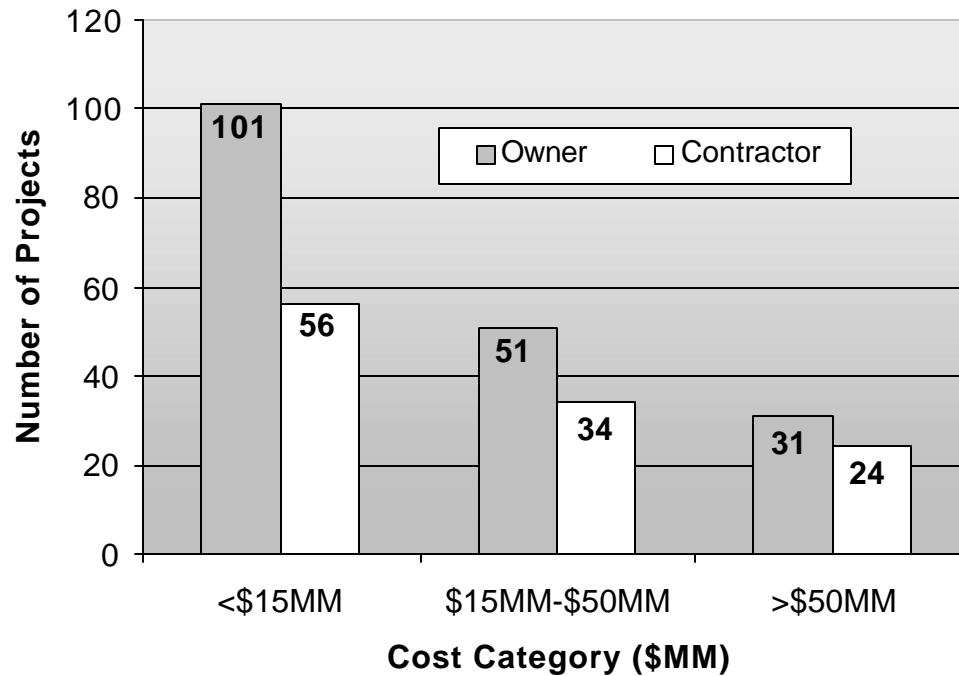
# Construction Industry Institute

---



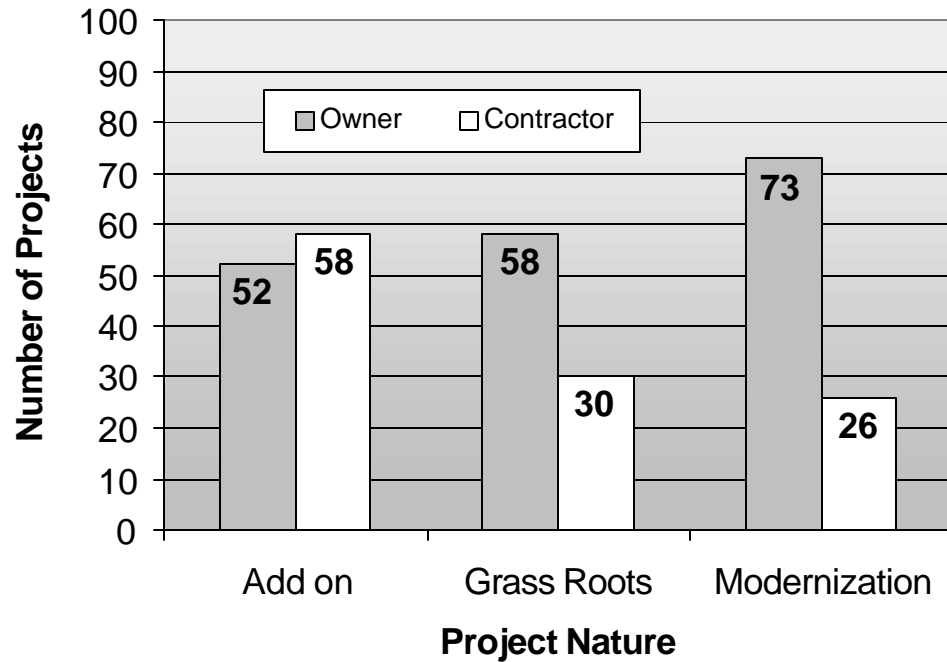
# Construction Industry Institute

---



# Construction Industry Institute

---



# Construction Industry Institute

| <b>Performance Metric</b>       | <b>Owners</b> | <b>Contractors</b> |
|---------------------------------|---------------|--------------------|
| <b>Cost Growth</b>              | -0.026        | 0.041              |
| <b>Schedule Growth</b>          | 0.045         | 0.025              |
| <b>R.I.R.</b>                   | 2.184         | 2.203              |
| <b>L.W.C.I.R.</b>               | 0.585         | 0.093              |
| <b>Field Rework Cost Factor</b> | 0.054         | 0.030              |



# Construction Industry Institute

| Practice Use | Owners | Contractors |
|--------------|--------|-------------|
| 100%         | 7.88   | 8.23        |
| 75%          | 1.79   | 2.88        |
| 50%          | 0.75   | 1.48        |
| 25%          | 0.00   | 0.56        |
| 0%           | 0.00   | 0.00        |
| Mean         | 1.28   | 2.01        |

