Rice Global E&C Forum
Engineering & Construction

# RICE GLOBAL ENGINEERING & CONSTRUCTION FORUM

RICE

## Dr. Stephen Mulva

***Associate Director***

**The Knowledge Leader for Project Success**

*Leveraging 25 Years of Industry Leadership*

# *"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

Construction Industry Institute®

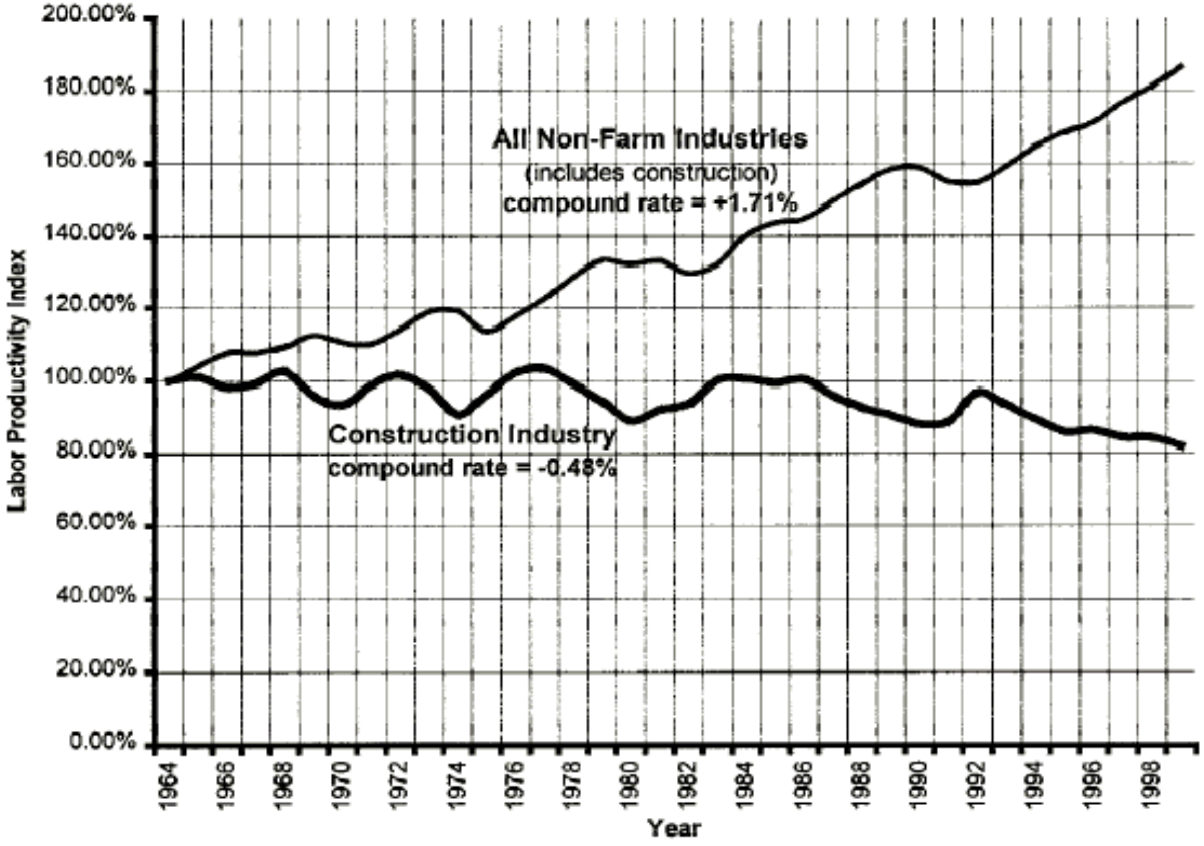
- A consortium of leading owners, contractors, and academics working collaboratively to improve the constructed project and the capital investment process.
- An organized research unit of the Cockrell School of Engineering at The University of Texas at Austin.

# 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)
Sources: U.S. Bureau of Labor Statistics, U.S. Dept of Commerce

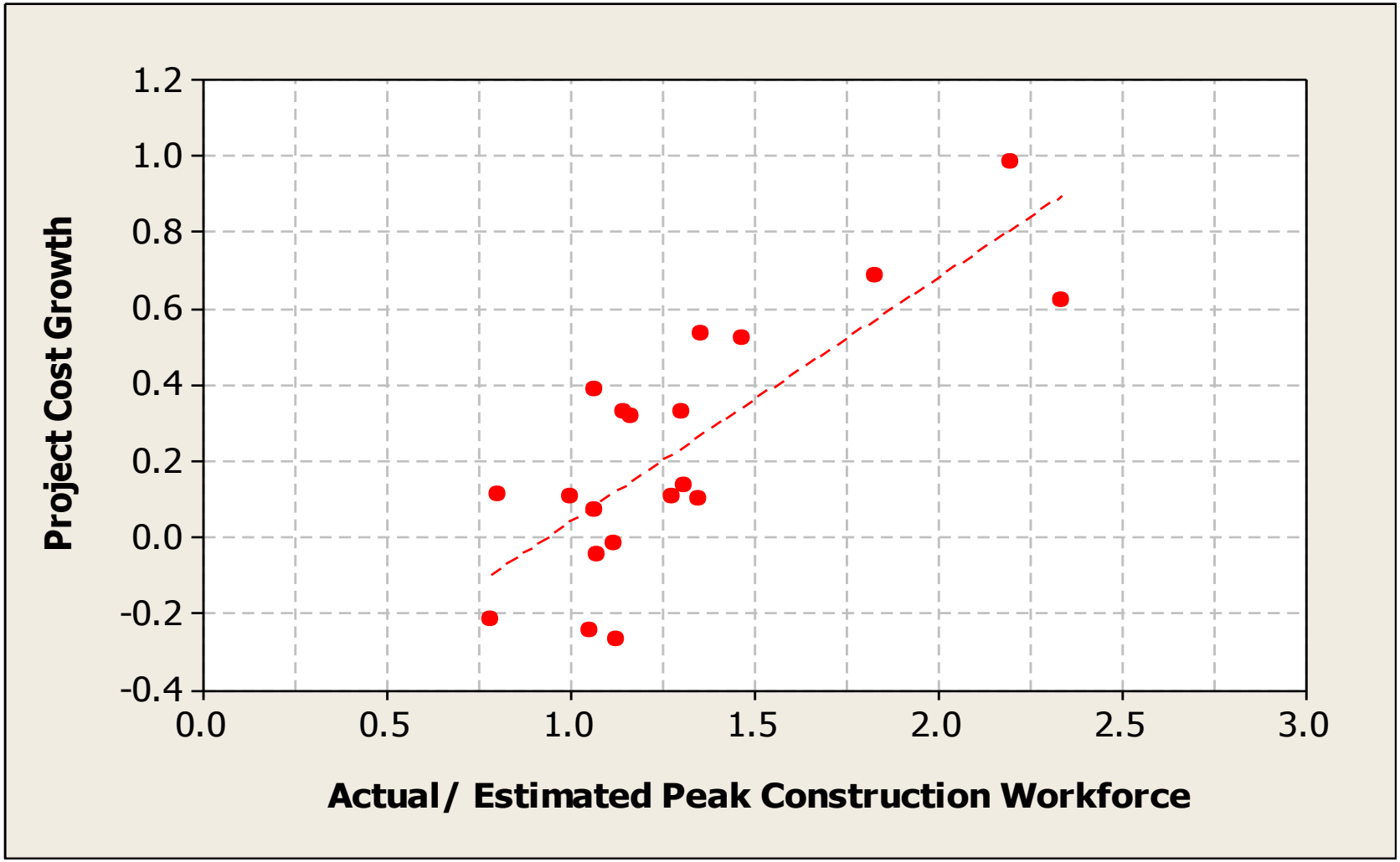



All Non-Farm Industries
+1.71%

**Construction Industry**
**-.48%**

Source: *Journal of Construction Engineering and Management* (Sept./Oct. 2001)

