Enhancing Predictability to Achieve World-Class Projects Performance

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Project Controls EXPO
Melbourne, Australia

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This is Hexagon PPM

Awarded Solutions Provider

Hexagon PPM is the No. 1 overall worldwide provider of engineering design tools for plant design for TEN consecutive years in 5 different categories.

Global Presence

More than **2,500** employees, with offices in **60** countries

R&D Focused

18% of total revenue invested in 2017 (€76M)

Innovative

PPM presently has **45** registered patents around the world

Hexagon PPM brings **capital projects execution construction, fabrication and operations** to the Hexagon portfolio

Our solutions are used by **nearly all of the Fortune Global 500 Owner / Operators** as well as the majority of EPC companies, within our industry segments

2017 Revenue by Region:

- North America: €130M
- South America: €15M
- EMIA: €158M
- APAC: €88M
- China: €31M

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EcoSys: Enterprise Projects Performance

Market Leadership

- EcoSys founders were the original developers of Primavera P6
- First to market and industry leader in Enterprise Projects Performance platform
- Deep portfolio & project management expertise

Business Momentum

- Largest adoption in enterprise projects performance space
- Global presence – users in 20+ countries
- A part of Hexagon PPM (formerly Intergraph Process Power & Marine) since 2015.

Loyal & Growing Customer Base

- 200+ clients globally
- Strong partnerships: SAP, Oracle, SAP, Microsoft, Accenture, IBM, and more

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EcoSys Customers by Industry

Engineering & Construction

ch2m: · JACOBS · BLACK & VEATCH · BECHTEL · WorleyParsons resources & energy · McDERMOTT · Petrofac · BURNS McDONNELL · SBM OFFSHORE · JGC · SNC·LAVALIN · Technip

Oil, Gas & Chemicals

MARATHON · AIR PRODUCTS · DOW · ENBRIDGE · Husky · lyondellbasell · Williams · Columbia Pipeline Group · noble energy · SUNCOR ENERGY · TESORO

Utilities

DUKE ENERGY · AEP AMERICAN ELECTRIC POWER · Ameren · Thames Tideway Tunnel · Creating a cleaner, healthier River Thames · ALSTOM · ONTARIO POWER GENERATION · Bruce Power · TVA · EDF · LA DWP

Aerospace & Defense

Sandia National Laboratories · Ball · JPL · IRVING · Irving Shipbuilding Inc.

Transportation

FEDERAL AVIATION ADMINISTRATION · Governments SANBAG Working Together · SFMTA Municipal Transportation Agency · METROLINX An agency of the Government of Ontario · CALIFORNIA High-Speed Rail Authority · Illinois Tollway · CONTRA COSTA transportation authority · Metro

Mining

AGNICO EAGLE · AngloAmerican · GOLDCORP · bhpbilliton · FREEPORT-McMoRan · ENRC

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EcoSys Enterprise Projects Performance

ECOSYS PRODUCTS AND PROCESS AREAS ACROSS THE PROJECT LIFECYCLE

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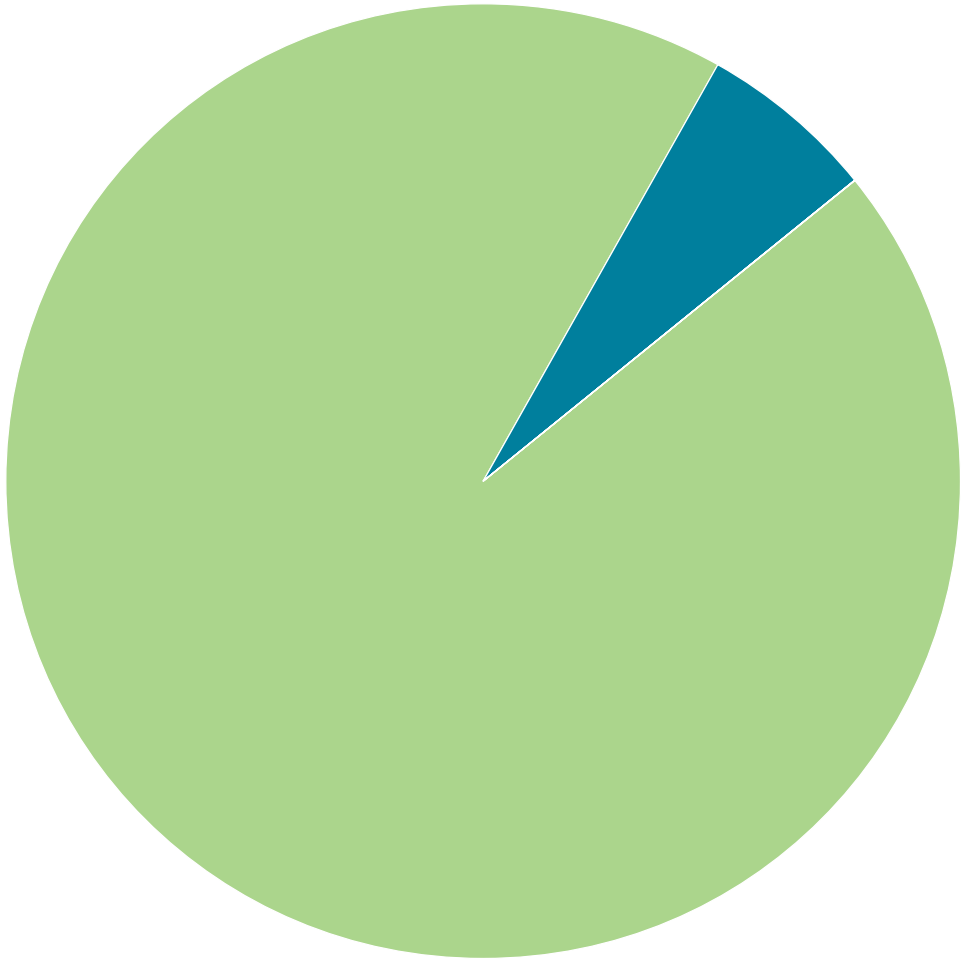
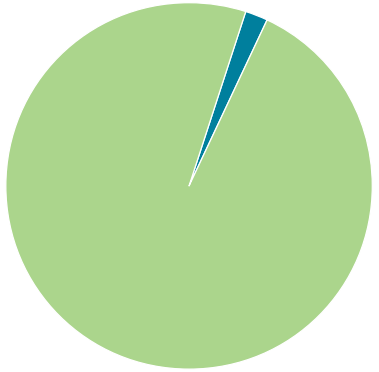
Introduction to Predictability

