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Construction Performance Committee Workshops

‘From Lagging to Leading’

Benchmarking Phase 3: 10-10 Program

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Associate Director – Capital Project Analytics

May 10, 2017 Edmonton, CA

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Goals

- 10-10 Program concept
- Correlating Performance – Leading/Lagging
- Applied Research with Best Practices

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Brief Background of CII

- Founded in 1983 by 28 organizations; now ~130
- An Organized Research Unit of the Cockrell School of Engineering at the University of Texas at Austin
- First structured Owner-Contractor-Academic research collaboration for the constructed project
- Focused on improving capital projects' execution (safety, productivity, cost and schedule effectiveness)
- Focused on using capital projects to drive business results

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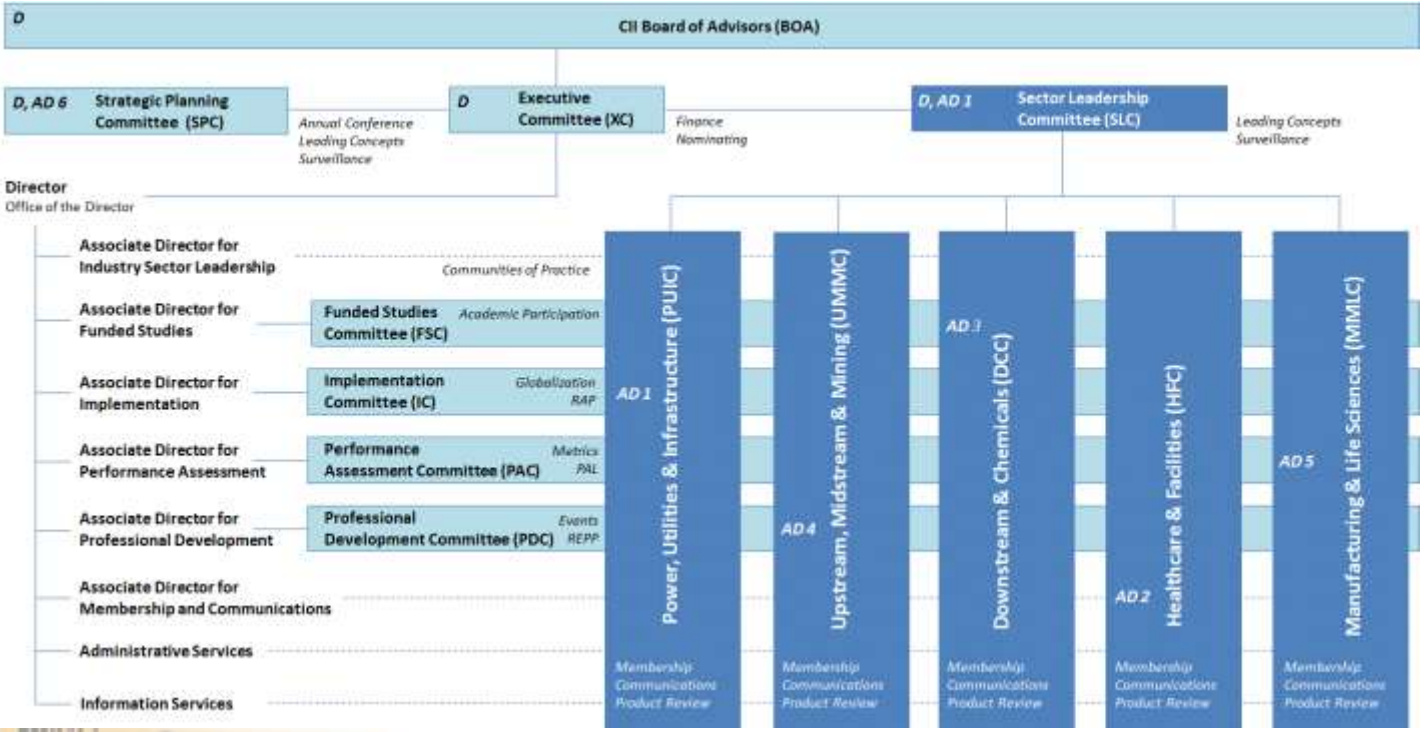
CII Structure



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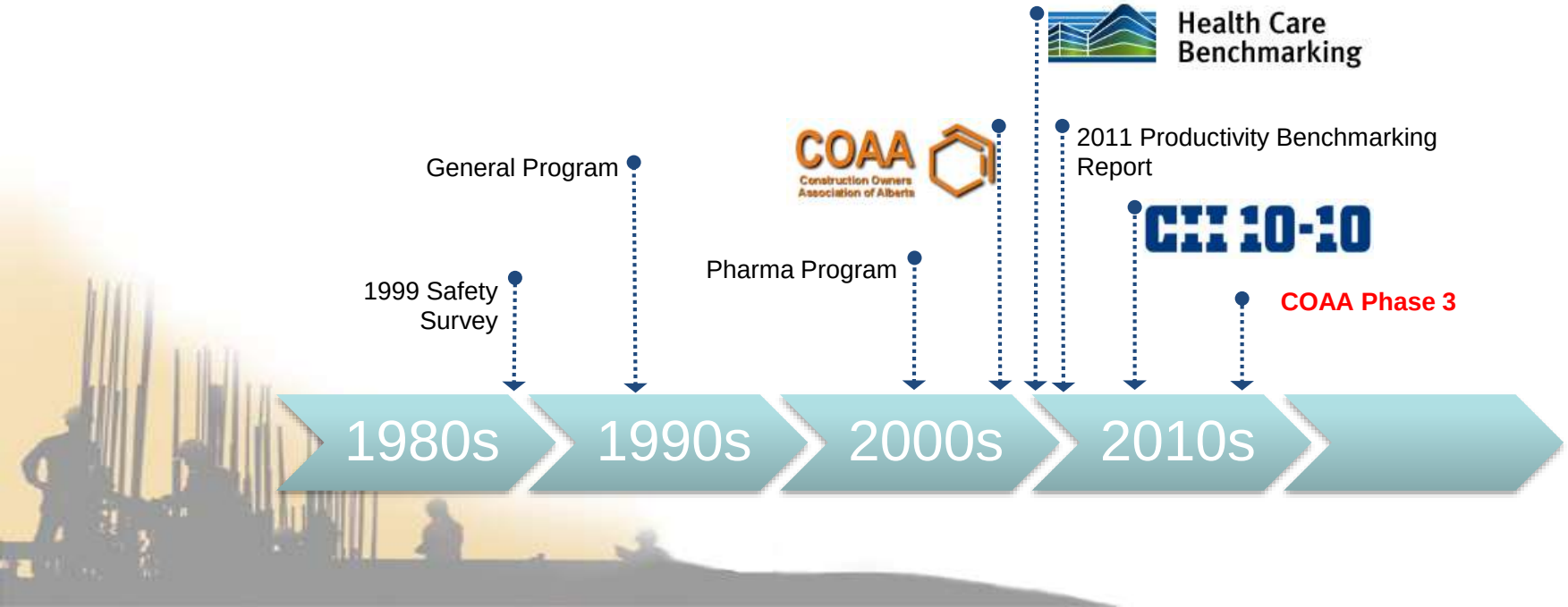
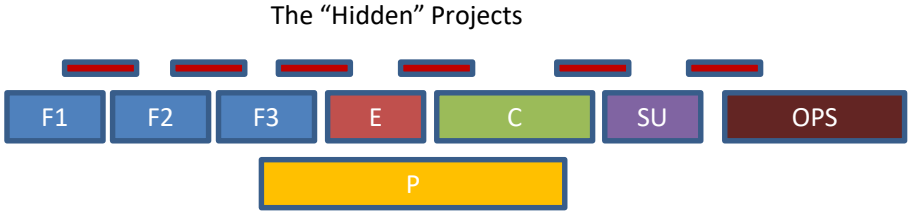
CII Performance Assessment TimeLine