# Actual / Estimated Peak Construction Workforce



# 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

**10 Input Measures**

- Planning
- Controlling
- Design Efficiency
- Human Resources

**10 Outcomes**

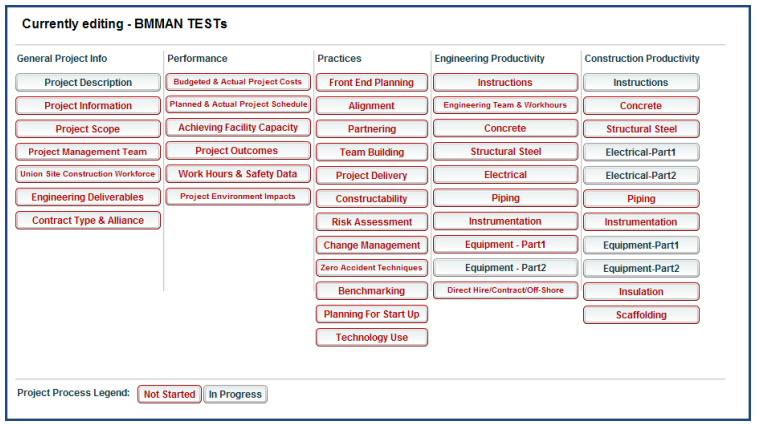
- Proj. Sch. Efficiency
- Capacity Efficiency
- Proj. Cost Efficiency
- Burn Rate

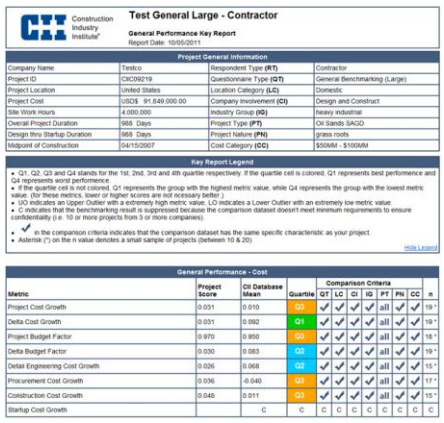
**CII 10-10 Program**

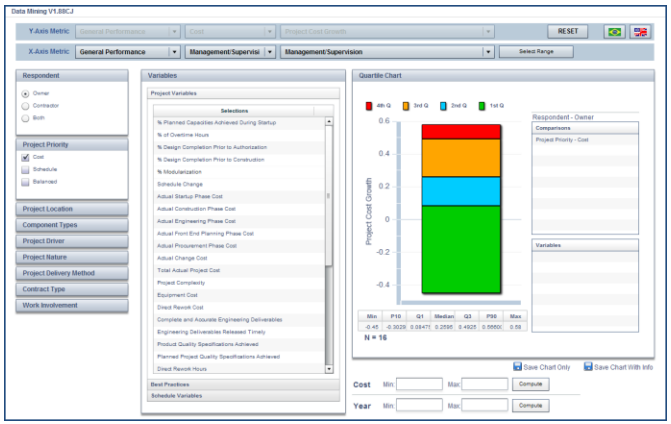
$/BOED, $/GSF, Capacity Efficiency
Quality, Design Efficiency, Leading, HR

**CII/COAA Benchmarking**

Budget Factor, Change Cost Growth, WH/LF Piping, Safety, etc.



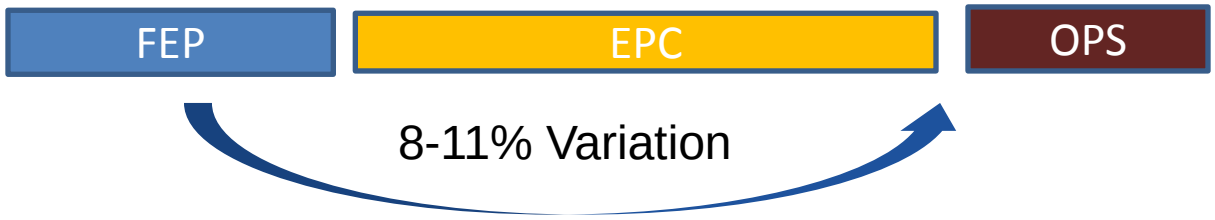



# CII's 10-10 Program

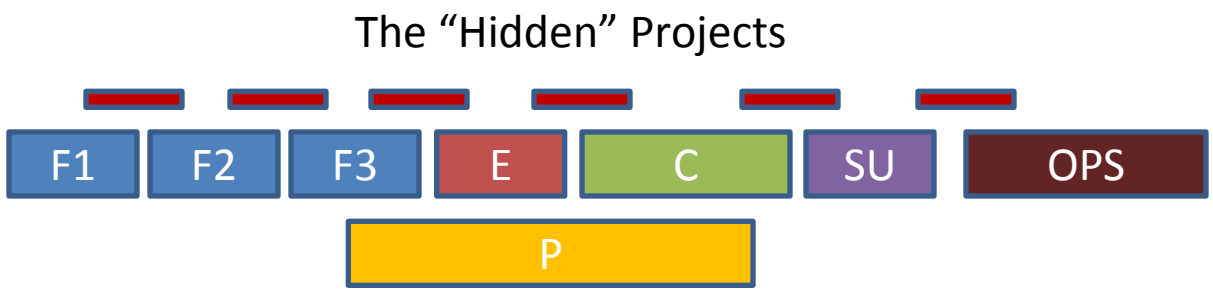
- Simple and Important Measures
  - 10 Input Measures (Leading Indicators)
  - 10 Output Measures (Cost, Duration, Capacity, FTE, Quantities)
- Research-Based
  - 75% CII Research (e.g., Project Health Indicators)
  - 15% Capital Projects Research (CII Members)
  - 10% Other Industries (Project Management 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