# Construction Industry Institute

| <b>Outcome Metric</b><br><b>-Owners-</b> | <b>4th</b> | <b>3rd</b> | <b>2nd</b>    | <b>1st</b>    |
|--|------------|------------|---------------|---------------|
| <b>Project Cost</b>                      | -0.020     | -0.020     | <b>-0.034</b> | -0.028        |
| <b>Growth</b>                            |            |            |               |               |
| <b>Schedule Growth</b>                   | 0.055      | 0.088      | <b>0.026</b>  | 0.030         |
| <b>R.I.R.</b>                            | 3.015      | 2.081      | 2.444         | <b>1.439</b>  |
| <b>L.W.C.I.R.</b>                        | 0.529      | 1.017      | 0.653         | <b>0.238*</b> |
| <b>Field Rework</b>                      | 0.060      | 0.043*     | <b>0.052</b>  | 0.059         |
| <b>Cost Factor</b>                       |            |            |               |               |

# Construction Industry Institute

| <b>Outcome Metric<br/>-Contractors-</b> | <b>4th</b> | <b>3rd</b> | <b>2nd</b>   | <b>1st</b>   |
|---|------------|------------|--------------|--------------|
| <b>Project Cost</b>                     | 0.040      | 0.099      | 0.027        | <b>0.010</b> |
| <b>Growth</b>                           |            |            |              |              |
| <b>Schedule Growth</b>                  | 0.040      | 0.017      | <b>0.016</b> | 0.026        |
| <b>R.I.R.</b>                           | 2.957*     | 1.820*     | 2.291*       | 1.829        |
| <b>L.W.C.I.R.</b>                       | 0.000*     | 0.077*     | 0.137*       | 1.163        |
| <b>Field Rework<br/>Cost Factor</b>     | C.T.       | C.T.       | 0.026*       | 0.024*       |

# Construction Industry Institute

| • Project | Type  | Nature      | Cost<br>(\$MM) | Const.<br>Dur. |
|-----------|-------|-------------|----------------|----------------|
| • O1      | Chem. | Grass Roots | 56.6           | 12             |
| • O2      | Chem. | Grass Roots | 66.4           | 13             |
| • O3      | Chem. | Grass Roots | 137.0          | 12             |
| • C1      | Chem. | Grass Roots | 41.6           | 12             |
| • C2      | Chem. | Addition    | 173.6          | 21             |
| • C3      | Chem. | Addition    | 156.4          | 16             |

# Construction Industry Institute

| <b>Outcome Metric<br/>Owners</b>  | <b>O1</b>    | <b>O2</b>    | <b>O3</b>    | <b>CII</b> |
|-----------------------------------|--------------|--------------|--------------|------------|
| • Cost Growth (%)                 | -15.7*       | -18.8*       | -5.5         | -4.3       |
| • Schedule Growth (%)             | -9.0*        | -7.2         | -8.8*        | 3.1        |
| • Recordable Incident Rate        | 0.80         | 1.45         | 0.73         | 2.1        |
| • <b>D/IT Use (0 to 10 scale)</b> | <b>5.24*</b> | <b>2.44*</b> | <b>5.38*</b> | <b>1.7</b> |
| – Integrated Database             | X            | N            | X            |            |
| – EDI                             | X            | X            | X            |            |
| – 3D CAD                          | X            | X            | X            |            |
| – Bar Code                        | X            | S            | N            |            |

# Construction Industry Institute

| <b>Outcome Metric<br/>Contractors</b> | <b>C1</b>   | <b>C2</b>    | <b>C3</b>   | <b>CII</b>  |
|---------------------------------------|-------------|--------------|-------------|-------------|
| • Cost Growth (%)                     | -8.5*       | -11.1*       | 1.4         | 3.6         |
| • Schedule Growth (%)                 | -46.4*      | 3.0          | 0.0         | 2.3         |
| • Recordable Incident Rate            | 0.90        | 1.74         | 0.34*       | 2.07        |
| • <b>D/IT Use (0 to 10 scale)</b>     | <b>4.3*</b> | <b>4.55*</b> | <b>5.3*</b> | <b>2.19</b> |
| – Integrated Database                 | X           | X            | X           |             |
| – EDI                                 | X           | X            | X           |             |
| – 3D CAD                              | X           | X            | X           |             |
| – Bar Code                            | X           | X            | X           |             |

# Construction Industry Institute

## BAR CODING

- **Lessons Learned**
  - **Cost not justified for tracking pipe spool (\$/piece)**
  - **Time card abuse by employees**

# **Construction Industry Institute**

## **BAR CODING**

- **Standard Use - Current**
  - Employee badging
  - Time sheets – job coding, payroll
  - Material receipt/tracking
- **Limited Use - Current**
  - Inventory control
  - Tool control
  - Job progress reporting



# **Construction Industry Institute**

## **BAR CODING**

- **Likely Expanded Use**
  - **Bill of materials coding**
  - **Job progress reporting/tracking**

# **Construction Industry Institute**

## **INTEGRATED DATABASE**

- **Lessons Learned**
  - **Software compatibility problems were experienced**
  - **Provided time & dollar savings for owners & contractors**
  - **Compatible capabilities by both owner & contractor are key to expanded use**

# **Construction Industry Institute**

## **INTEGRATED DATABASE**

- **Standard Use - Current**
  - For conceptual to final design phase by owners & contractors
  - Material tracking within the organization
  - Internal productivity reports, actual vs budget
- **Limited Use - Current**
  - During construction by owners & contractors
  - International design “links”

# **Construction Industry Institute**

## **INTEGRATED DATABASE**

- **Likely Expanded Use**
  - **More international design**
  - **Owner/contractor links**

# **Construction Industry Institute**

## **3D CAD**

- **Lessons Learned**
  - **Biggest savings result from reduced rework**
  - **Cycle time was reduced by more concurrent work**
  - **Cost savings were realized from precise material take-offs**

# Construction Industry Institute

## 3D CAD

- **Standard Use - Current**
  - Interference checking
  - Material take-off
  - Fabrication drawings
- **Limited Use - Current**
  - Piping
  - Structural
  - Electrical – conduits & cable trays, lighting