Phased Based Measurement

'Old School' Project Management

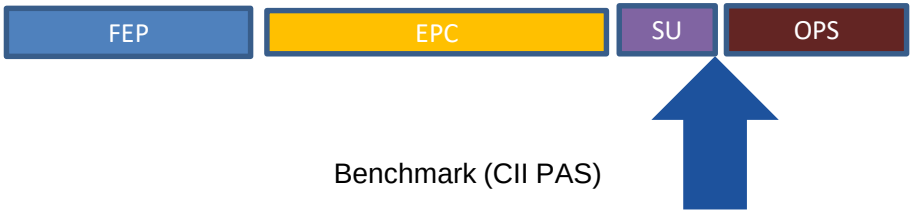
Phase-Gate Based Project Management



Phased Based Measurement

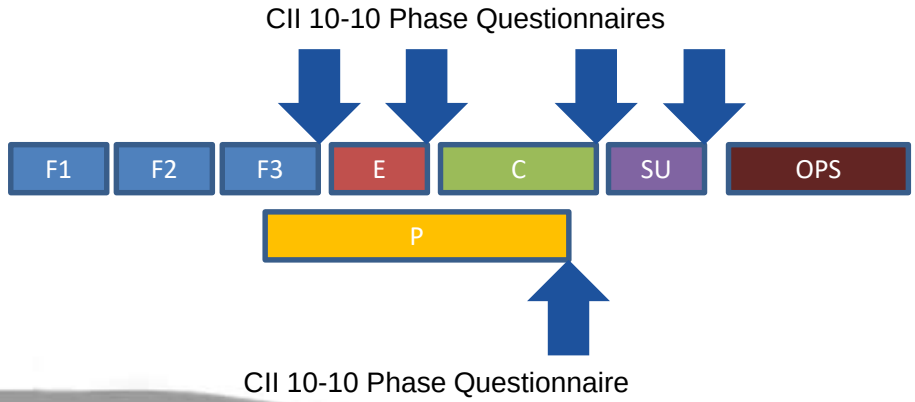
General Benchmarking

Process, Practice



10-10 Benchmarking

People, Practice



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CII 10-10 Program

- Performance Assessment System with simple and important indicators
  - 10 Leading Indicators
  - 10 Lagging Indicators

- Assesses project performance and team performance
- Provides **actionable** information
- Based on CII research

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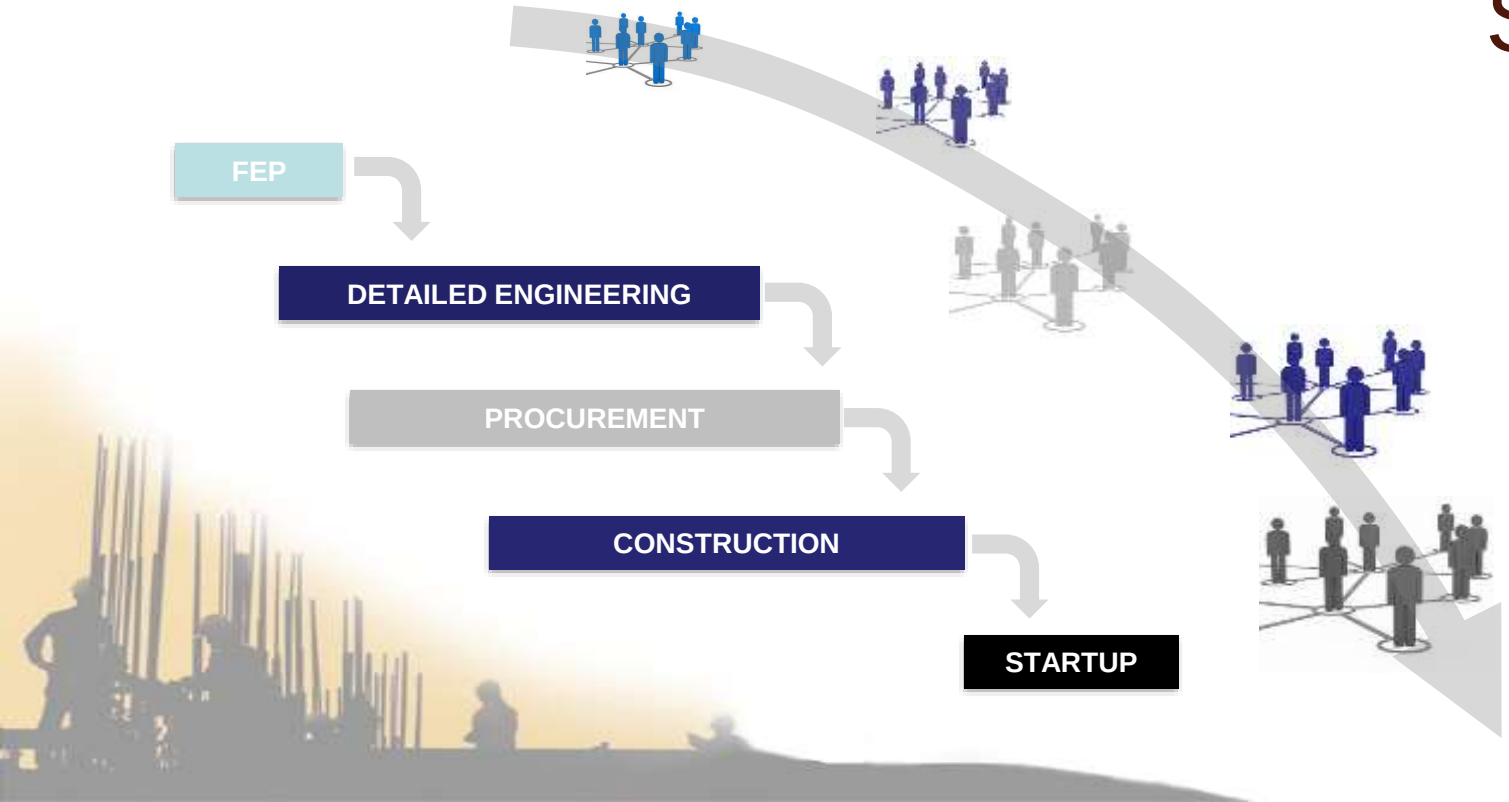
Phase Teams and Surveys



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Leading Indicators

- Assessing Practices and Working Relationships
- Capturing the opinion of multiple team members, anonymously
- Tests the Implementation, Adoption, Culture and Maturity of practices

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Leading Indicators

1. Planning
2. Organizing
3. Leading
4. Controlling
5. Human Resources
6. Quality
7. Sustainability
8. Supply Chain
9. Safety/EHS
10. Design Efficiency

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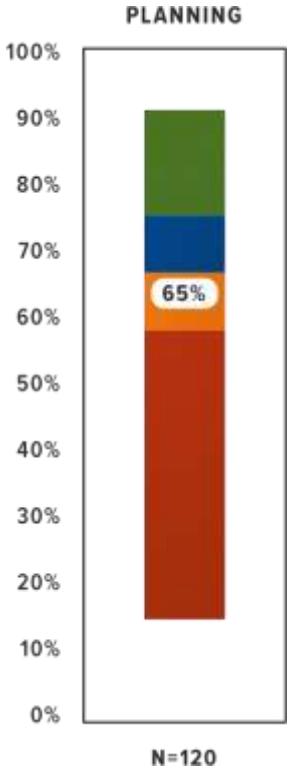
10 Leading Indicators

Planning:

- To predetermine a course of action
- Forecasting, Objective Setting, Program Development, Scheduling, Budgeting, and Policies and Procedures Development.

Organizing:

- To arrange and relate the work to be done so people can perform it most effectively
- Development of Organization Structure, Delegation of Responsibility and Authority, and Establishment of Relationships.



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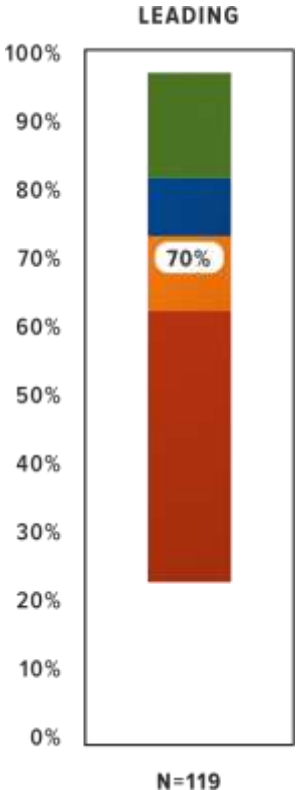
10 Leading Indicators

Leading:

- To cause people to take effective action
- Decision-Making, Communications, Motivation, Selection of People, and Development of People

Controlling:

- To assess and regulate work in progress and completed
- Establishment of Performance Standards, Measurement of Performance, Evaluation of Performance, and Correction of Performance.