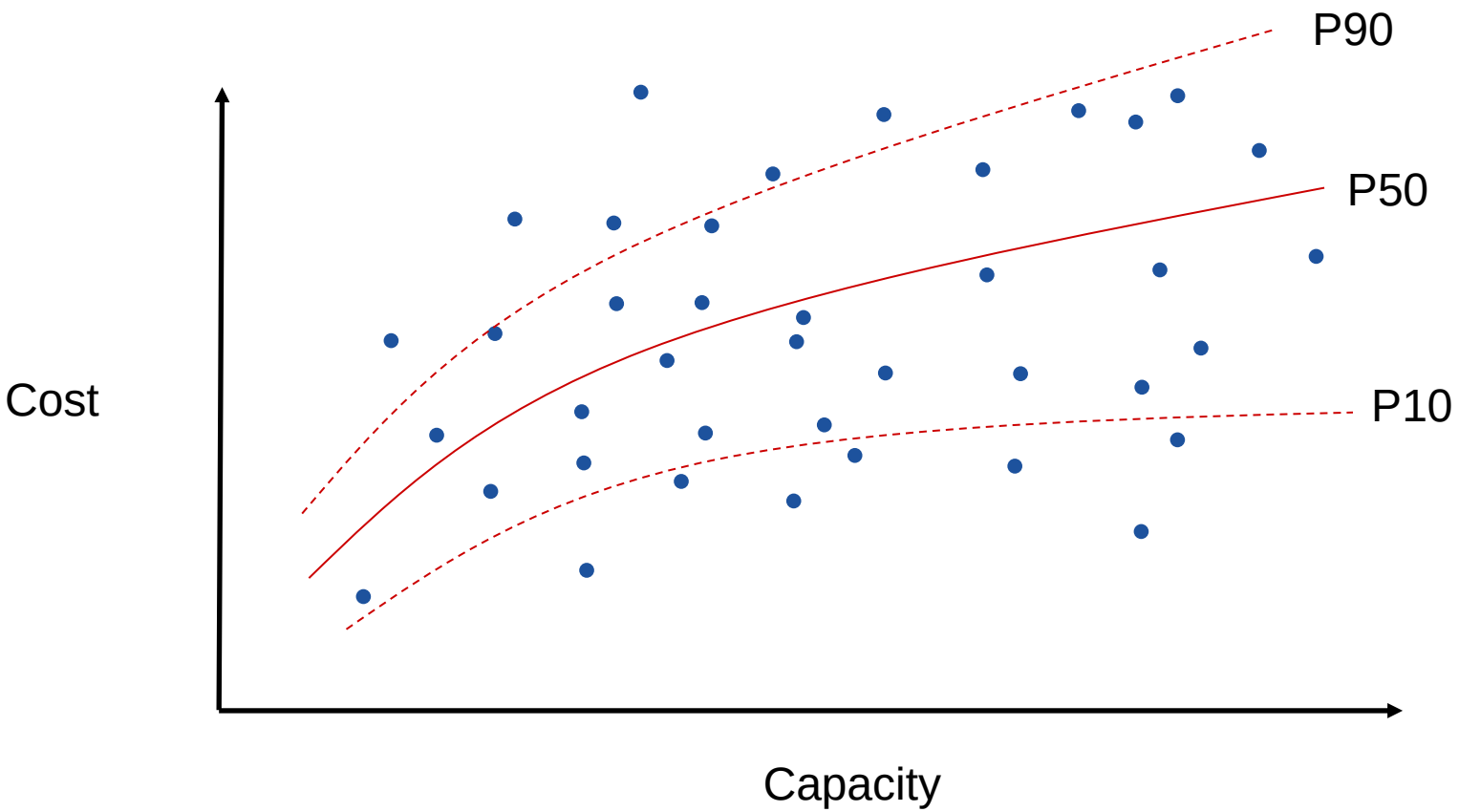
**"Old School" Project Management**



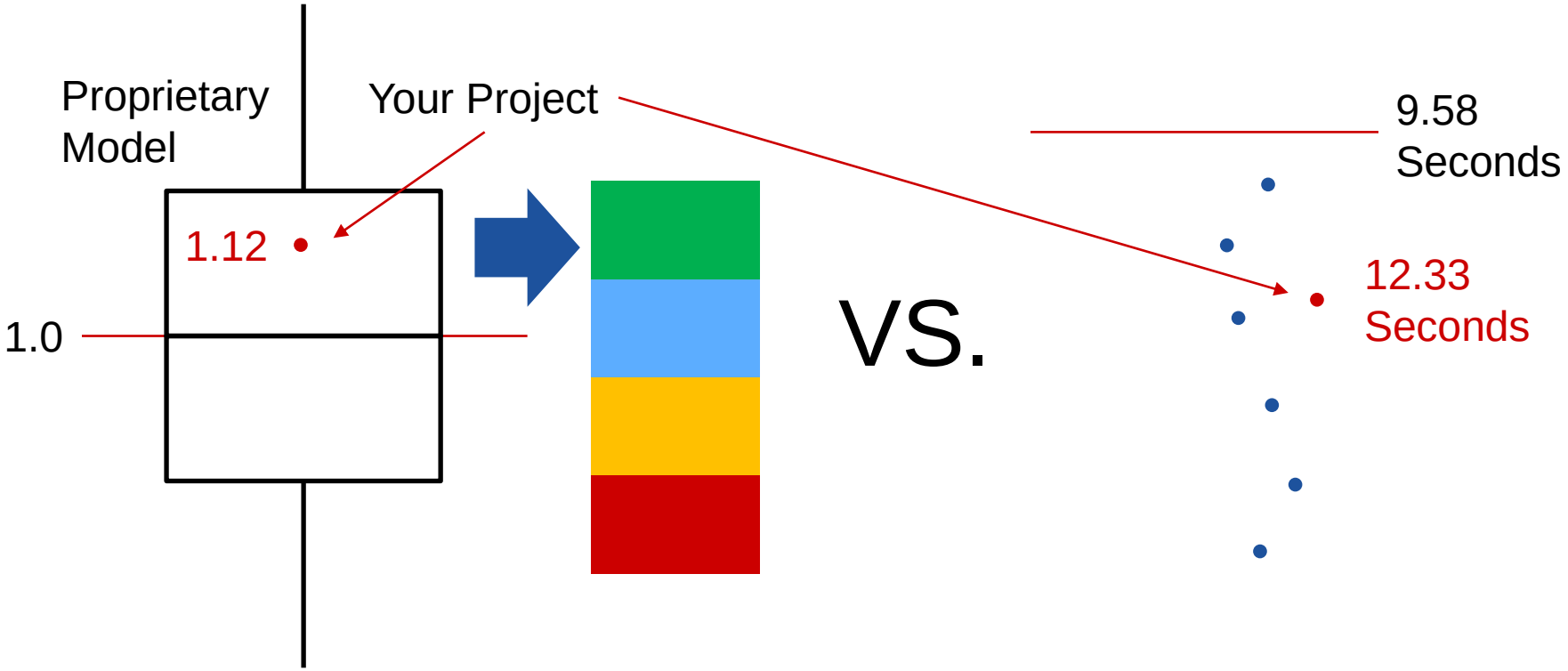

**Phase-Gate Based Project Management**



# 20th Century Measurement: C Students

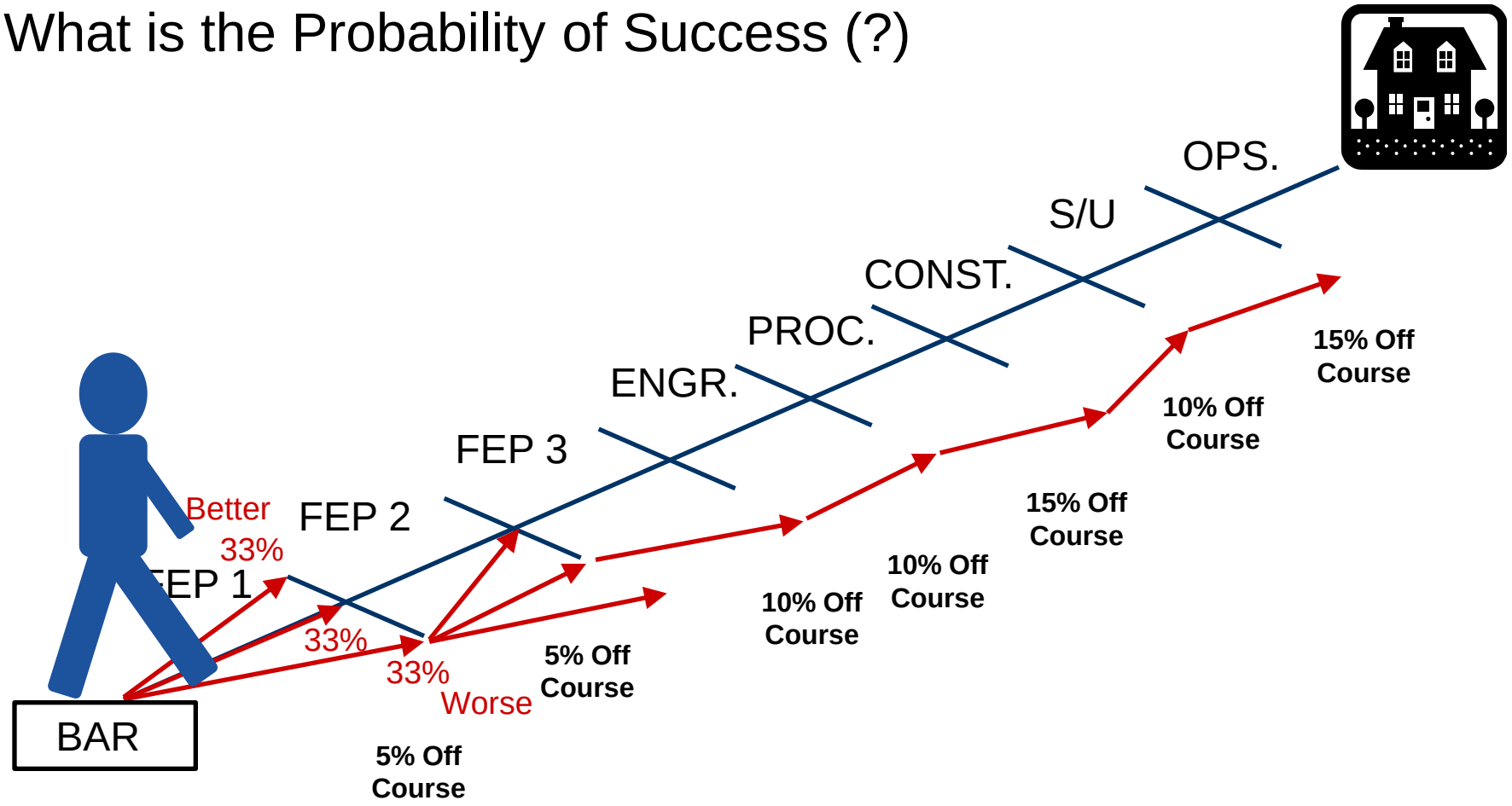


# 21st Century Measurement: Breaking Records

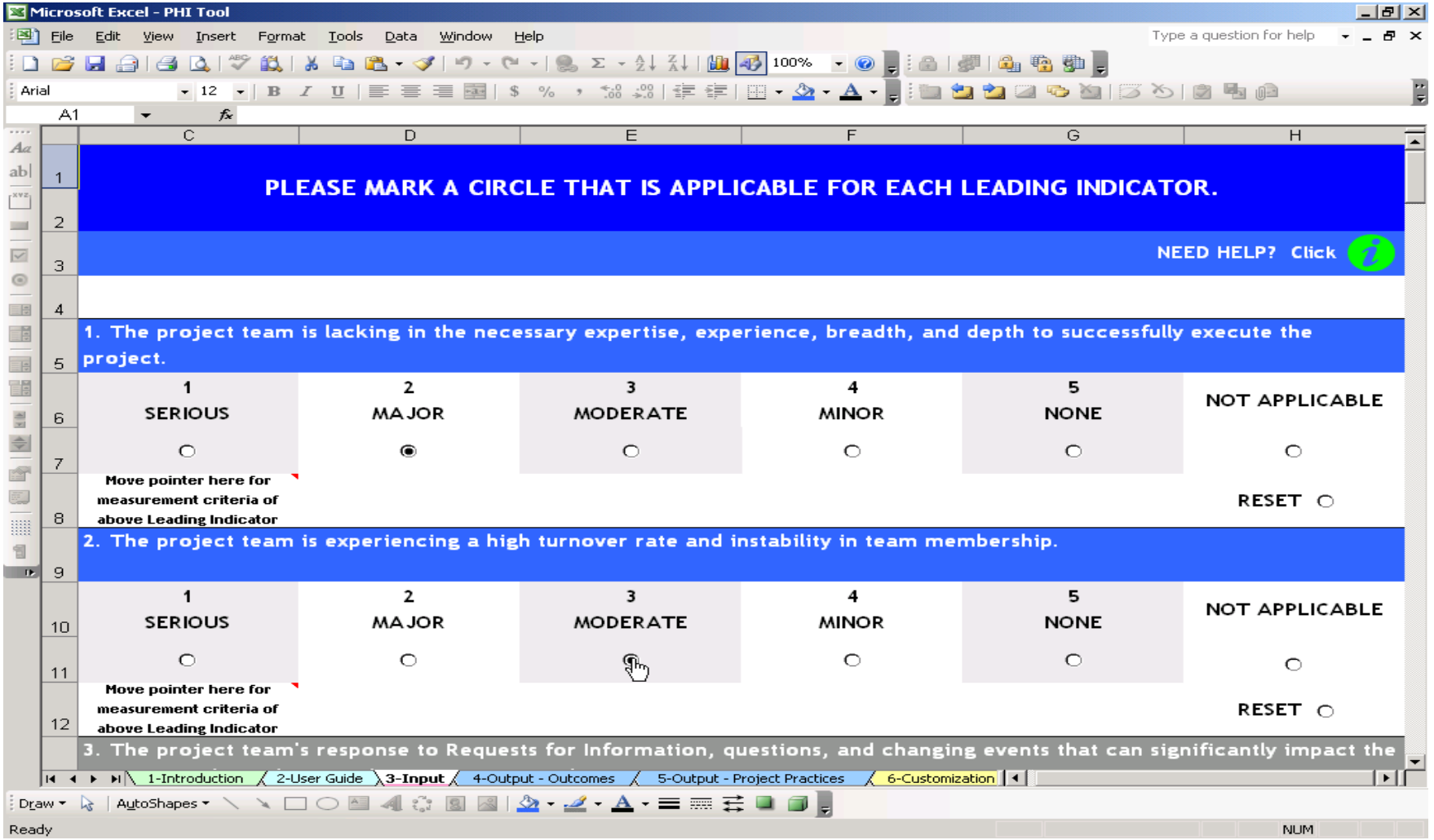


# Phase-Based Surveys (Markov Chain Theory)

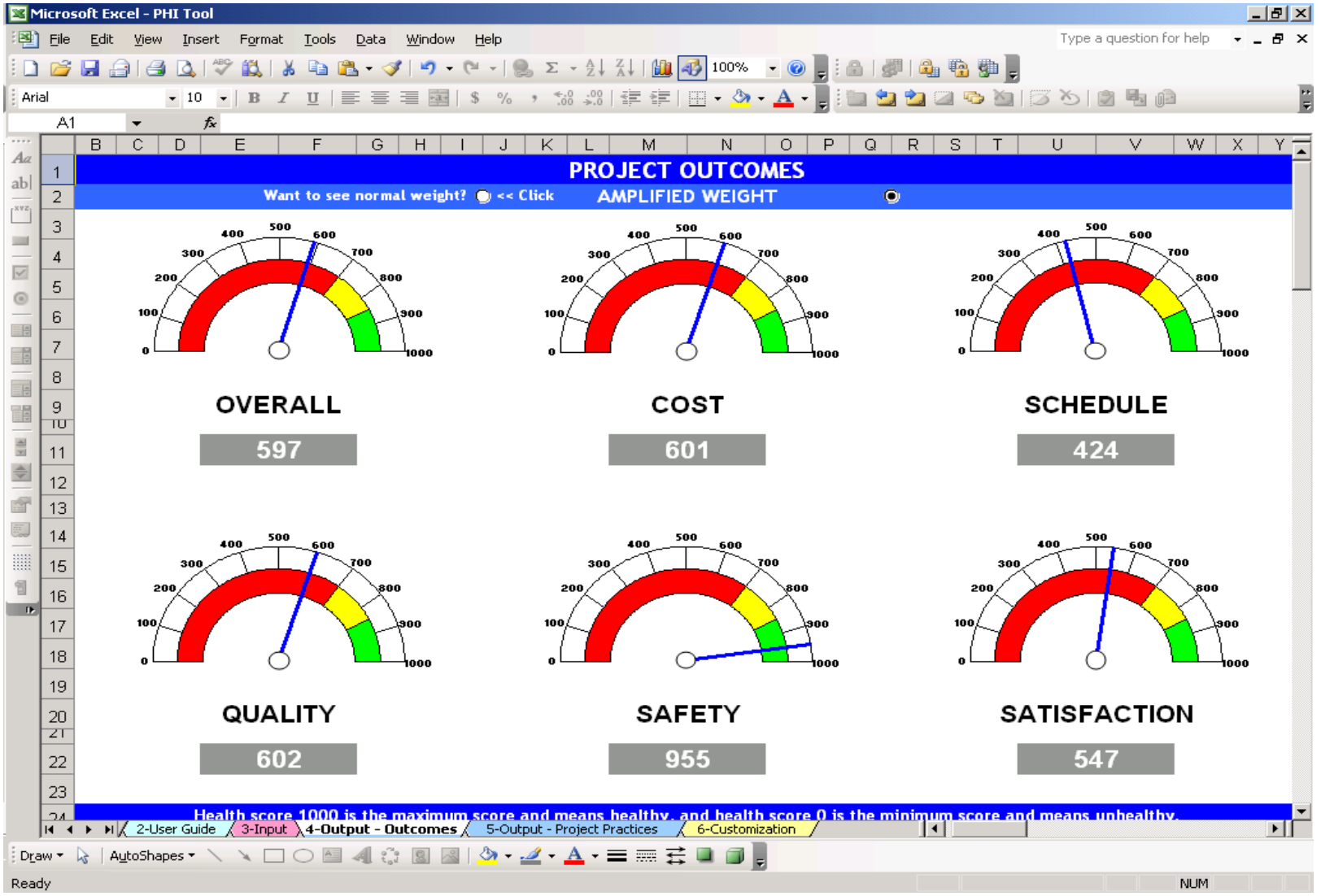
