Dr. Stephen Mulva
Associate Director

"10-10 Performance Assessment Program"
Dr. Stephen P. Mulva

- Associate Director of the Construction Industry Institute; University of Texas at Austin
- Lecturer, Researcher, and Consultant in the benchmarking of capital projects
- Program Management Expert
- Former employee of Fluor (Constructability Coordinator and Field Engineer), Phillips Petroleum, Bechtel, ePM, and Texas State University
• A consortium of leading owners, contractors, and academics working collaboratively to improve the constructed project and the capital investment process.

• An organized research unit of the Cockrell School of Engineering at The University of Texas at Austin.
History

- Organizational motivation was The Business Roundtable’s Construction Industry Cost Effectiveness (CICE) Project in 1982.
- Founded in 1983 by 28 organizations; now 140
- Purpose is to measurably improve capital project delivery
- Mission is to create global competitive and market advantage for its members
- Alliances: Norway, Canada, Brazil, South Africa, Russia, Singapore, and Saudi Arabia
Construction Productivity Decline

Productivity Index (1964-1999)
(Constant $ of contracts / workhours of hourly workers)

All Non-Farm Industries
+1.71%

Construction Industry
-.48%

Source: Journal of Construction Engineering and Management (Sept./Oct. 2001)
Actual / Estimated Peak Construction Workforce

![Graph showing the relationship between Actual/Estimated Peak Construction Workforce and Project Cost Growth. The x-axis represents Actual/Estimated Peak Construction Workforce, ranging from -0.4 to 3.0, and the y-axis represents Project Cost Growth, ranging from -0.4 to 1.2. The data points are scattered along a trend line, indicating a positive correlation.]
We Stand for the Project!

• What are the “governing dynamics” of project organizations?
5 Principles of Project Integration

• Work and Work Process
• Organizational Engineering
• Leadership and Governance
• Communications and Information Flow
• Business Environment and Culture
Motivation

• Senior Management Disconnect
• Need for Actionable Information
• Measures Roll Up, Down

CII/COAA Benchmarking
Budget Factor, Change Cost Growth, WH/LF Piping, Safety, etc.
CII’s 10-10 Program

• Simple and Important Measures
  – 10 Input Measures (Leading Indicators)
  – 10 Output Measures (Cost, Duration, Capacity, FTE, Quantities)

• Research-Based
  – 75% CII Research (e.g., Project Health Indicators)
  – 15% Capital Projects Research (CII Members)
  – 10% Other Industries (Project Management Measures)

• Launched July 2013 (CII Annual Conference)
• Industrial, Building, and Infrastructure Sectors (late March)
• Phase-Based Surveys
• CII Requested 10 Project-Phase Surveys from Each CII Member by May 2, 2014
• www.10-10program.org
21st Century Project Context

“Old School”
Project Management

Phase-Gate Based
Project Management

The “Hidden” Projects

8-11% Variation
20\textsuperscript{th} Century Measurement: C Students

![Graph showing the relationship between capacity and cost with curves labeled P10, P50, and P90.](image)
21st Century Measurement: Breaking Records

Proprietary Model

Your Project

1.12 vs. 9.58 Seconds

12.33 Seconds

VS.
Phase-Based Surveys (Markov Chain Theory)

What is the Probability of Success (?)
### Project Health Indicators (RT 220)

**PLEASE MARK A CIRCLE THAT IS APPLICABLE FOR EACH LEADING INDICATOR.**

1. The project team is lacking in the necessary expertise, experience, breadth, and depth to successfully execute the project.