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10 Leading Indicators

Design Efficiency:

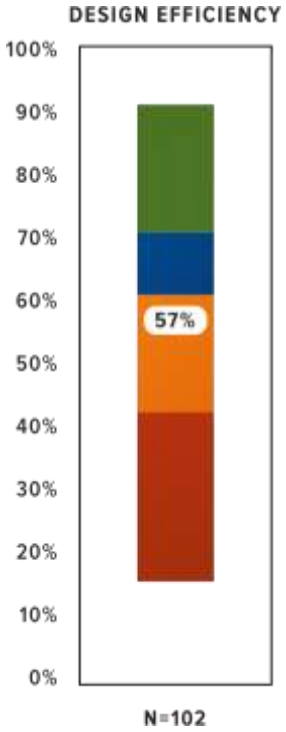
- Exploiting techniques to optimize the design
- Use of material quantities
- Maximum capacity at minimum cost

Human Resources:

- Appropriately staffed
- Minimum turnover
- Appropriate training
- Capability maturity

Quality:

- Direct conformance to project requirements
- Assure the delivery of material goods as intended



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10 Leading Indicators

Sustainability:

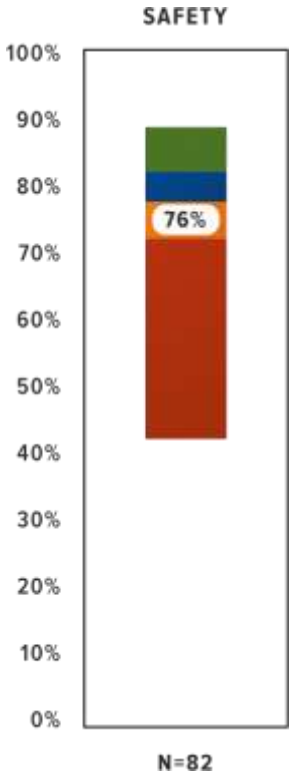
- Environmental impact of the project during construction and operation

Supply Chain Management:

- Promote enhanced working relationships amongst all project stakeholders including those in the project supply chain

Safety:

- Eliminate any possibility of personal injury or property damage on the project.



Leading Indicator Survey

Questions are:

- Yes/No
- 5-point scales (strongly agree - strongly disagree)
- Multiple choice questions

The interfaces between project stakeholders were well-managed.

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

The availability and competency of craft labor was adequate

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

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Leading Indicators

Assessing Practices and Working Relationships

Individual Input Measures - 6 Surveys

		Mean | SD		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
22	The project team was well aligned in terms of the owner's objectives, needs and expectations.	2.67 | 1.97	6	17%	33%	17%	17%	17%
36	All of the necessary, relevant project team members were involved in the risk assessment process.	2.67 | 1.03	6		33%			67%
38	Leadership effectively communicated business objectives, priorities, and project goals.	2.67 | 1.51	6		50%	17%	33%	
45	The project's work processes and systems (e.g., document management, project controls, business and financial systems) supported project success.	2.67 | 1.51	6	17%	17%		50%	17%
18	The Front End Planning process included sufficient resources necessary to adequately define the scope.	2.50 | 2.17	6	17%	33%	17%		33%
20	The project team members were familiar with the project execution plan (PEP) and they used it to manage their work.	2.50 | 1.76	6		50%	17%	17%	17%
21	The Procurement strategy and plan were developed and communicated to the project team during Front End Planning.	2.50 | 1.22	6		33%		50%	17%

Leading Indicators

Relevance of multiple responses

Formal classroom safety training was attended:

3.44

Was there a formal new hire safety orientation process?

3.00

Did an owner representative participate in the orientation?

2.89

Was safety performance a criterion for contractor and subcontractor selection?

2.89

Were safety toolbox meetings held daily?

2.78

3.00
Project Average Score

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Leading Indicators

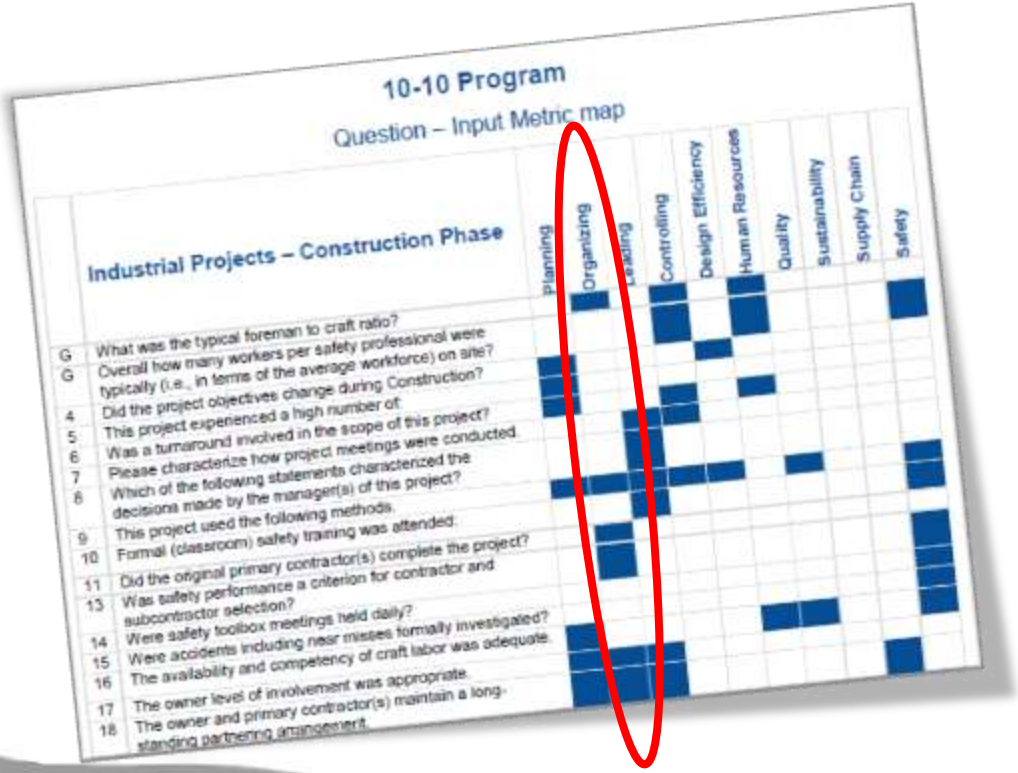
Assessing Practices and Working Relationships

Individual Input Measures - 1 Surveys

		Mean | SD	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
18	The Front End Planning process included sufficient resources necessary to adequately define the scope.	5.00 | 1	100%				
23	The project execution plan supported the objectives of this project.	5.00 | 1	100%				
24	The Front End Planning process adapted to changes in project objectives or market conditions.	5.00 | 1	100%				
26	The project had an effective risk identification and management process.	5.00 | 1	100%				
27	Preassembly, prefabrication, modularization, and offsite fabrication were thoroughly evaluated during Front End Planning.	5.00 | 1	100%				
32	People on this project worked effectively as a team.	5.00 | 1	100%				
36	All of the necessary, relevant project team members were involved in the risk assessment process.	5.00 | 1	100%				
37	Project leaders recognized and rewarded outstanding personnel and results.	5.00 | 1	100%				

Mapping Questions

Questions are mapped to Leading indicators



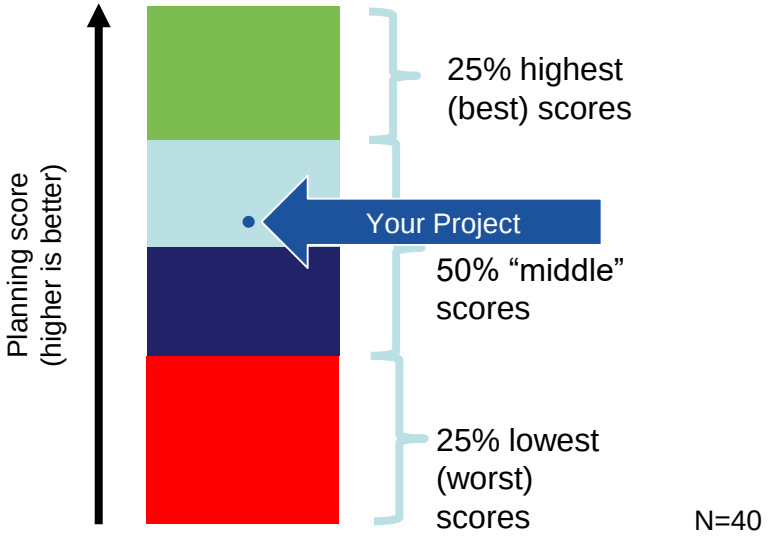
10-10 Program

Question – Input Metric map

	Industrial Projects – Construction Phase	Planning	Organizing	Leading	Controlling	Design Efficiency	Human Resources	Quality	Sustainability	Supply Chain	Safety
G	What was the typical foreman to craft ratio?		■		■		■				■
G	Overall how many workers per safety professional were typically (i.e., in terms of the average workforce) on site?				■		■				
4	Did the project objectives change during Construction?	■				■					
5	This project experienced a high number of	■			■		■				
6	Was a turnaround involved in the scope of this project?	■			■						
7	Please characterize how project meetings were conducted.			■							
8	Which of the following statements characterized the decisions made by the manager(s) of this project?	■	■	■	■	■		■			■
9	This project used the following methods.			■							■
10	Formal (classroom) safety training was attended.		■								■
11	Did the original primary contractor(s) complete the project?		■								■
13	Was safety performance a criterion for contractor and subcontractor selection?										■
14	Were safety toolbox meetings held daily?							■	■		■
15	Were accidents including near misses formally investigated?	■									
16	The availability and competency of craft labor was adequate.	■	■	■	■						■
17	The owner level of involvement was appropriate.	■	■								
18	The owner and primary contractor(s) maintain a long-standing partnering arrangement.	■	■								