What is the Probability of Success (?)



# Project Health Indicators (RT 220)



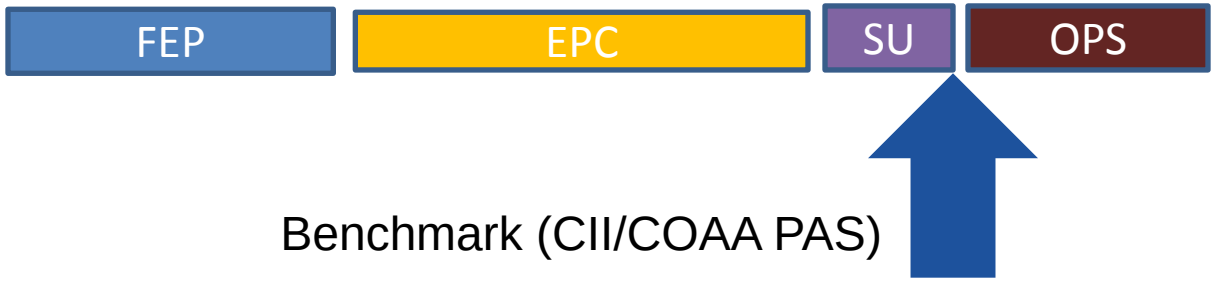
# PHI (RT 220) – Predicted Outcomes



# Traditional Benchmarking vs. 10-10 Performance Assessment Program

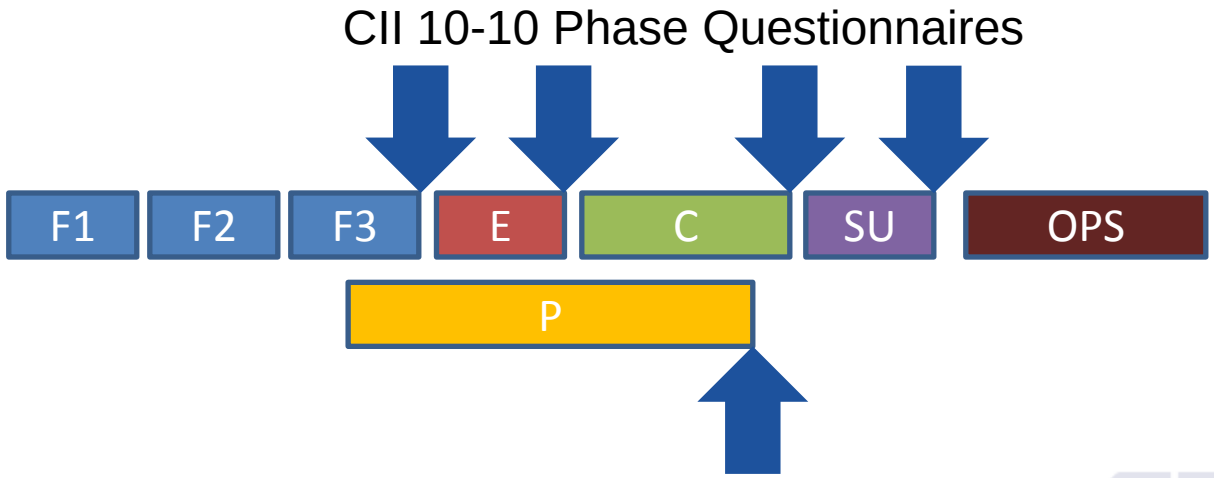
**CII General Benchmarking Program**

Process, Practice