   - **1** SERIOUS
   - **2** MAJOR
   - **3** MODERATE
   - **4** MINOR
   - **5** NONE
   - **NOT APPLICABLE**

2. The project team is experiencing a high turnover rate and instability in team membership.

   - **1** SERIOUS
   - **2** MAJOR
   - **3** MODERATE
   - **4** MINOR
   - **5** NONE
   - **NOT APPLICABLE**

3. The project team's response to Requests for Information, questions, and changing events that can significantly impact the project.
Traditional Benchmarking vs. 10-10 Performance Assessment Program

CII General Benchmarking Program
- Process, Practice

CII 10-10 Program
- People, Practice

Benchmark (CII/COAA PAS)

CII 10-10 Phase Questionnaires

CII 10-10 Phase Questionnaire
How CII’s 10-10 Program Works

Sample Statement-Based Question

26. The interfaces between project stakeholders were well managed.

Strongly Disagree Neutral Strongly Agree

Strong
disagree
neutral
strongly
agree

Sample Output Metrics

- Project Diagnostics (KBSC)
- Implement CII Research and Tools

Sample Input Metrics

Q26

Sample output metrics include metrics such as project cost efficiency, phase cost efficiency, and communication effectiveness. Sample input metrics show the distribution of responses to the question, with categories for Organizing and Leading. The graph shows a breakdown of responses with N=25 for each category.
10-10 Questionnaires

• Practice-Based
  – Yes/No
  – 5-point scales (strongly agree → strongly disagree)

• Phase-Based
  – Help for current projects
  – Answered as project nears phase completion

• Quantitative, yet simple to answer
• Research-based, empirically tested
• Internet-Based (2014+)
• Examples…
“Famous” Construction Quote

“Construction would be easy, if it weren’t for all the people involved”

– Ted VanWyck
The interfaces between project stakeholders were well-managed.

A. Strongly Agree
B. Agree
C. Neutral
D. Disagree
E. Strongly Disagree

Input Metrics: Organizing, Leading
The equipment procurement and vendor schedules were a significant challenge or problem for this project.

A. Strongly Agree
B. Agree
C. Neutral
D. Disagree
E. Strongly Disagree

Input Metrics: Planning, Controlling, Supply Chain Management
Preferred suppliers were used effectively to streamline the procurement process

A. Strongly Agree
B. Agree
C. Neutral
D. Disagree
E. Strongly Disagree

Input Metrics: Planning, Controlling, Quality, and Supply Chain Management (SCM)
Construction Questionnaire

The availability and competency of craft labor was adequate

A. Strongly Agree
B. Agree
C. Neutral
D. Disagree
E. Strongly Disagree

Input Metrics: Planning, Controlling, Quality, HR and Safety
Start-Up Questionnaire

The project experienced an excessive number of project management team personnel changes

A. Strongly Agree
B. Agree
C. Neutral
D. Disagree
E. Strongly Disagree

Input Metrics: Organizing, Leading, and Human Resources (HR)
Start-Up Questionnaire

• Which of the following statements characterize the decisions made by the manager(s) of this project? (please check all that apply)
  – Considered final and not revisited
  – Collaborative and inclusive
  – Made at the lowest appropriate level in the organization
  – Communicated promptly to the team
  – Made in a timely and effective manner
  – Consistent with the delegation of authority

• Input Measure: Leading
Output Measure: Capacity Efficiency

- CII Model Plant / CII Reference Project

- Project A
  - Capacity: 2,600 tons/yr
  - BOM: 1.78 RF

- Project B
  - Capacity: 1,150 tons/yr
  - BOM: 0.83 RF

Bill of Material (BOM)  Work Hours
Baseline  Reference Factor (RF)

\[
\frac{CAP_A}{RF_A} = 1,461 \ (DE)
\]

\[
\frac{CAP_B}{RF_B} = 1,386 \ (DE)
\]
Capacity Efficiency = \frac{(\text{Capacity}/\text{Reference Project Capacity})}{(\text{Installed Quantity}/\text{Reference Project Installed Quantity})}