# **Construction Industry Institute**

## **3D CAD**

- **Likely Expanded Use**
  - **More components being added to design**
  - **Increased integration with engineering analysis software**
  - **For virtually all designs regardless of size/cost**

# **Construction Industry Institute**

## **EDI**

- **Lessons Learned**
  - **EDI supports successful alliances with suppliers**
  - **Use promotes design efficiency: more likely to get exact product needed, material take-offs can be done by supplier, only exact inventory is paid for**



# **Construction Industry Institute**

## **EDI**

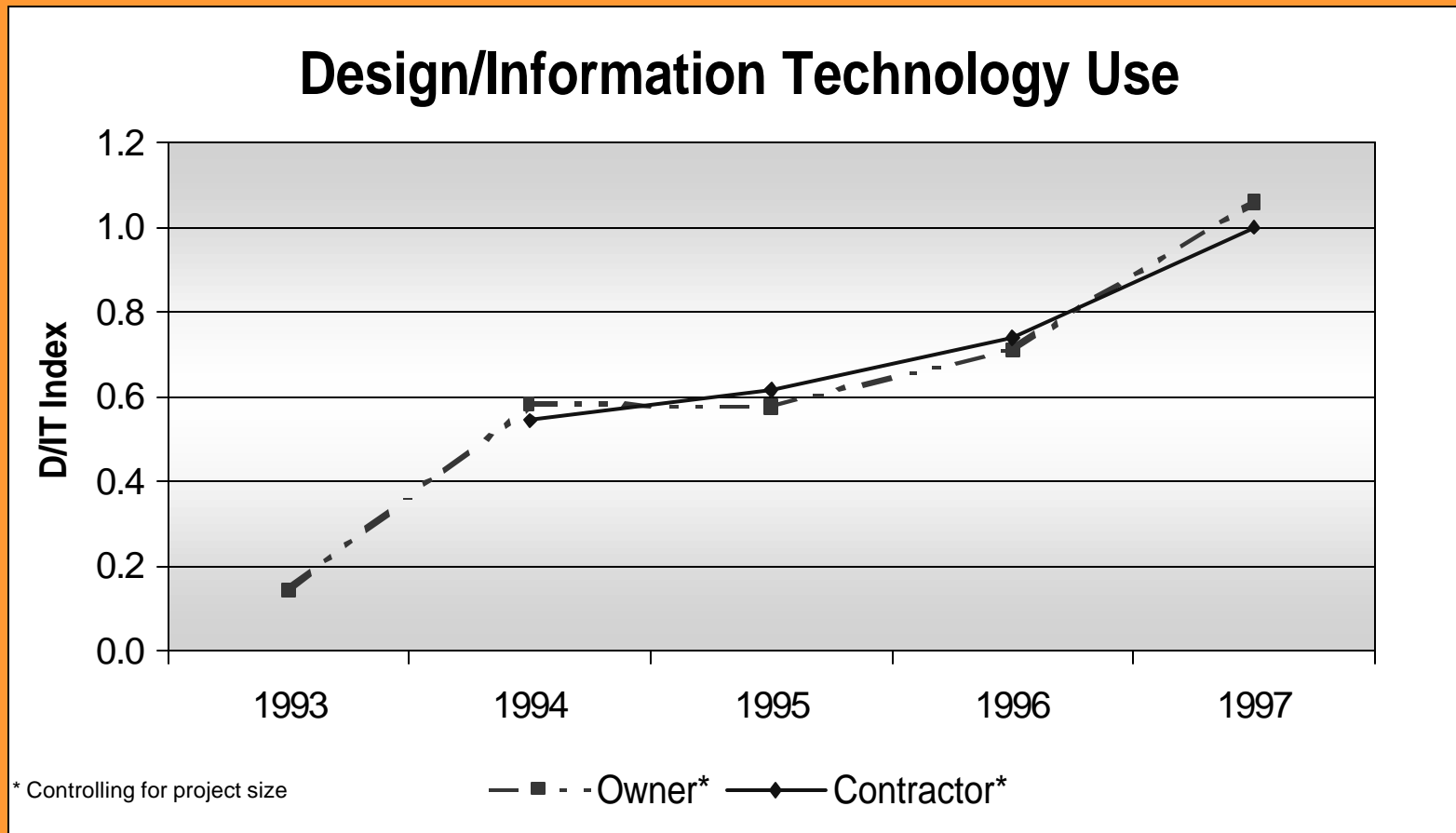
- **Standard Use - Current**
  - **Electronic funds transfer**
  - **Purchase orders**
  - **Material releases**
- **Limited Use - Current**
  - **Transferring design specifications**
  - **Supplier alliances**
  - **Inspection reports to vendors**