**CII 10-10 Program**

People, Practice

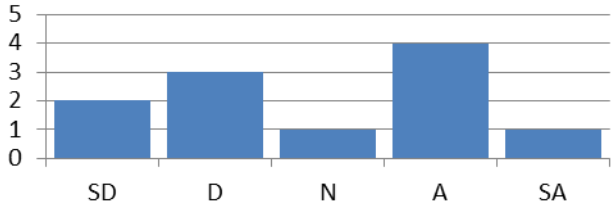


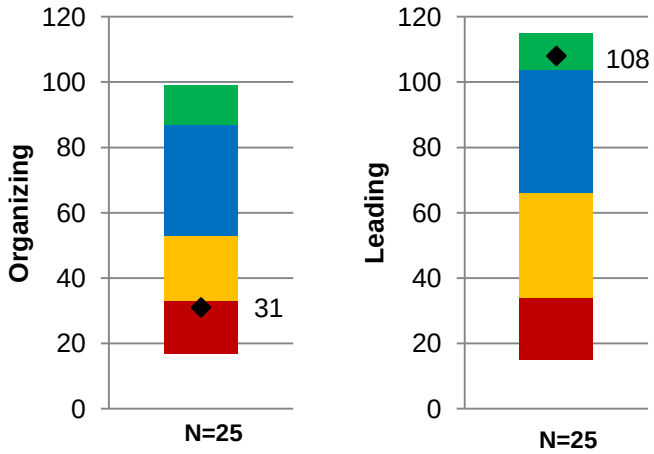
# How CII's 10-10 Program Works

## Sample Statement-Based Question

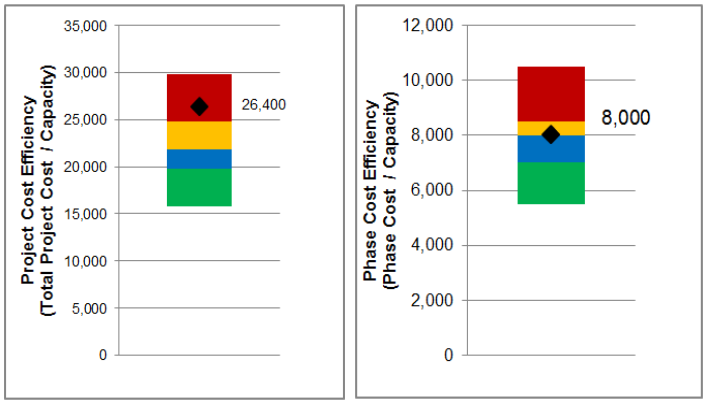
| 26. The interfaces between project stakeholders were well managed. | Strongly Disagree | | Neutral | | Strongly Agree |
|---|---|---|---|---|---|
| | ◘ | ◘ | ◘ | ◘ | ◘ |