N = 87

Capacity Efficiency

0.0  0.5  1.0  1.5  2.0  2.5  3.0  3.5

0.37  0.75  3.18
## 10-10 Program Integration

### Member Imperatives
- 10-10 Program
- Knowledge Base

### CII Project Execution Knowledge Structure (C-PEKS)

<table>
<thead>
<tr>
<th>Knowledge Areas</th>
<th>Management Attributes</th>
<th>Project Phases</th>
<th>Project Functions or Roles</th>
<th>Resource Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Planning</td>
<td>Business and Project Processes</td>
<td>Planning</td>
<td>Feasibility</td>
<td>Project Business Sponsor</td>
</tr>
<tr>
<td>Design</td>
<td>Project Controls</td>
<td>Organizing</td>
<td>Concept</td>
<td>Project Management</td>
</tr>
<tr>
<td>Procurement, Contracts &amp; Materials Mgmt.</td>
<td>Risk Management</td>
<td>Leading</td>
<td>Detailed Scope</td>
<td>Architects &amp; Engineering</td>
</tr>
<tr>
<td>Construction</td>
<td>HSE, Security &amp; Sustainability</td>
<td>Controlling</td>
<td>Detailed Design (Engineering)</td>
<td>Project Controls</td>
</tr>
<tr>
<td>Commissioning &amp; Startup</td>
<td>Information Mgmt. &amp; Technology</td>
<td></td>
<td></td>
<td>Quality Management</td>
</tr>
<tr>
<td>Human Resource Management</td>
<td>Project Organization &amp; Communication</td>
<td></td>
<td></td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>Project &amp; Program Management</td>
<td>Quality Management</td>
<td></td>
<td></td>
<td>Presentations</td>
</tr>
</tbody>
</table>

- Overview & Conclusions
- Health, Safety & Environmental
- Risk Management
- Implementation Tools
- Key Supporting Graphics & Information
- Education Materials
- Journal Articles & Conference Papers
- Reference Materials
10-10 Diagnostics (KBSC)

- Phase-Based, Sector-Based, Attribute-Based

<table>
<thead>
<tr>
<th>List of CII Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design Effectiveness Toolkit (64 Strategies)</td>
</tr>
<tr>
<td>2. Constructability Principles</td>
</tr>
<tr>
<td>3. eGuide for Materials Management</td>
</tr>
<tr>
<td>4. PePC</td>
</tr>
<tr>
<td>5. Common Commodity Codes (CCE)</td>
</tr>
<tr>
<td>6. Product Integrity Concerns (PIC) - no tool?</td>
</tr>
<tr>
<td>7. Interim Product Database (IPD)</td>
</tr>
<tr>
<td>8. Industrial Engineering Techniques</td>
</tr>
<tr>
<td>9. Lean Principles in Construction (35 Principles &amp; Sub-principles)</td>
</tr>
<tr>
<td>10. Planning for Startup SuperTool</td>
</tr>
<tr>
<td>11. Activity Analysis</td>
</tr>
<tr>
<td>12. Rework Reduction</td>
</tr>
<tr>
<td>13. Crew Scheduling 'Look Up' Table</td>
</tr>
<tr>
<td>14. Best Practices Productivity Improvement Index (BPII)</td>
</tr>
<tr>
<td>15. Voice of the Craft Worker (VOW) Tool</td>
</tr>
<tr>
<td>16. Attracting and Maintaining a Skilled Construction Workforce (75 Activities)?</td>
</tr>
<tr>
<td>17. Multiskilling Cost Model</td>
</tr>
<tr>
<td>18. Compass (Communications Project Assessment) Tool</td>
</tr>
<tr>
<td>19. Global Virtual Engineering Team (GVET) Planner</td>
</tr>
<tr>
<td>20. Project Priority Calculator — worthy of more investigation...</td>
</tr>
<tr>
<td>22. Management of Virtual Team Checklist</td>
</tr>
<tr>
<td>23. Partnering Toolkit</td>
</tr>
<tr>
<td>24. Leader Selection Guide</td>
</tr>
<tr>
<td>25. Team Leadership Planner</td>
</tr>
<tr>
<td>26. Team Health Check</td>
</tr>
<tr>
<td>27. Trust Evaluation System (RT24)</td>
</tr>
<tr>
<td>28. ValuesShare Tool</td>
</tr>
<tr>
<td>29. QMS Correlation Matrix</td>
</tr>
<tr>
<td>30. Zero Field Rework Opportunity Checklist</td>
</tr>
<tr>
<td>31. Value Management Process (VMP) Selection Tool</td>
</tr>
<tr>
<td>32. Small Projects Toolkit</td>
</tr>
<tr>
<td>33. Quality Performance Management System (QPMS) superseded by QMS Correlation Matrix</td>
</tr>
<tr>
<td>34. Work Packaging Execution Model</td>
</tr>
<tr>
<td>35. Cost/Schedule Tradeoff Tool (CSTT) — 23 techniques</td>
</tr>
<tr>
<td>36. Project Health Indicator (PHI) Tool</td>
</tr>
<tr>
<td>37. Indirect Construction Cost (IDCC) Checklist</td>
</tr>
</tbody>
</table>