Leading Indicator - Report

- Understanding Quartiles
- Suppose a group of 40 “similar” projects and how they perform for the planning indicator



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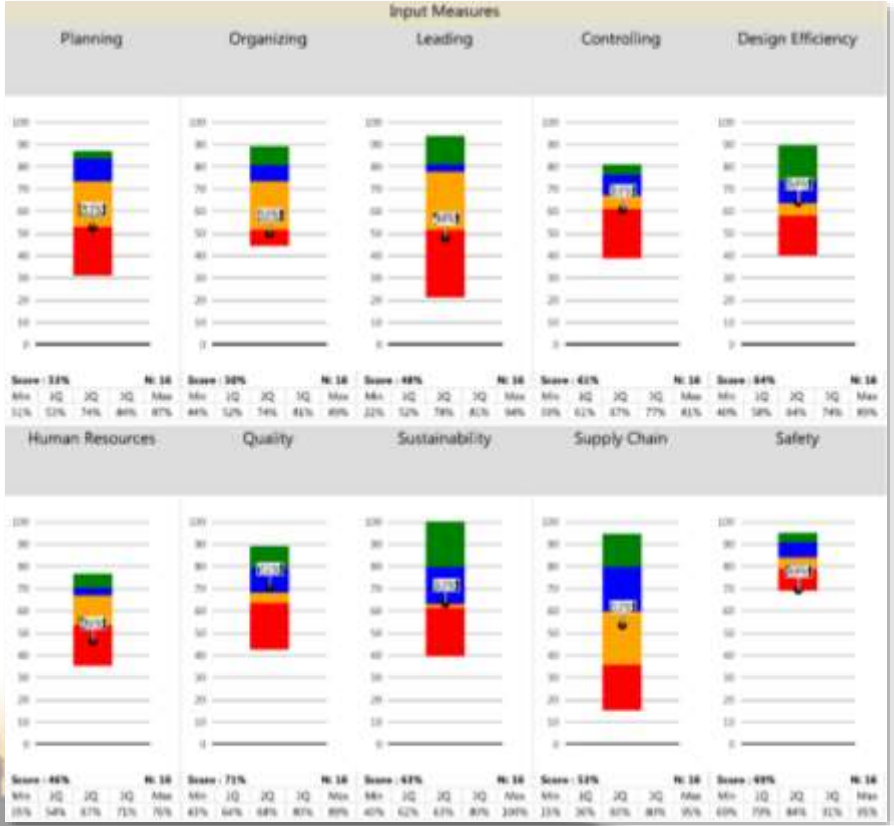
Leading Report



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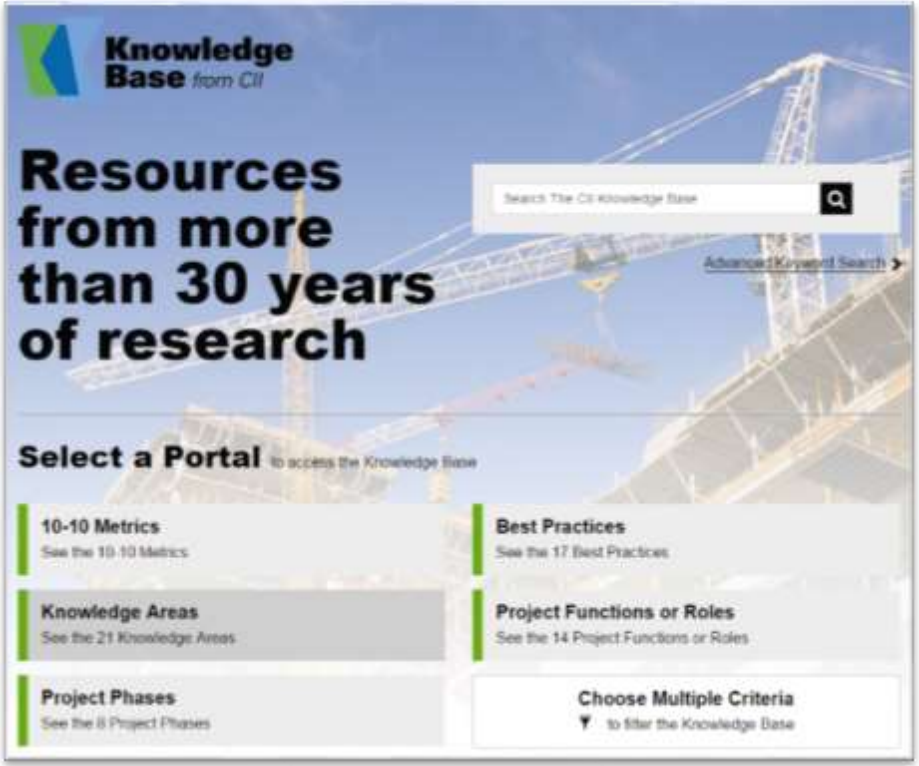
Finding CII resources for specific indicators



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Measurement of Practices

Best Practice	FEP	Engineering	Procurement	Construction	Startup
Front End Planning	√				
Constructability	√	√			
Project Risk Assessment	√		√		
Planning for Startup	√	√	√	√	
Alignment	√	√	√	√	√
Team Building	√	√	√	√	√
Change Management		√	√	√	
Quality Management		√	√	√	√
Materials Management		√	√	√	
Zero Accident Techniques				√	√

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Lagging Indicators (Metrics) by Phase

Table 5: List Output Metrics by Phase

Metrics Type	FEP/PROG	ENG/DES	PRO	CON	STA/COM
Capacity-based Metrics	1. (Building) Forecasted Project Cost Efficiency 2. (Building) FEP (Programming) Cost Efficiency 3. (Building) Forecasted Project Schedule Efficiency 4. (Building) FEP (Programming) Schedule Efficiency	1. (Building) Forecasted Project Cost Efficiency 2. (Building) Engineering (Design) Cost Efficiency 3. (Building) Forecasted Project Schedule Efficiency 4. (Building) Engineering (Design) Schedule Efficiency 5. (Building) Capacity Efficiency	1. (Building) Forecasted Project Cost Efficiency 2. (Building) Total Equipment Cost/Capacity 3. (Building) Forecasted Project Schedule Efficiency 4. (Building) Procurement Schedule Efficiency	1. (Building) Forecasted Project Cost Efficiency 2. (Building) Construction Cost Efficiency 3. (Building) Forecasted Project Schedule Efficiency 4. (Building) Construction Schedule Efficiency 5. (Building) Capacity Efficiency	1. (Building) Actual Project Cost Efficiency 2. (Building) Startup (Commissioning) Cost Efficiency 3. (Building) Actual Project Schedule Efficiency 4. (Building) Startup (Commissioning) Schedule Efficiency
Relative Metrics	5. FEP (Programming) Cost Growth 6. FEP (Programming) Schedule Growth	6. Engineering (Design) Cost Growth 7. Engineering (Design) Schedule Growth	5. Procurement Schedule Growth 6. Total Cost of Equipment/Total Project Cost	6. Construction Cost Growth 7. Construction Schedule Growth	5. Startup (Commissioning) Cost Growth 6. Startup (Commissioning) Schedule Growth
Phase burn Metric	7. FEP (Programming) Burn Rate	8. Engineering (Design) Phase Burn Rate	7. Procurement Phase Burn Rate	8. Construction Phase Burn Rate	7. Startup (Commissioning) Phase Burn Rate
Procurement Metrics			8. Total Cost of Equipment/Total Number of Major Equipment 9. Total Project Cost/Number of Vendors 10. Total Project Cost/Number of Purchase Orders		
FTE-Based Metrics	8. Project Management Team Size/Total Project Cost (Adjusted for Complexity)	9. Project Management Team Size/Total Project Cost (Adjusted for Complexity) 10. Engineering Team Size/Total Project Cost (Adjusted for Complexity) 11. Engineering Team Size/Engineering Phase Cost	11. Project Management Team Size/Total Project Cost (Adjusted for Complexity) 12. Procurement Team Size/Total Project Cost (Adjusted for Complexity) 13. Procurement Team Size/Total Cost of Major Equipment	9. Project Management Team Size/Total Project Cost (Adjusted for Complexity) 10. Craft Work Force/Construction Phase Cost	8. Startup (Commissioning) Management Team Size/Total Project Cost (Adjusted for Complexity) 9. Startup (Commissioning) Phase Management Team Size/Startup Phase Cost
Safety Metrics				11. TRIR 12. DART	