**Q26**




Sample Input Metrics




Sample Output Metrics

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

# 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

# FEP Questionnaire

The interfaces between project stakeholders were well-managed.

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

Input Metrics: Organizing, Leading

# Engineering Questionnaire

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

# Procurement Questionnaire

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

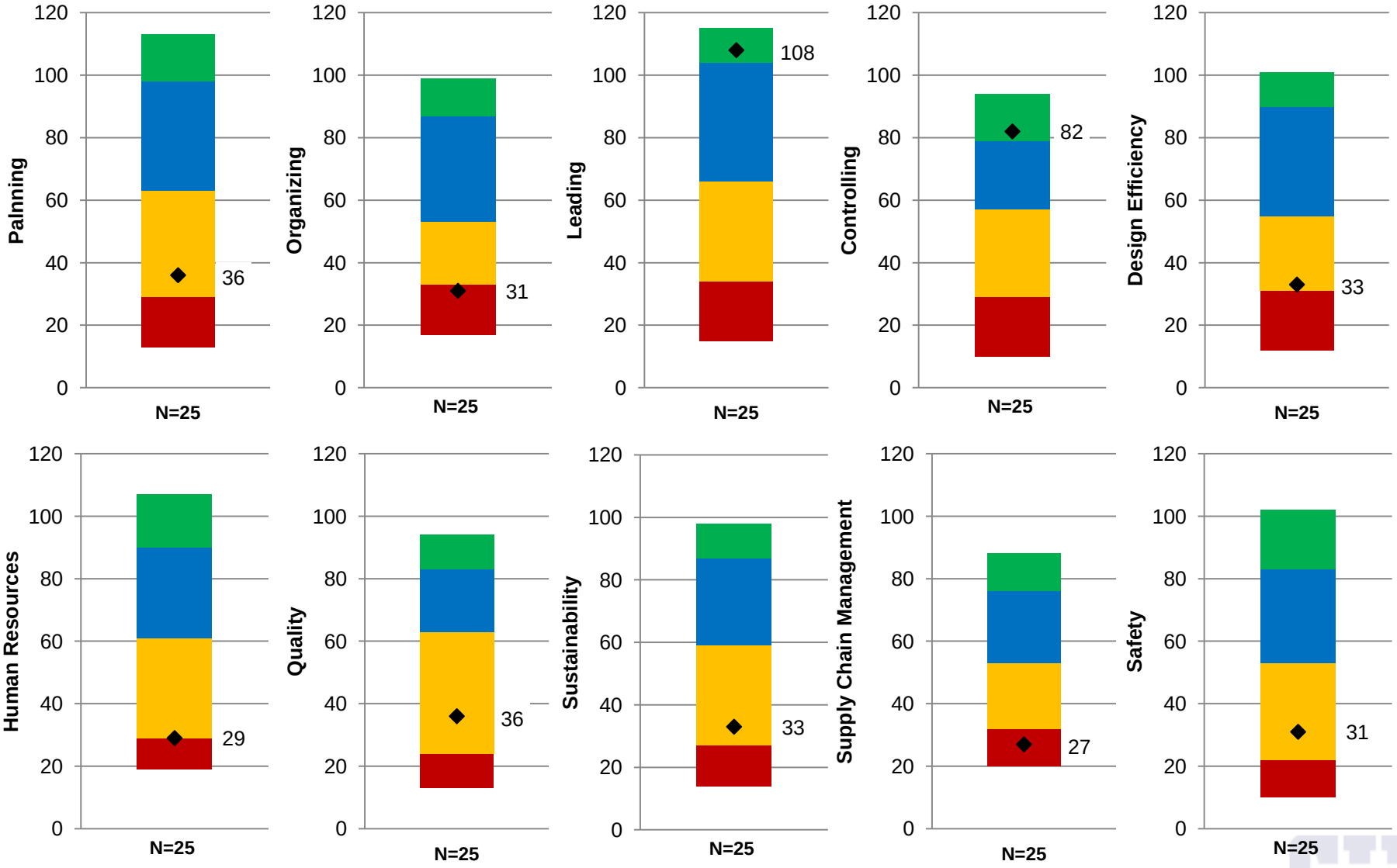
The project experienced an excessive number of project management team personnel changes

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

# Start-Up Questionnaire

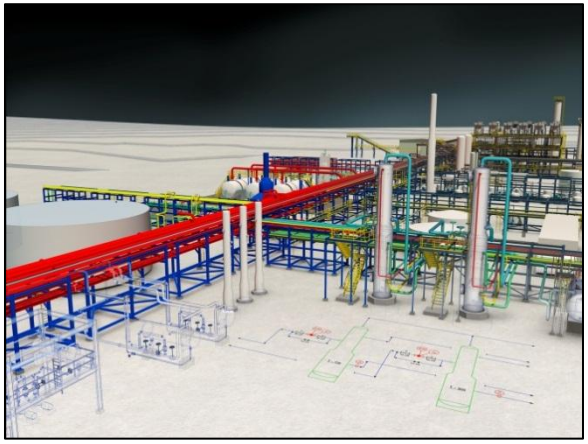
- Which of the following statements characterize the decisions made by the manager(s) of this project? (please check all that apply)
  - Considered final and not revisited
  - Collaborative and inclusive
  - Made at the lowest appropriate level in the organization
  - Communicated promptly to the team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