# **Construction Industry Institute**

## **EDI**

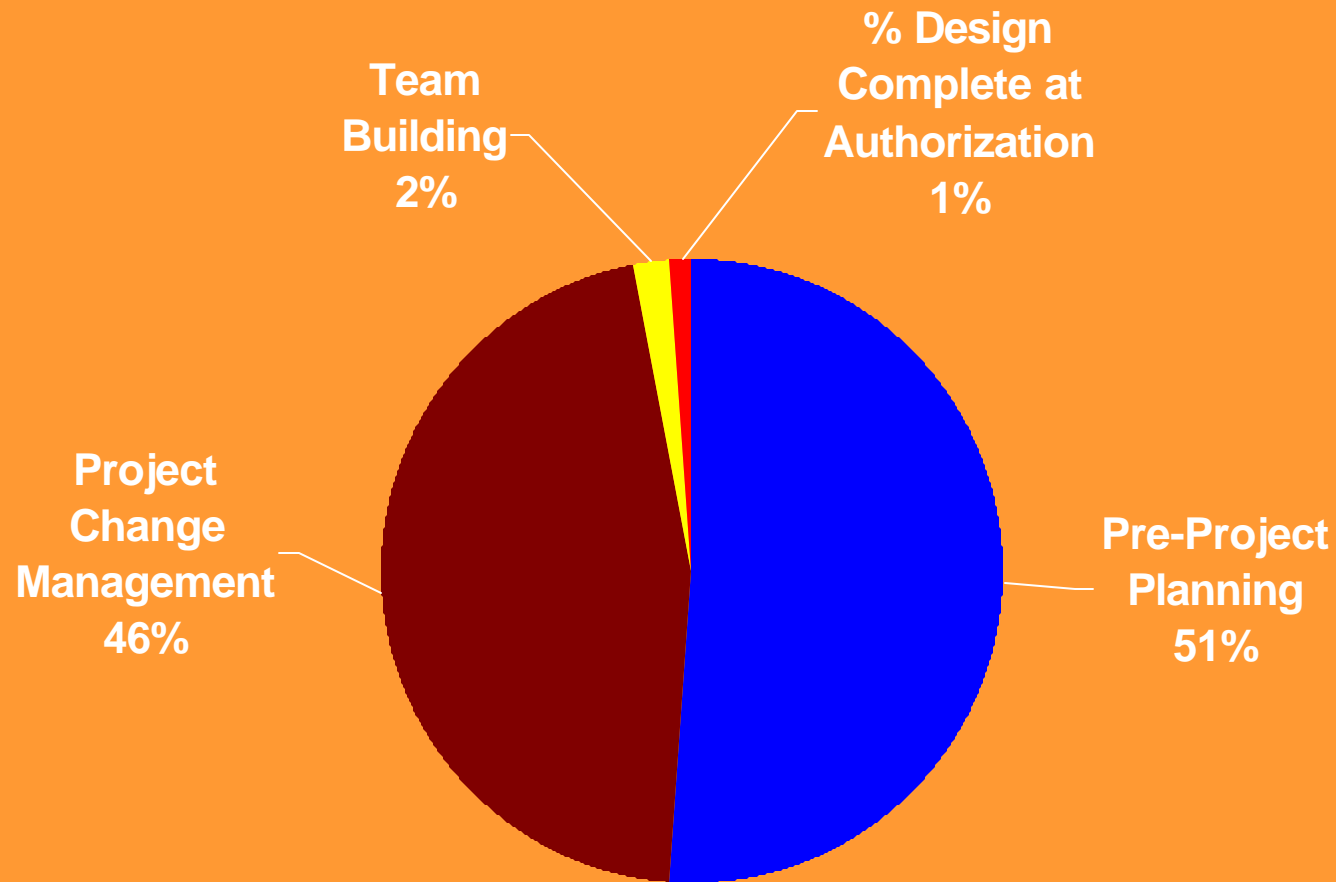
- **Likely Expanded Use**
  - **Drawings & specifications transfer for bids**
  - **More alliances**