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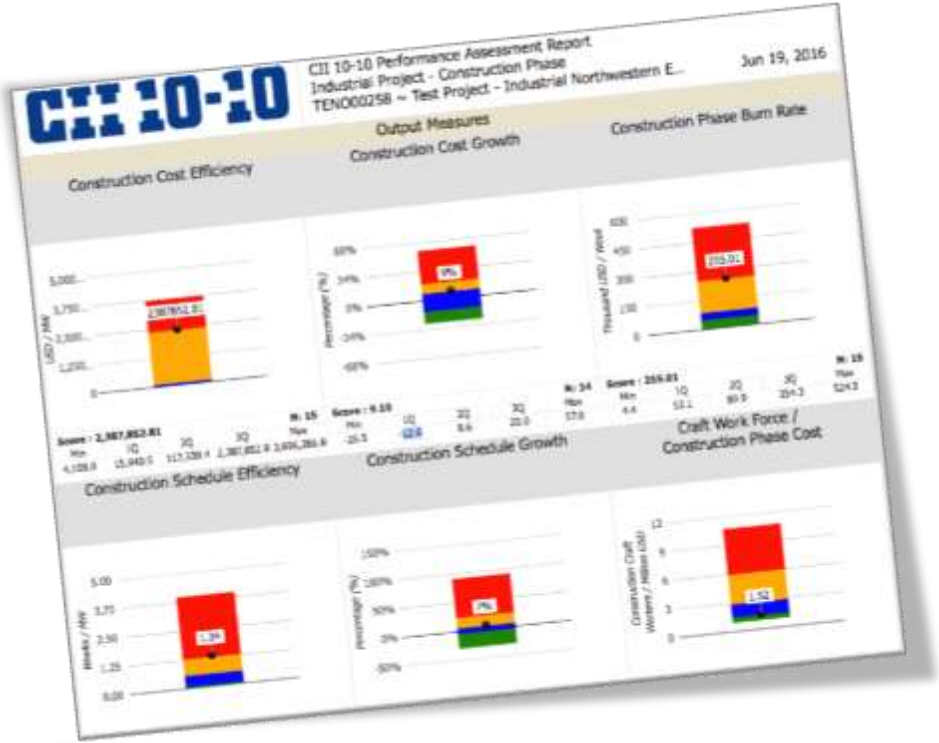
Lagging Indicators

Assessing Project Outcomes

Construction Cost growth:

$$\frac{\text{Actual Cost - Estimated Cost}}{\text{Estimated Cost}}$$



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Lagging Indicators

Assessing Project Outcomes

Matching similar projects:

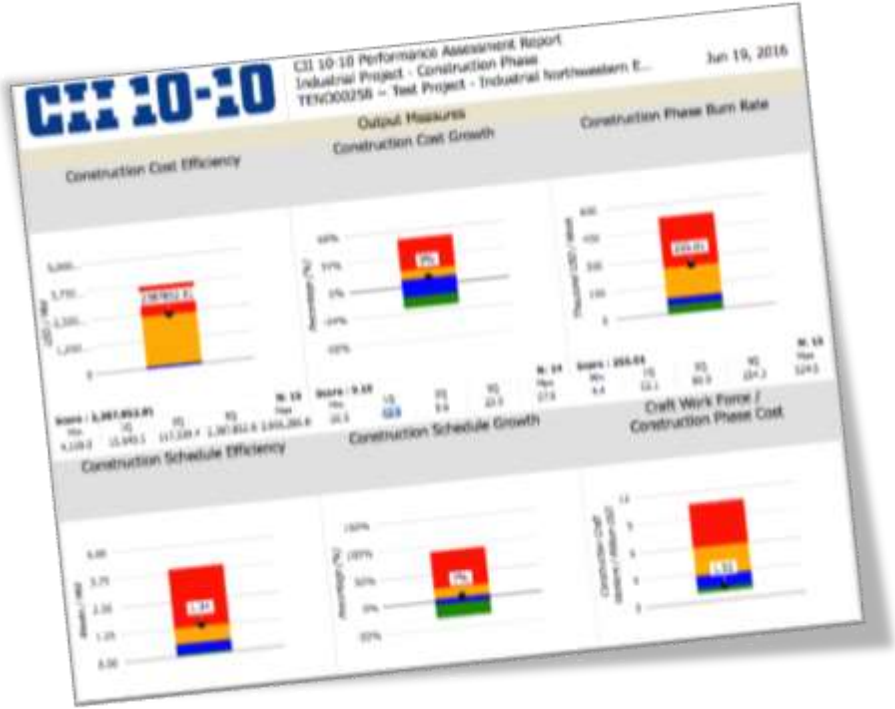
Start with all Projects: 1,800

⌊Phase [Construction]: 1,200

⌊Respondent [Owner]: 1,000

⌊Type [Refining]: 400

⌊Capacity Unit [BPD]: 60



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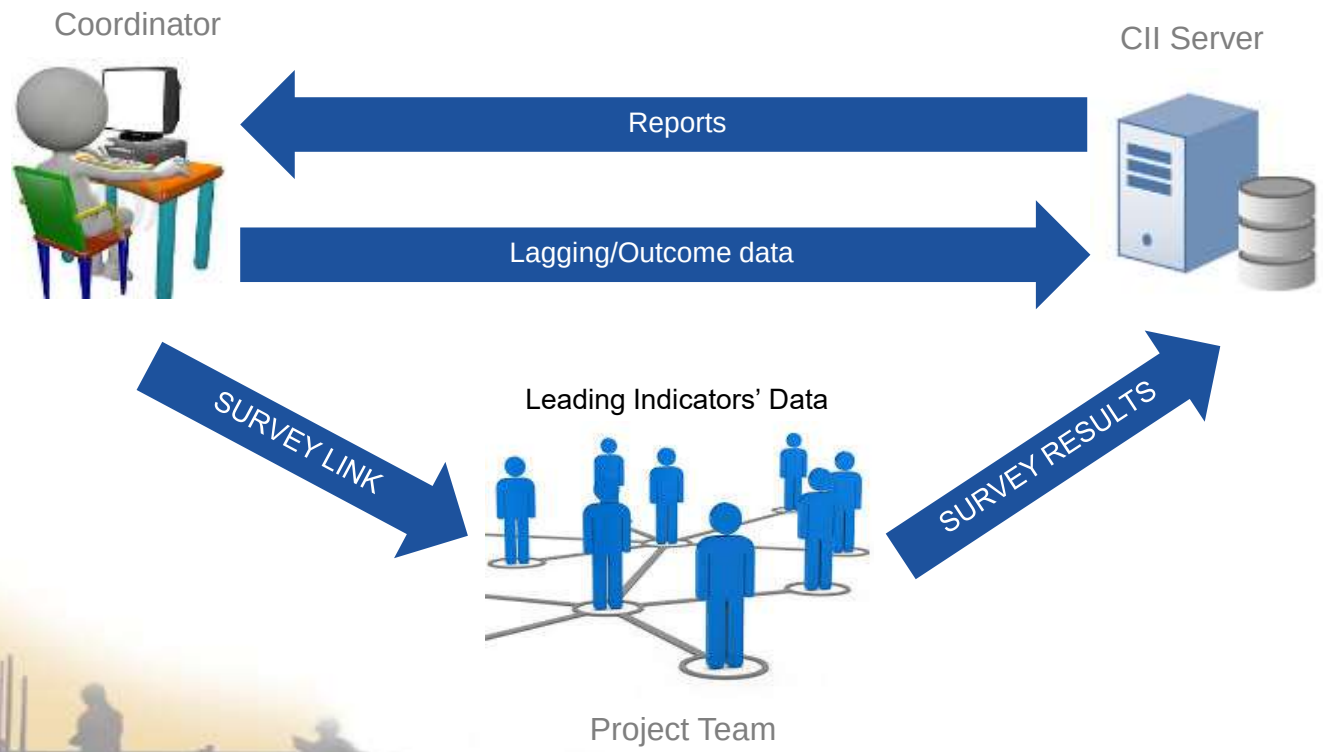
CII 10-10 Model



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10-10 PERFORMANCE ASSESSMENT FINDINGS