| 38. Project Controls and Management Systems (PCMS) Participants Involved Tool (interfaces) |
| 39. Project Controls and Management Systems (PCMS) Information Flow Tool (interfaces) |
| 40. Predictive Tools Road Map (RTM) |
| 41. Interactive Risk Register Tool (incl. Probabilistic Risk Analysis) |
| 42. Contract Strategy Selection Tool (from C/R RT 260) |
| 43. Equitable Risk Allocation (ERA) Tool |
| 44. Project Delivery and Contract Strategy (PDSC) Selection Tool |
| 45. International Project Risk Assessment (IPRA) Tool |
| 46. Dispute Review Board (DRB) Implementation Guidelines |
| 47. Disputes Potential Index (DPI) |
| 48. Commodity vs. Value-Added Contractor Services Communication and Evaluation Tool |
| 49. Single-Party Risk Assessment Worksheet |
| 50. Two-Party Risk Assessment Worksheet |
| 51. Contractor Compensation Strategies (31 flavors) Checklist |
| 52. Construction Contract Change Clause Checklist (vol. I and II) |
| 53. "Hot Button" Risks Checklist (incl. Contract Language Table) |
| 54. Risk Management Model and Checklist |
| 55. Active and Passive Safety Leading Indicators Checklist |
| 56. Checklist for Sustainable Construction Job Sites |
| 57. Design for Construction Safety Toolbox, Version 2.0 |
| 58. Workers' Compensation Contractor Checklist |
| 59. Environmental Information Gathering Checklist |
| 60. Good Environmental Practice Criteria for Construction Projects Checklist |
| 61. Zero Injury Techniques Checklist |
| 62. Safety Self-Assessment Instrument |
| 63. Guidelines for Managing Subcontractor Safety |
| 64. Safety Program Guidelines for Contractors and Subcontractors |
| 65. Integration Opportunity Assessment Tool |
| 66. BIM Project Execution Plan Template |
| 67. LEVER Technology Prediction Tool (Productivity) |
| 68. EPC Macro Model Logic Diagram for Impact of Process Change |
| 69. D/B/B Macro Model Logic Diagram for Impact of Process Change |
| 70. EPC Macro Model Activity List (Information Management) |
| 71. Advanced Construction Technology Systems (ACTS) Database |
| 72. Lessons Learned Self-Assessment Questionnaire |
| 73. Security Rating Index Tool |
| 74. FEP Alignment Thermometer |
| 75. PDRI for Industrial |
| 76. PDRI for Building |
| 77. PDRI for Infrastructure |
10-10 Program Campaign

• August 2013 – May 2014
  – Collected 578 projects
  – Collected 700+ to date

• July 21-23, 2014 CII Annual Conference

• 2014 and beyond
  – August 2014: 10-10 online system launch
  – Norway, Canada (COAA), Singapore, etc.
  – Integration with CII knowledge base
CII AC: Industrial Sector FEP Input Measures

- **Wide Variation**
CII AC: Industrial Sector FEP Input Measures

- Good Leadership = 29.3% Better Scope Definition

N=14

N=12

p=0.085
Industry Recognition

Top 400

ENR

ENGINEERING NEWS-RECORD

FORTUNE

100 BEST COMPANIES

TO WORK FOR

CH30

Projects of the Year
Questions?

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