# Construction Industry Institute



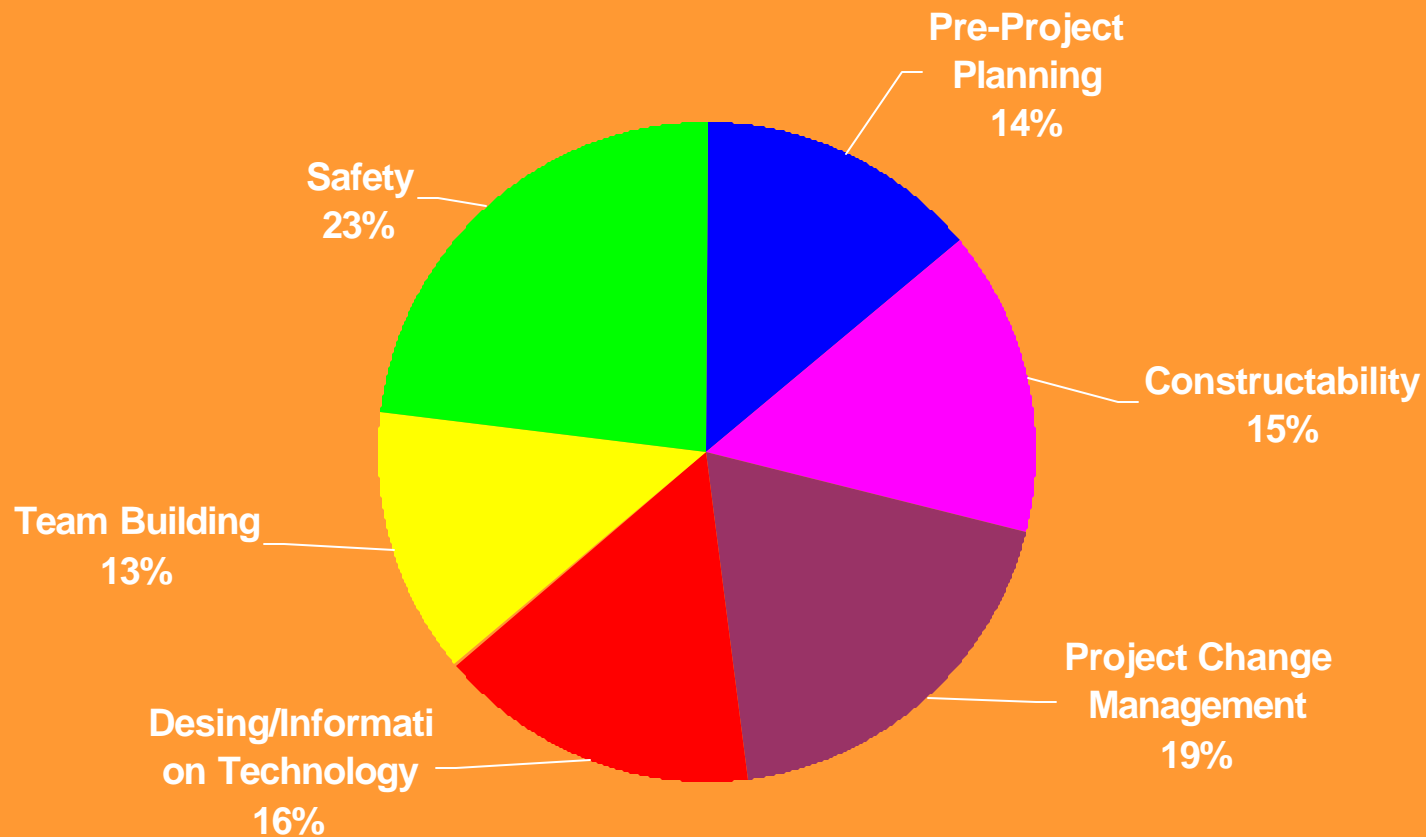
# Relative Cost Benefit of Practice Use

Respondent: Owners  
Industry: Heavy Industrial



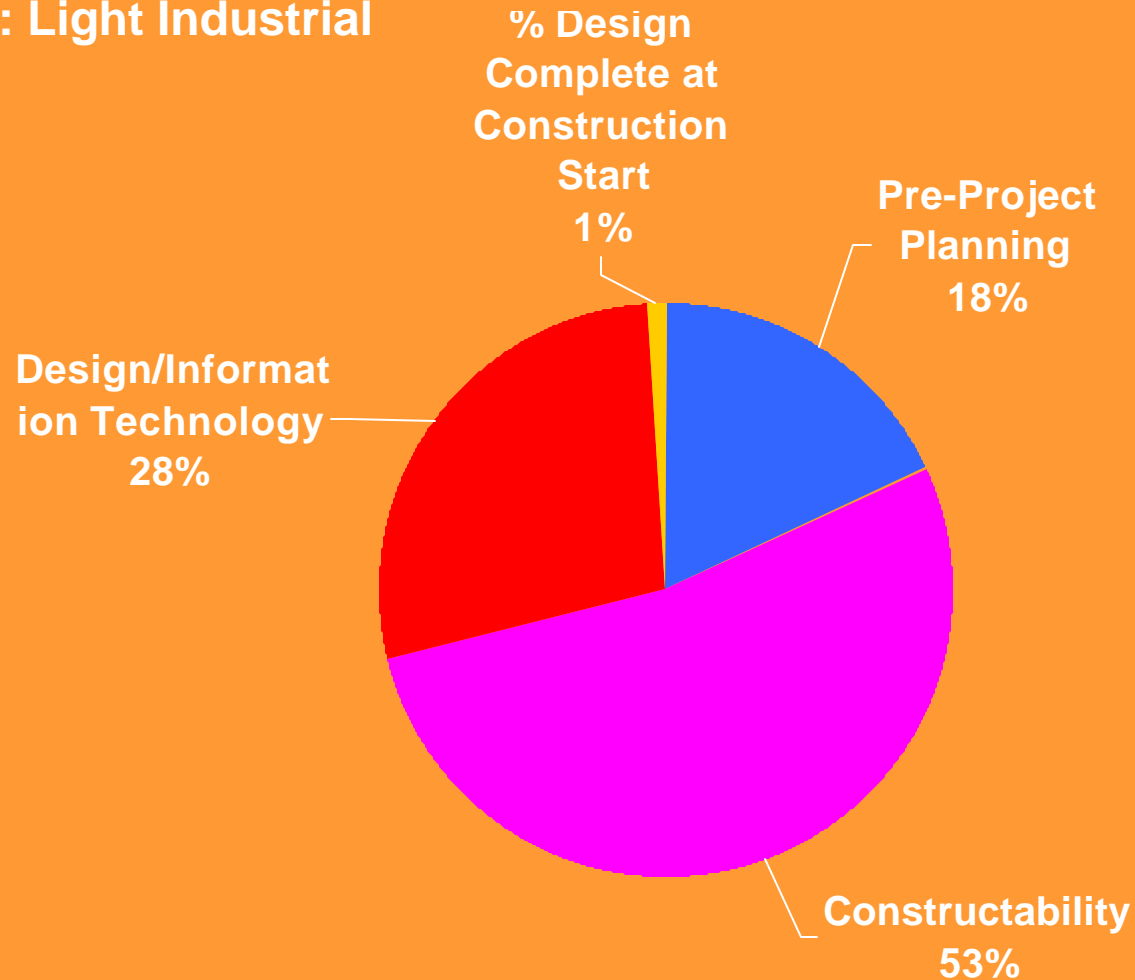
# Relative Cost Benefit of Practice Use

Respondent: Contractors  
Industry: Heavy Industrial



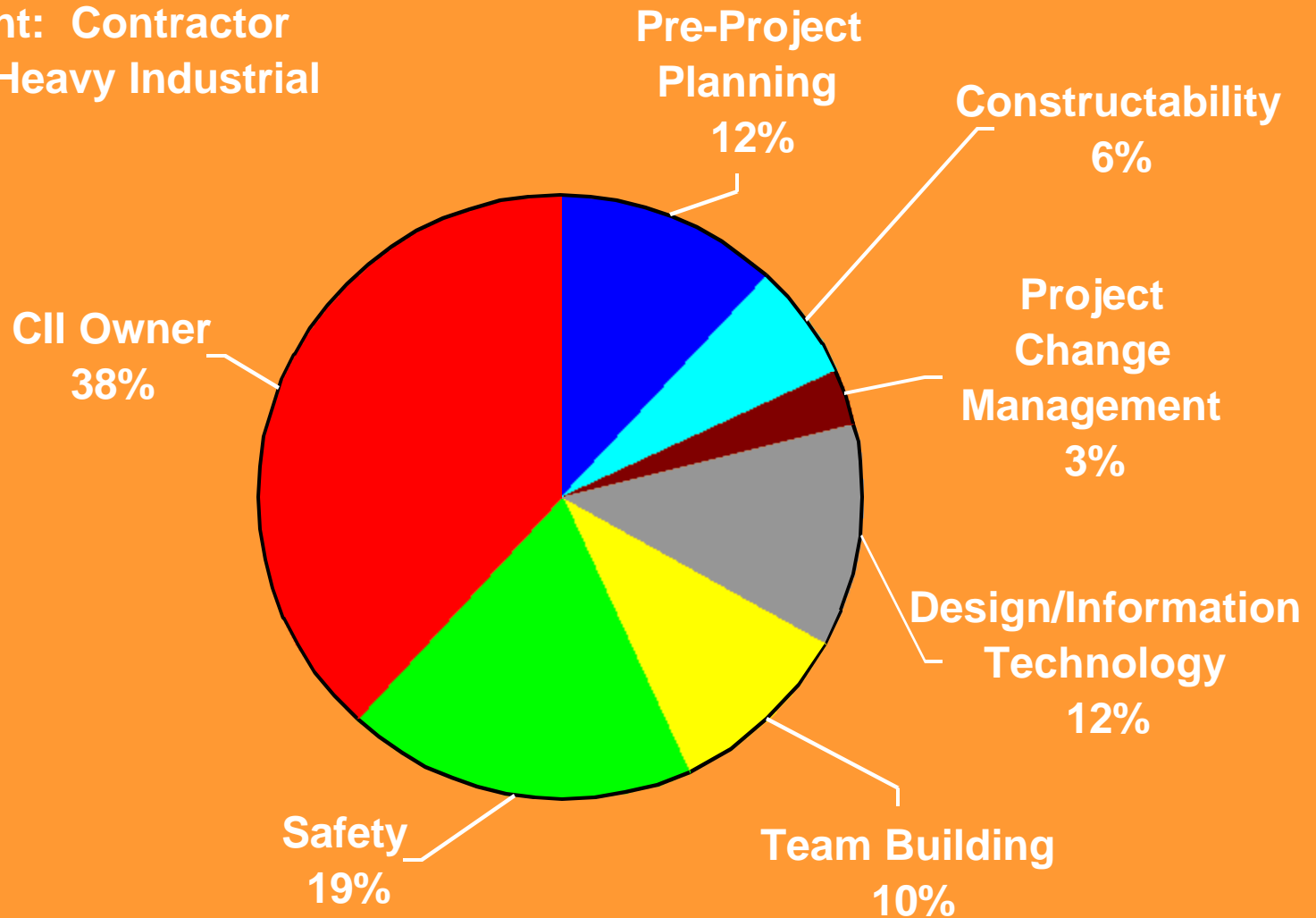
# Relative Schedule Benefit of Practice Use

Respondent: Owners  
Industry: Light Industrial



# Importance of Who You Work For

Respondent: Contractor  
Industry: Heavy Industrial



# **Introducing FIATECH**

## **An Overview**

---

**October, 2000**





*Bringing High Technology  
to Capital Facilities*

# FIATECH Vision

**Owners, contractors, and suppliers dramatically improving the effectiveness of large capital facilities - engineering, construction and operation - through the integrated application and deployment of the latest computer, automation, advanced communications, and other technologies.**



*Bringing High Technology  
to Capital Facilities*

# FIATECH Mission

---

To provide leadership, direction and the forum to undertake collaborative **Research, Development and Deployment, **RD&D**, leading to fully integrated and automated capital project processes, FIAPP, for the purpose of reducing cycle time and costs, and improving the effectiveness of capital facilities in the context of the owner's corporate enterprise.**