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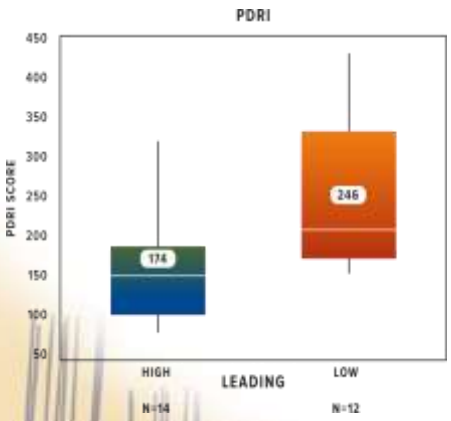
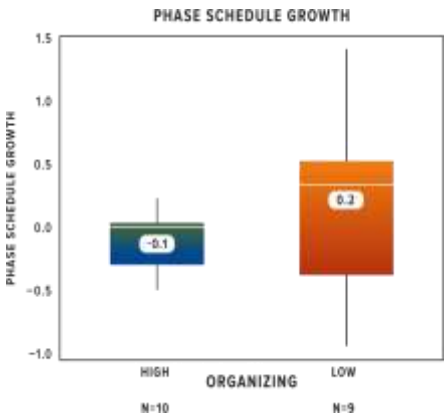
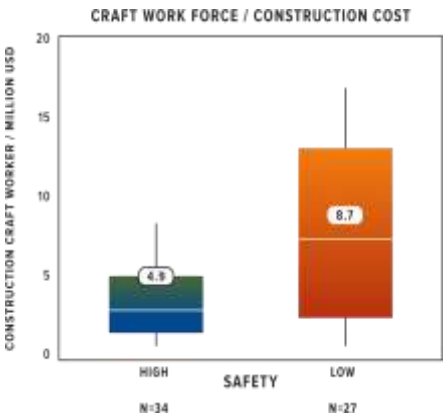
Leading Impact on Lagging

Effect of Leadership



Effect of Organizing





Impact of Safety

Applied Research

CII Best Practice

- A process or method that, when executed effectively, leads to enhanced project performance.
- Proven, through extensive industry use and impact validation

Value of Best Practices

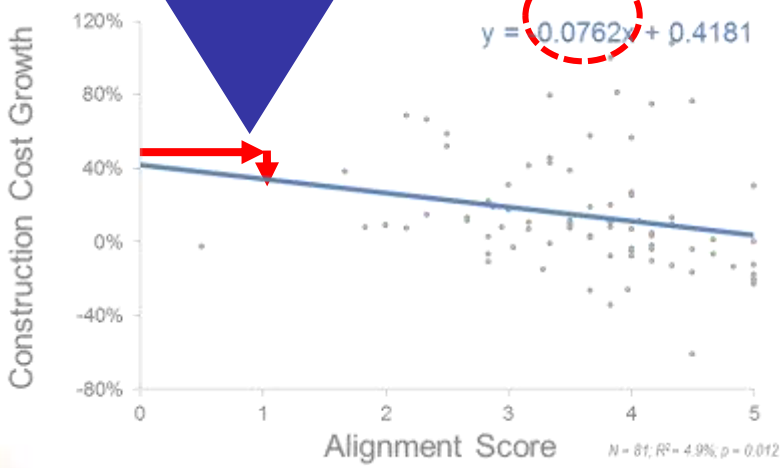
- Project benchmarking is used to understand extent of implementation & impacts
- Value of Best Practices Report is updated/reissued periodically

Assessing the Impact of Practices

What is the impact of practices on phase outcomes?

For 1 unit increase in the Alignment score, Construction Cost Growth decreased, on average, by 7.6%

We look at the coefficient of x in the regression equation



Practice Scores Across Phases

To what extent are practices *implemented* across phases?

What's HIGH? … What's LOW?

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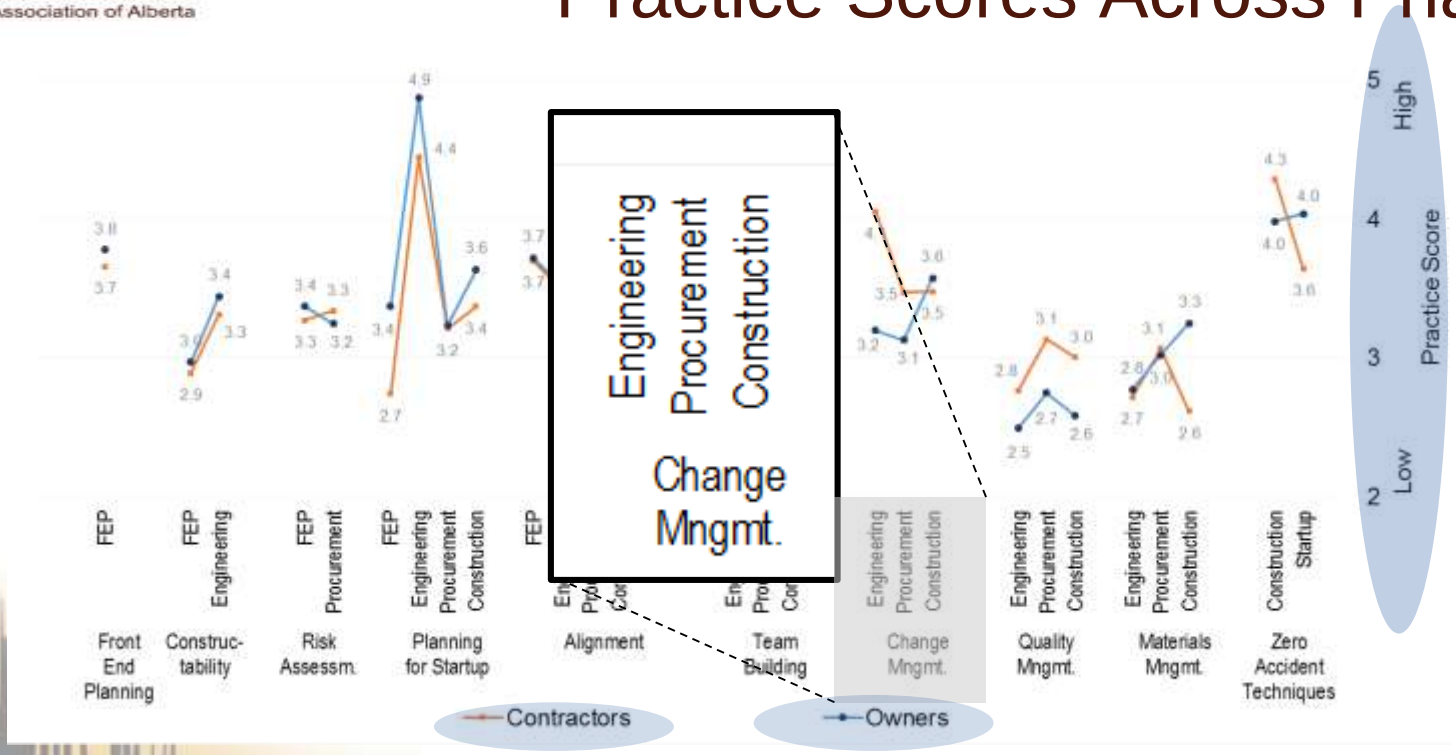
Practice Scores Across Phases