# 10-10 Report: Input Measures



# Output Measure: Capacity Efficiency

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

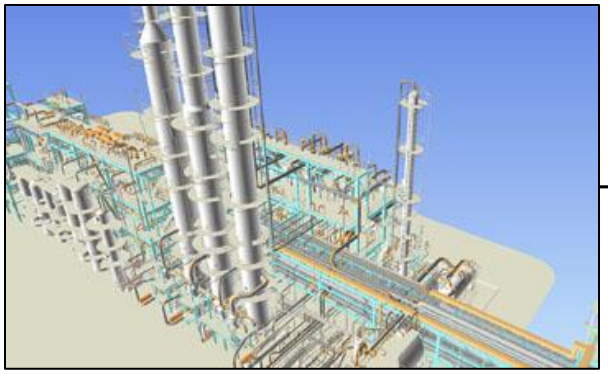


$$\frac{CAP_A}{RF_A} = 1{,}461\ (DE)$$

CII 10-10 Database

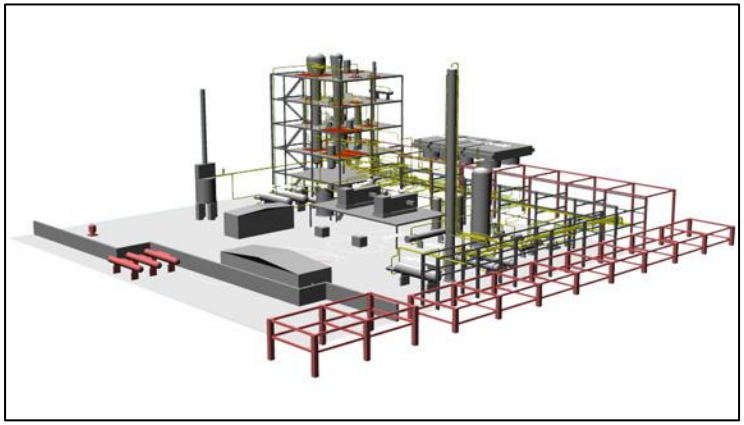
$$\frac{CAP_B}{RF_B} = 1{,}386\ (DE)$$

- CII Model Plant / CII Reference Project



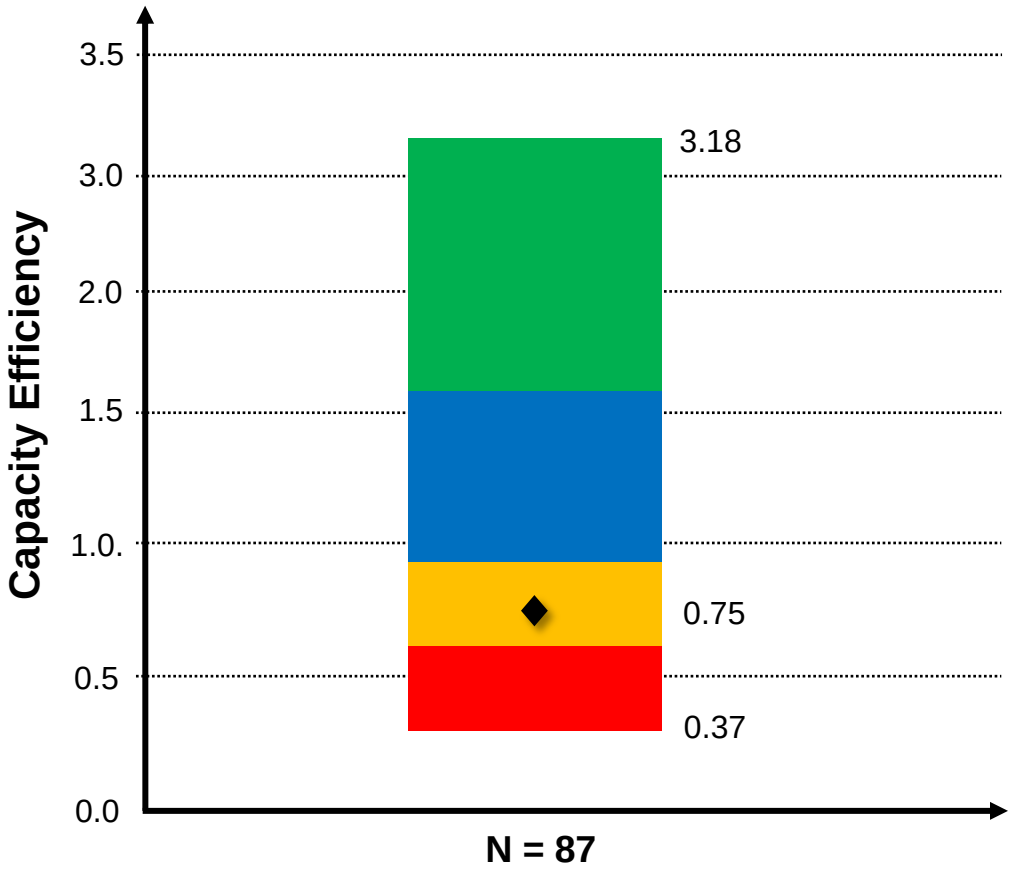
- Project B
- Capacity: 1,150 tons/yr
- BOM: 0.83 RF

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



# 10-10 Report: Output Measure (Capacity Efficiency)

$$\text{Capacity Efficiency} = \frac{\text{(Capacity/Reference Project Capacity)}}{\text{(Installed Quantity/Reference Project Installed Quantity)}}$$



# 10-10 Program Integration

Member Imperatives

- 10-10 Program
- Knowledge Base

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

4/18/2014

| Knowledge Areas | | Management Attributes | Project Phases | Project Functions or Roles | | Resource Materials |
|---|---|---|---|---|---|---|
| Project Planning | Business and Project Processes | Planning | Feasibility | Project Business Sponsor | Operations & Maint. | Overview & Conclusions |
| Design | Project Controls | Organizing | Concept | Project Management | Health, Safety & Environmental | Key Supporting Graphics & Information |
| Procurement, Contracts & Materials Mgmt. | Risk Management | Leading | Detailed Scope | Architects & Engineering | Risk Management | Implementation Tools |
| Construction | HSE, Security & Sustainability | Controlling | Detailed Design (Engineering) | Project Controls | Quality Management | Key Performance Indicators |
| Commissioning & Startup | Information Mgmt. & Technology | | Procurement | Procurement & Contracts | Business Dev. & Proposals | Presentations |
| Human Resource Management | Project Organization & Communicatio | | Construction | Construction | SBU/Corp Functions | Education Materials |
| Project & Program Management | Quality Management | | Commission & Startup | Commission & Startup | External Stakeholders | Journal Articles & Conference Papers |
| | | | Handover and Closeout | | | Reference Materials |