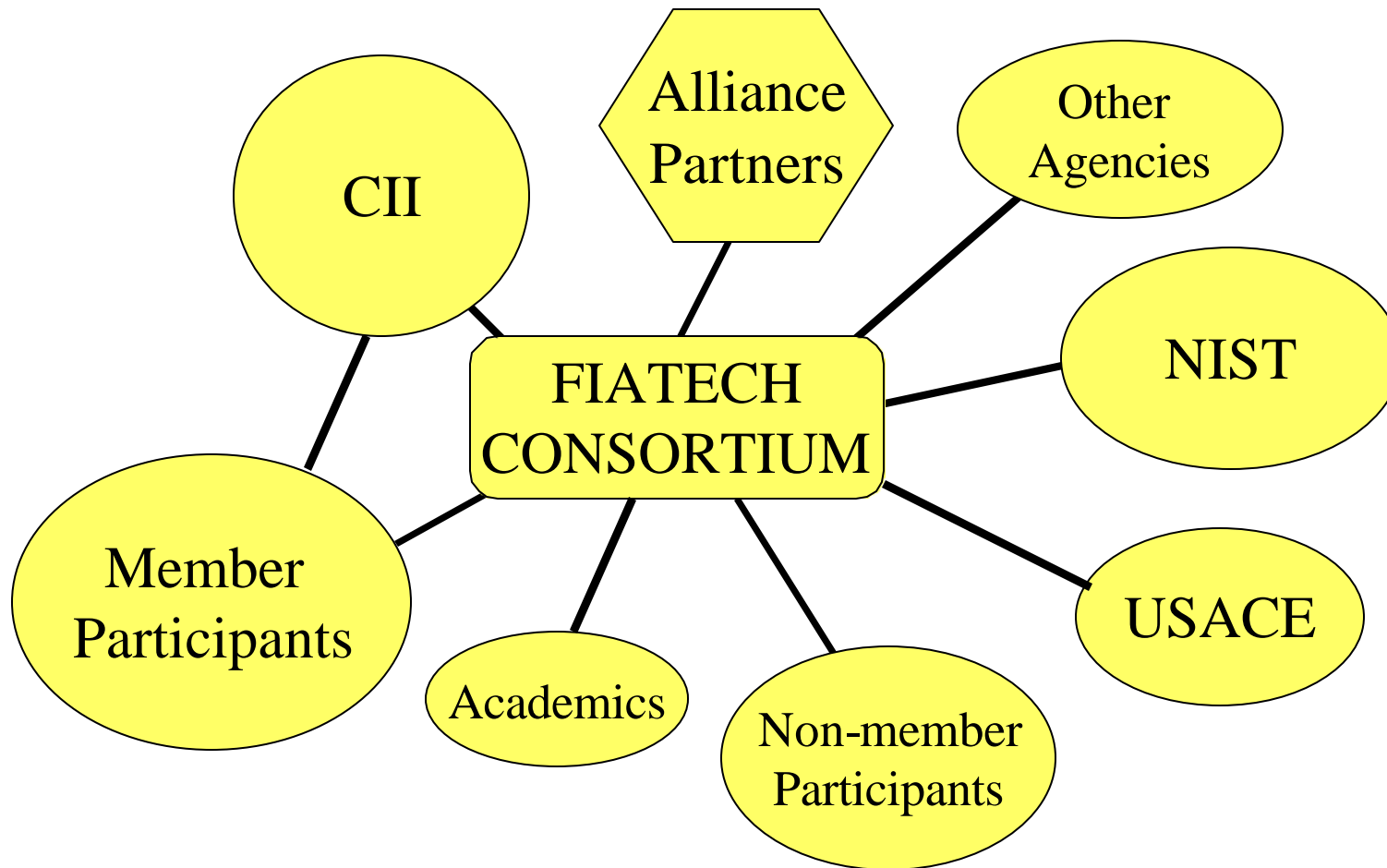
# FIATECH

*Bringing High Technology  
to Capital Facilities*

# FIATECH

## Consortium Participants

---





*Bringing High Technology  
to Capital Facilities*

# FIATECH Members

---

## **Who FIATECH is:**

**Membership in FIATECH is open to Owners, Contractors, Suppliers, and others committed to achieving FIAPP and seamless integration of facilities in improving enterprise performance.**

## **Charter members include:**

**Air Products & Chemicals, BASF, Burns and Roe, Day and Zimmerman, DowChemical, DuPont, Eichleay Holdings, General Motors, Jacobs Engineering, Merck, NASA, Stone and Webster, H. B. Zachry**



*Bringing High Technology  
to Capital Facilities*

# **FIATECH Members**

**October, 2000**

**ABB Lummus Global**

**AEA Technology**

**Engineering Software**

**ASD International**

**Air Products and  
Chemicals**

**Army Corps of Engineers**

**Aspen Technology**

**BASF Corporation**

**B E & K**

**Bechtel**

**Bentley Systems**

**Burns and Roe Enterprises**

**Cadcentre**

**Cyra Technologies**

**Day & Zimmermann  
International**

**Dick Corporation**

**The Dow Chemical  
Company**

**Dow Corning**

**E.I. DuPont de Nemours**

**Eichleay Holdings**

**FileNET**



*Bringing High Technology  
to Capital Facilities*

# **FIATECH Members**

---

**October, 2000**

**Flour**

**General Motors**

**ICARUS**

**INOV<sub>x</sub>**

**Intergraph**

**Jacobs Engineering Group**

**Kvaerner**

**Lockwood Greene**

**Engineers**

**Matrix One**

**Merck & Co.**

**Millennium Inorganic  
Chemicals**

**NASA**

**NIST/Building & Fire  
Research Lab**

**Parsons Energy &  
Chemicals**

**Primavera Systems**

**Quillion**

**SAP America**

**Stone & Webster  
Engineering**

**Union Carbide**

**H. B. Zachry Company**



*Bringing High Technology  
to Capital Facilities*

# FIATECH Organization

---

- **Board of Directors**

**The principal policy-making body of FIATECH and the final governing body**

- **Strategic Focus Areas (SFA)**

**The entity charged with developing high level goals and objectives, a strategy for accomplishing those goals and objectives, and oversight of mission accomplishments within a well-defined area of member interest.**



*Bringing High Technology  
to Capital Facilities*

# FIATECH Organization

---

- **Possible SFAs include:**
  - **Owner-Operator FORUM for User Requirements (Chartered)**
  - **Capital Projects Integration Software**
  - **Data Definitions and Structures**
  - **Field Measurements and Integration**
  - **Automation Technologies and Integration**





*Bringing High Technology  
to Capital Facilities*

# SFA Operations

---

- **SFAs function as focus area/interest groups within FIATECH**
- **Members choose to participate**
- **SFAs are led by elected Boards to develop high level goals and objectives, and a strategy for accomplishing those goals and objectives**