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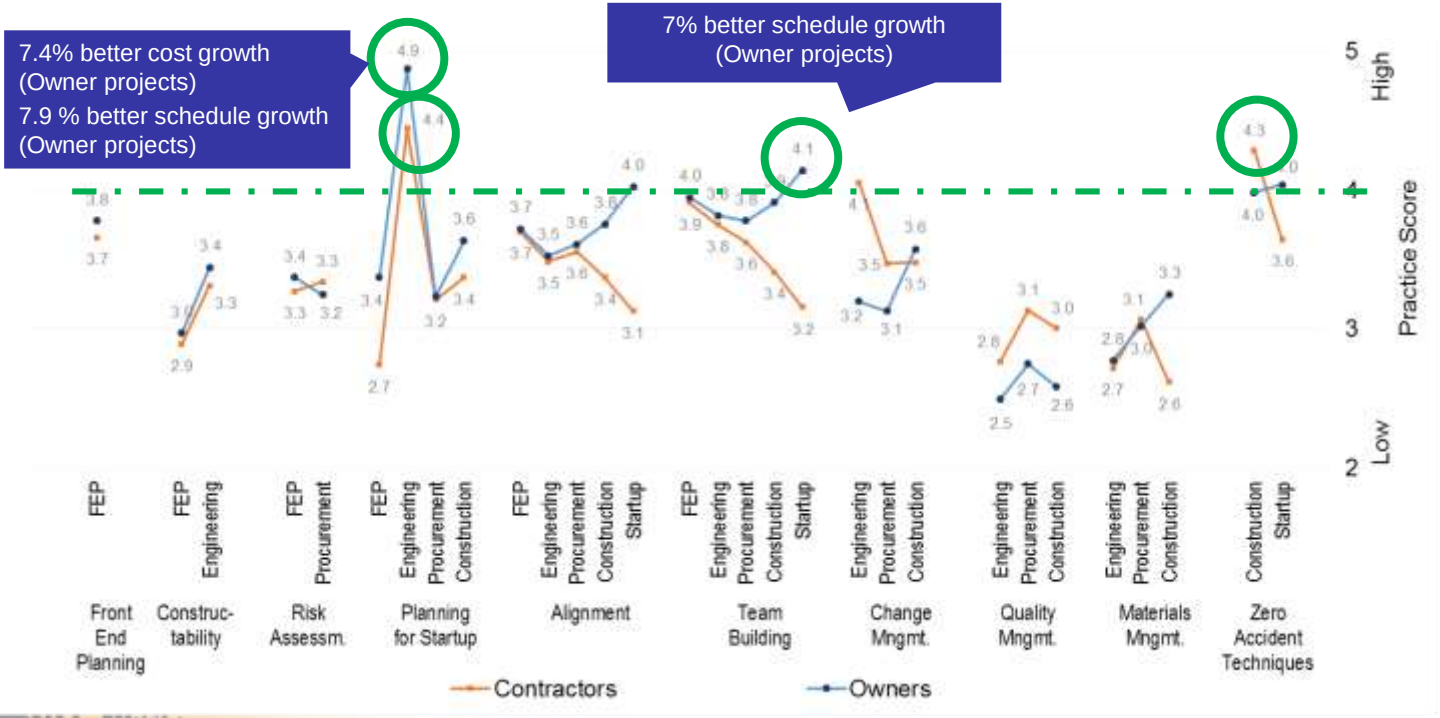
The Good News



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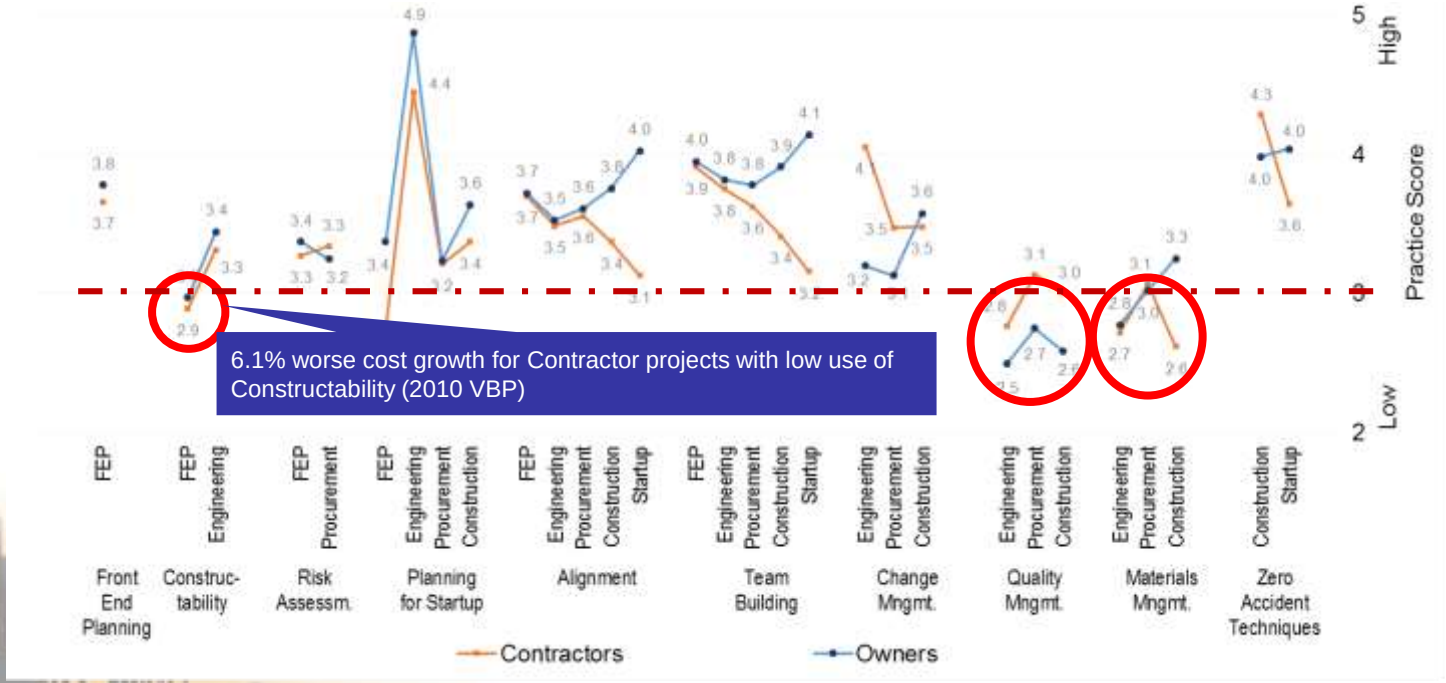
Opportunities for Improvement



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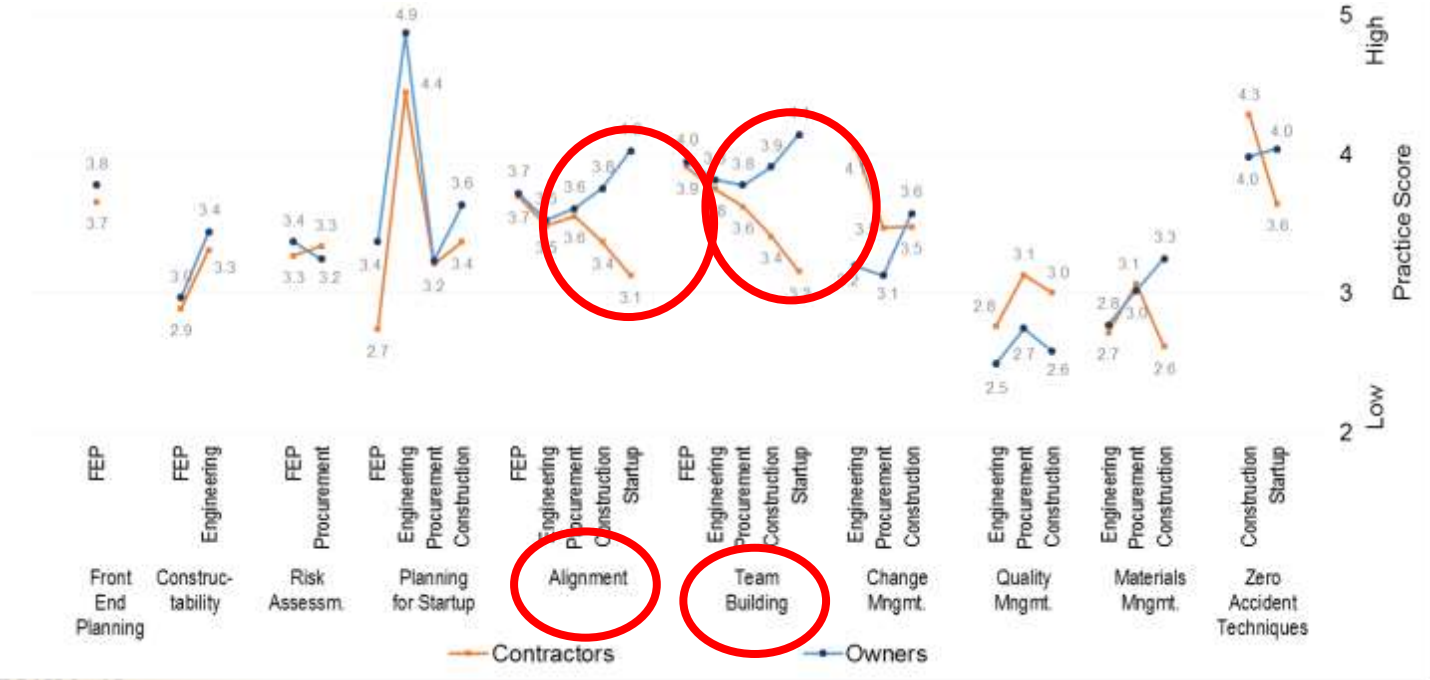
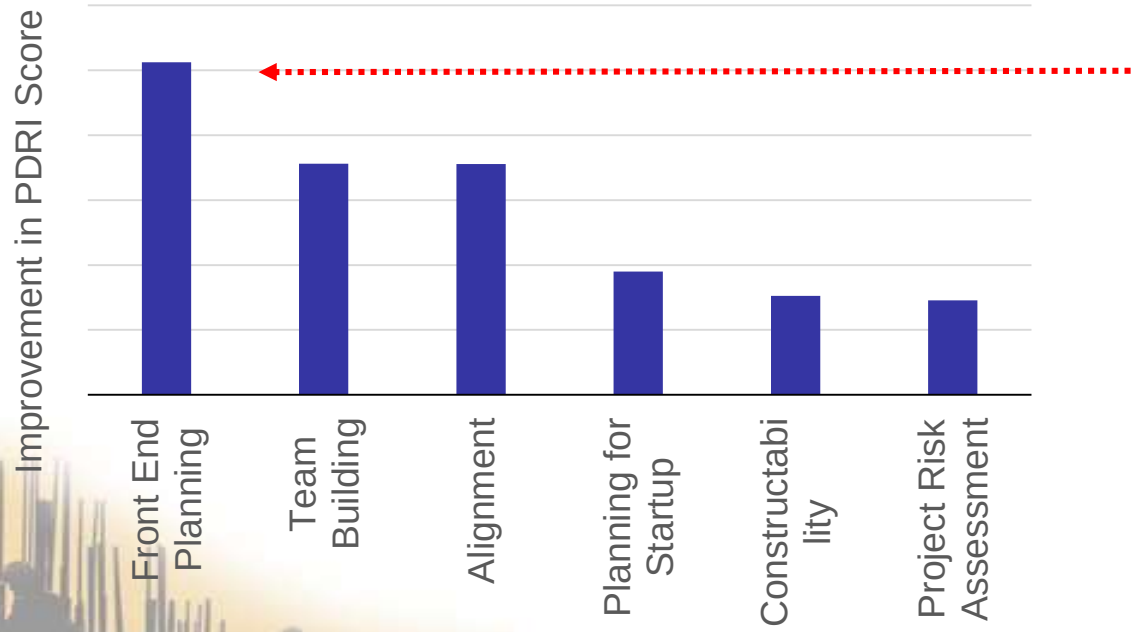
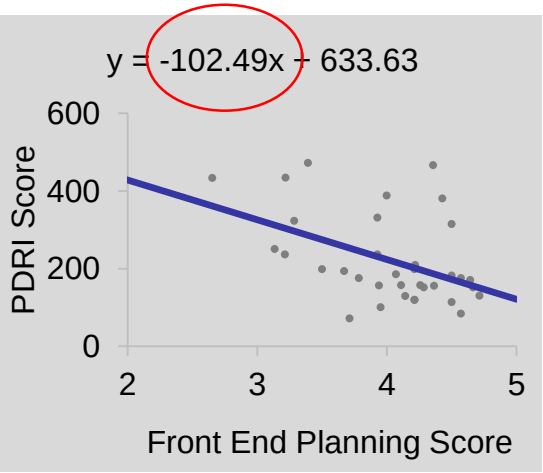
… No Alignment on Alignment ! !