# 10-10 Diagnostics (KBSC)

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

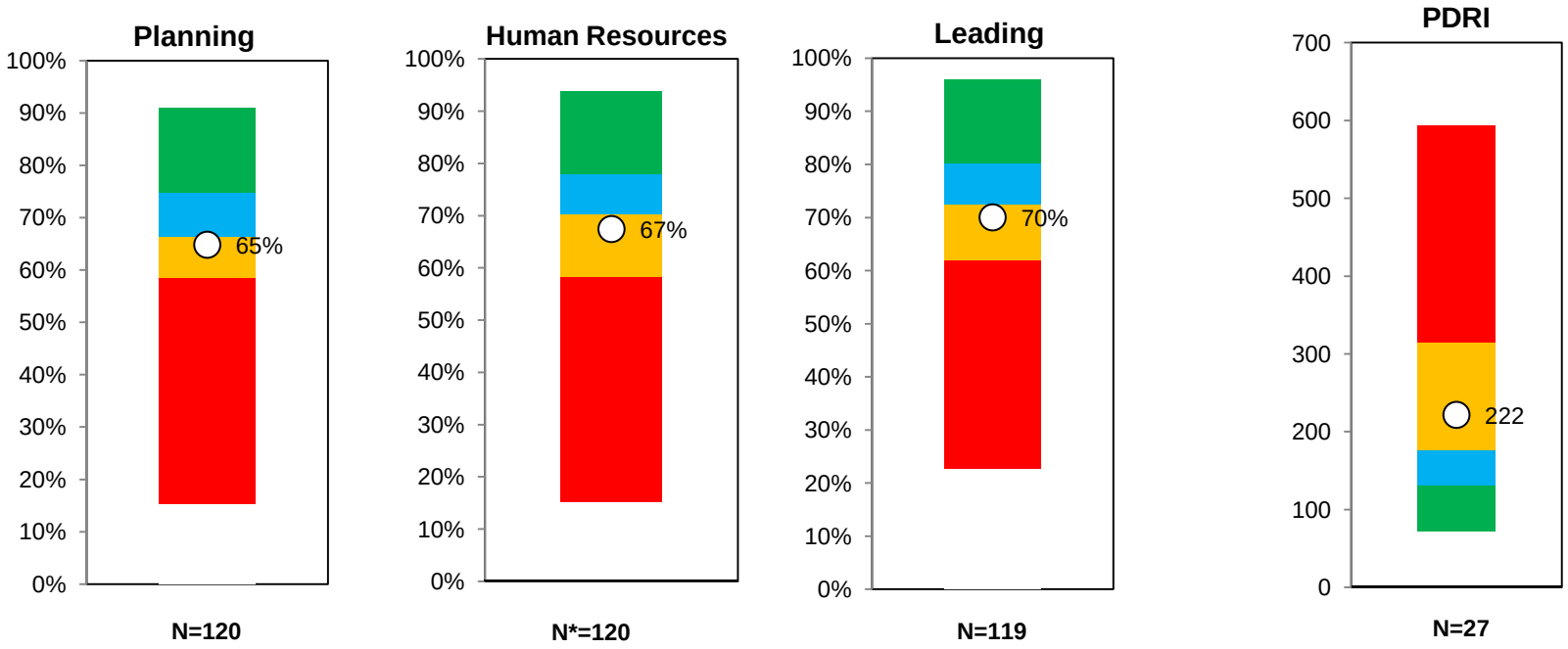
| | List of CII Tools |
|---|---|
| 1 | Design Effectiveness Toolkit (64 Strategies) |
| 2 | 17 Constructability Principles |
| 3 | eGuide for Materials Management |
| 4 | PEpC |
| 5 | Common Commodity Codes (?) |
| 6 | Product Integrity Concerns (video – no tool?) |
| 7 | Interim Product Database (IPD) |
| 8 | Industrial Engineering Techniques |
| 9 | Lean Principles in Construction (35 Principles & Sub-principles) |
| 10 | Planning for Startup SuPERTool |
| 11 | Activity Analysis |
| 12 | Rework Reduction |
| 13 | Crew Scheduling 'Look Up' Table |
| 14 | Best Practices Productivity Improvement Index (BPPII) |
| 15 | Voice of the Craft Worker (VOW) Tool |
| 16 | Attracting and Maintaining a Skilled Construction Workforce (75 Activities)? |
| 17 | Multiskilling Cost Model |
| 18 | Compass (Communications Project Assessment)Tool |
| 19 | Global Virtual Engineering Team (GVET) Planner |
| 20 | Project Priority Calculator – worthy of more investigation… |
| 21 | Core Competency Toolkit (Owner/Contractor Work Structure Process Handbook) |
| 22 | Management of Virtual Team Checklist |
| 23 | Partnering Toolkit |
| 24 | Leader Selection Guide |
| 25 | Team Leadership Planner |
| 26 | Team Health Check |
| 27 | Trust Evaluation System (RT24) |
| 28 | ValueShare Tool |
| 29 | QMS Correlation Matrix |
| 30 | Zero Field Rework Opportunity Checklist |
| 31 | Value Management Process (VMP) Selection Tool |
| 32 | Small Projects Toolkit |
| 33 | Quality Performance Management System (QPMS) superceded by QMS Correlation Matrix |
| 34 | Work Packaging Execution Model |
| 35 | Cost/Schedule Tradeoff Tool (CSTT) – 23 techniques |
| 36 | Project Health Indicator (PHI) Tool |
| 37 | Indirect Construction Cost (IDCC) Checklist |
| 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 (?) |
| 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 (PDCS) 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

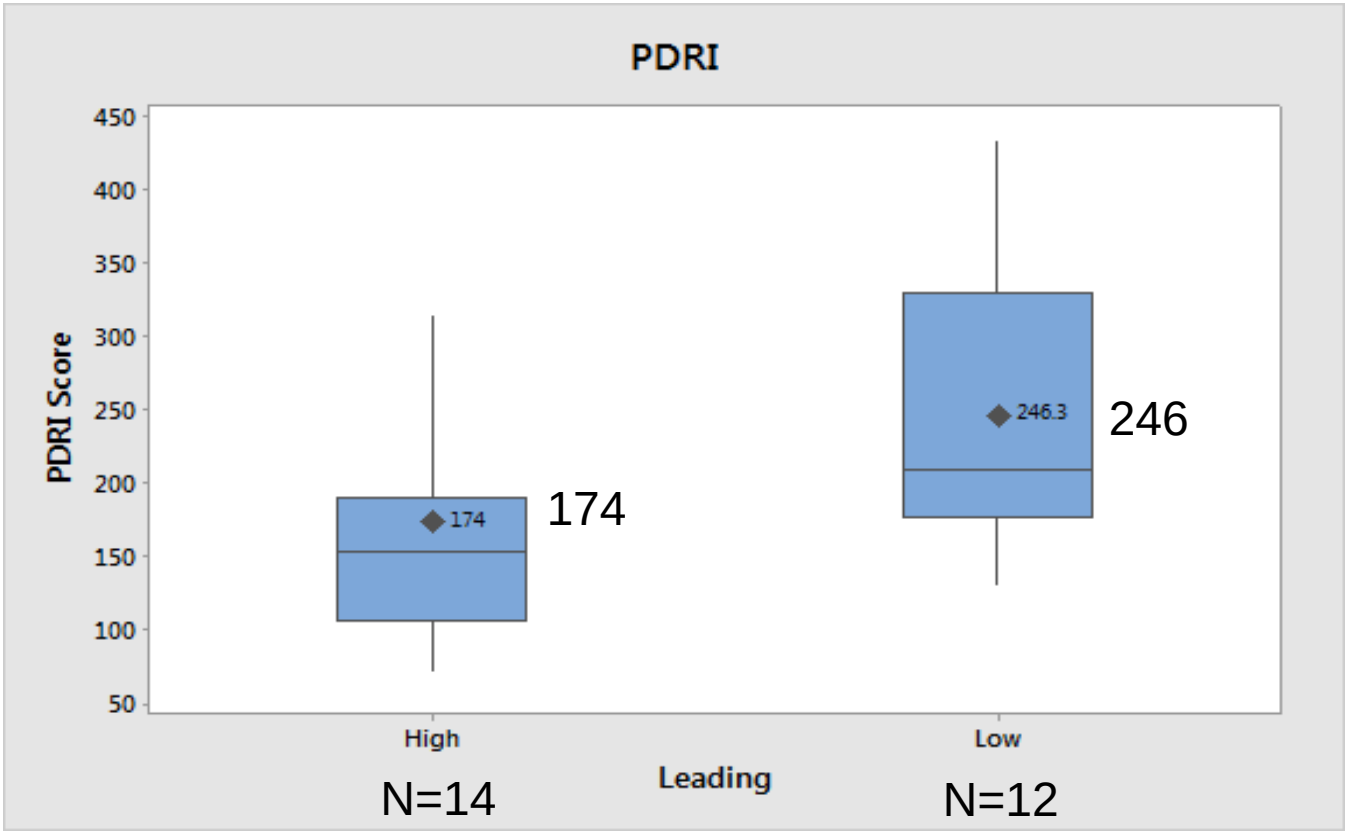
# CII AC: Industrial Sector FEP Input Measures

- Wide Variation



# CII AC: Industrial Sector FEP Input Measures

- Good Leadership = **29.3%** Better Scope Definition

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# Industry Recognition

TOP 400
ENR
ENGINEERING NEWS-RECORD


FORTUNE®
100 BEST
COMPANIES
TO WORK FOR

CII 30
Projects of the Year

# Questions?

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