*Bringing High Technology  
to Capital Facilities*

# SFA Operations

---

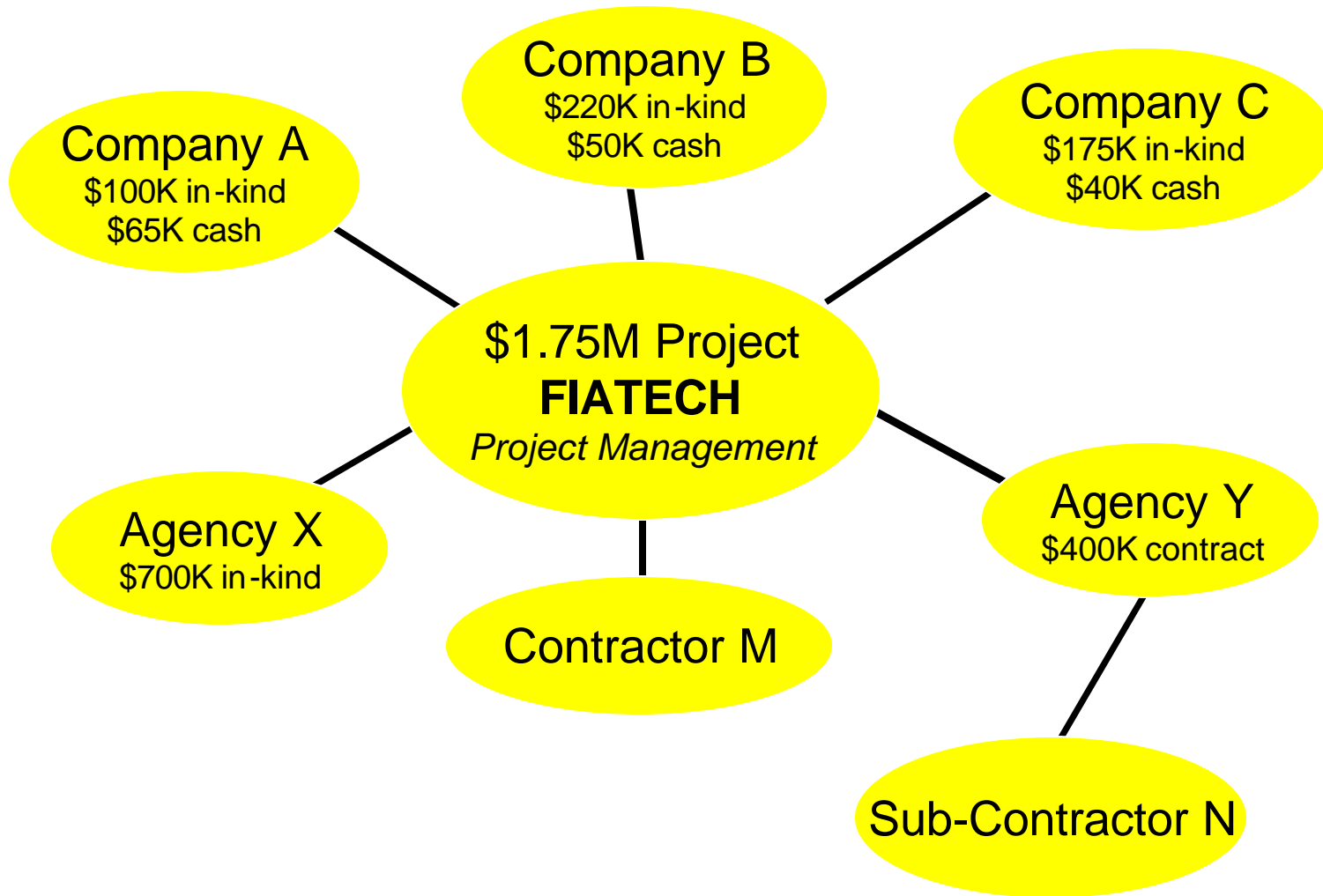
- **Hold annual workshops to develop or initiate projects**
- **Most SFA activities supported by FIATECH dues**
- **Develop and seek sponsorship of projects**



Bringing High Technology  
to Capital Facilities

# A Hypothetical FIATECH Leveraged Funding Project

---





*Bringing High Technology  
to Capital Facilities*

# How Activities Are Paid For...

---

## **Dues:**

- **Industry Forums and networking opportunities**
- **Creating Collaborative Project Concepts**
- **Workshops**
- **Government Liaison**
- **Information Research**



*Bringing High Technology  
to Capital Facilities*

# How Activities Are Paid For...

---

## Participant Investors/Other Investors:

- Statement of Work/ Work Breakdown
- Structure Preparation
- Proposal Preparation
- Collaborative Project Management
- Technical/ Financial/ Legal
- Deployment and Training



*Bringing High Technology  
to Capital Facilities*

# Membership & Dues Structure

---

- **Membership Criteria**

- Committed to FIAPP principles
- North American manufacturing
- Board approved

- **Dues**

- Small (sales of 0-\$50M) **\$5000/yr**
- Medium (sales of \$50M-\$1000M) **\$5000 + .00211% of sales over \$50 M/yr**
- Large (\$1000M and over) **\$25,000/yr**



*Bringing High Technology  
to Capital Facilities*

# Allocation of Intellectual Property

---

- **FIATECH Products**
  - **Determined by FIATECH participants.**
- **CII Research Team Products**
  - **Available to CII members and for sale to non-members.**



*Bringing High Technology  
to Capital Facilities*

## Summary: FIATECH...

---

- **Makes FIAPP happen** - A big step beyond *Best Practices* research
- Brings together **all committed parties** within and beyond the capital projects industry
- Focuses on **results for members**





*Bringing High Technology  
to Capital Facilities*

# Summary: FIATECH...

---

- **Leverages resources**
- **Collaborates** to develop and deploy **standards and protocols** for current IT technologies
- Produces **open architectures**
- Produce **intellectual property** for members