FEP Associations - Summary

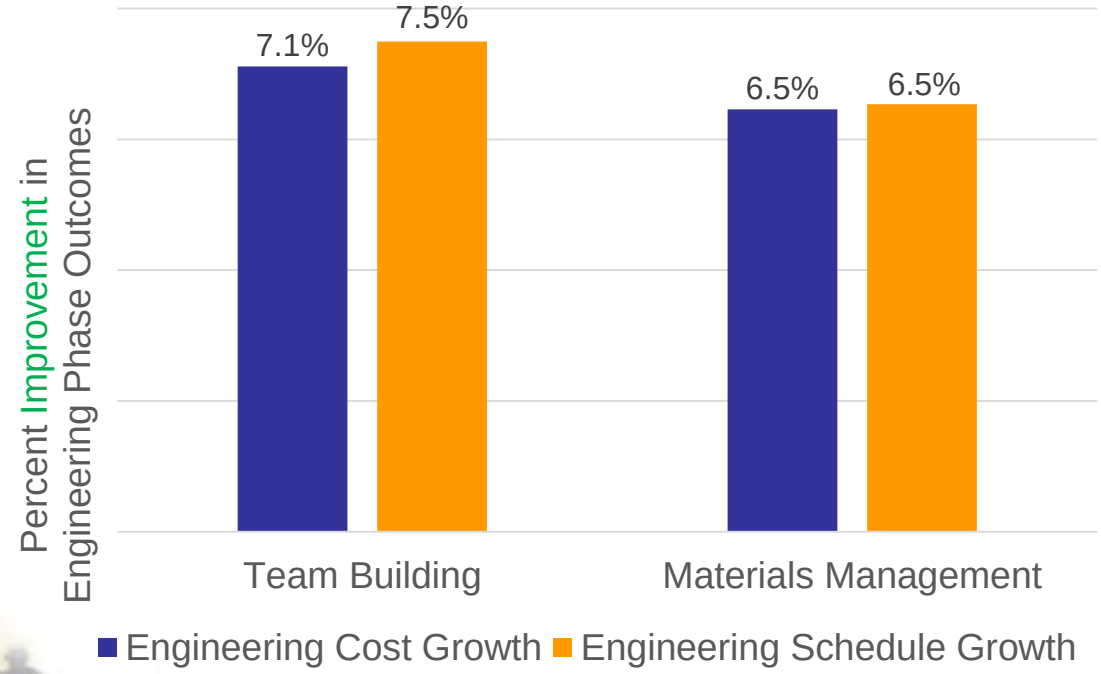
Improvement in PDRI score for one unit increase in practice score





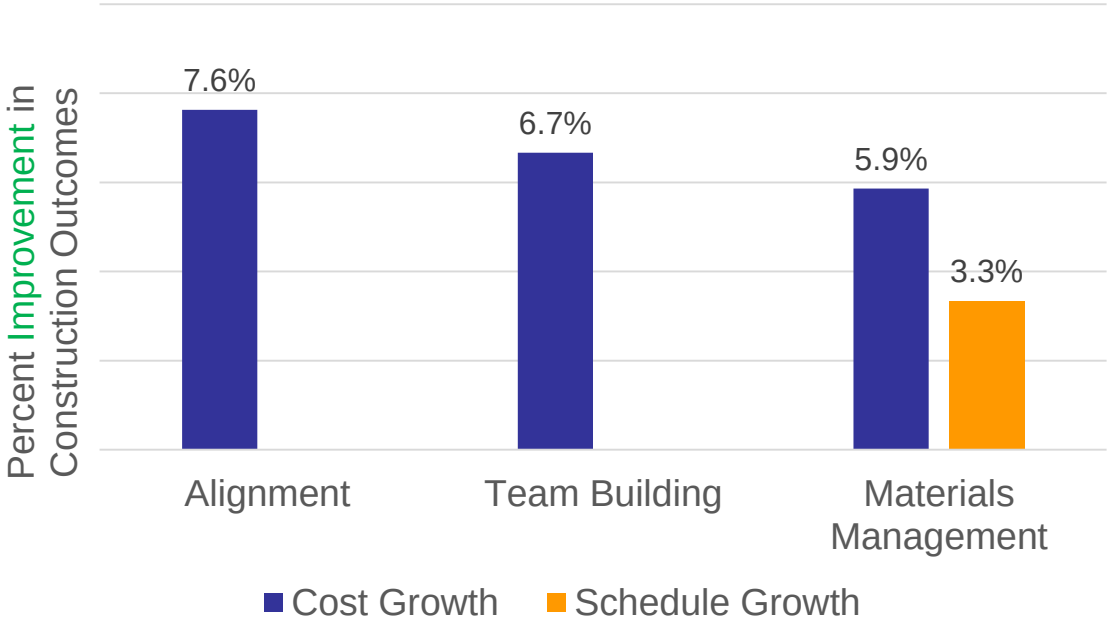
Associations During Engineering Phase

Improvement in score for <u>one unit increase in practice score</u>



Construction Phase Associations

Improvement in score for <u>one unit increase in practice score</u>



Summary of the Findings

1. Several practices had substantial impact on Scope Definition
   - Alignment, Team Building, Risk Management and Constructability
2. High potential for improvement for Materials and Quality Management
   - Especially in the Construction Phase
3. Overall, Alignment and Team Building are significantly correlated with project phase outcomes
   - These BPs still very relevant

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Call to Action

Benchmarking Phase 3:

- **Targeting 30+ projects in Phase 3**
- **Launch Leading Indicator '10-10' across project phases**
  - **Watch for Training schedule from the University of Calgary**
  - **Benchmarking Support offered directly through the University of Calgary**

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Questions?

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