Poor Predictability Across All Sectors



<6%

of projects deliver planned financial returns



98%

of megaprojects see cost overruns greater than 30 percent

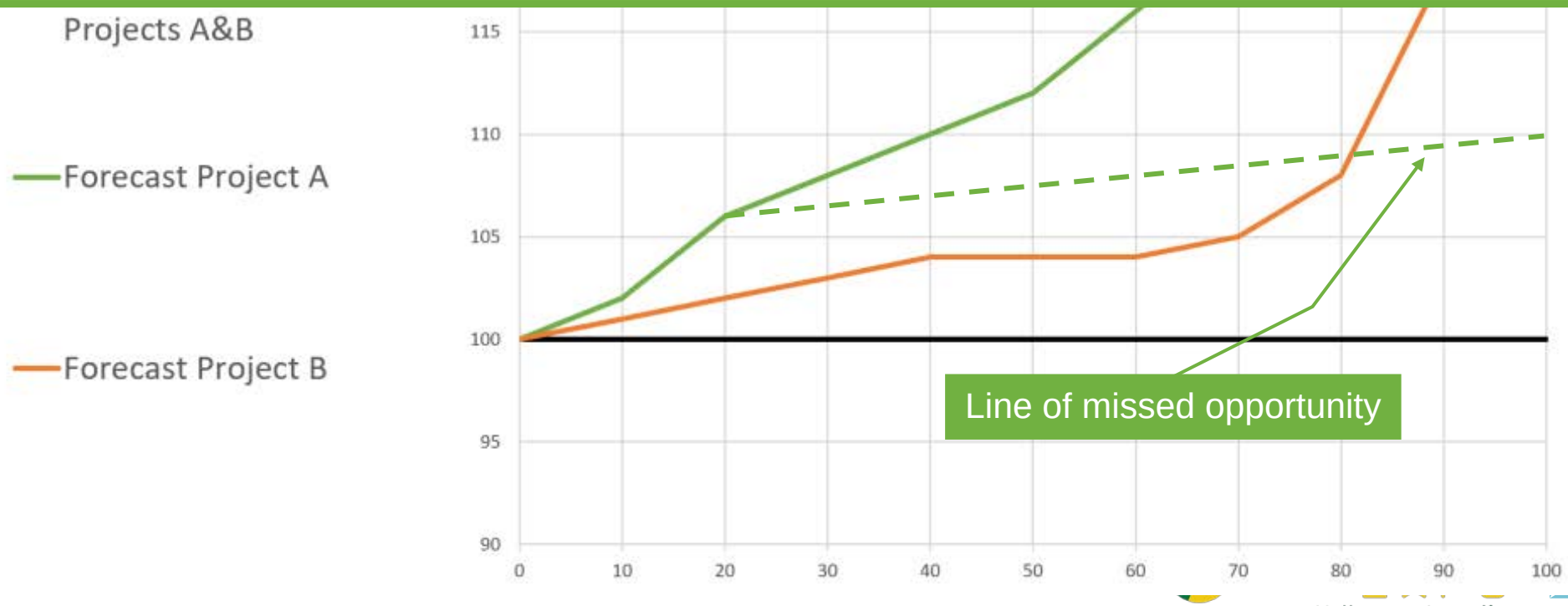
Sources:
** Construction Industry Institute*
** McKinsey: The Construction Productivity Imperative*

What is Predictability?

Both Projects have $100M Original Budget and $120M Actual Cost

Which is better and why?

A: The average point in time at which the project forecast becomes accurate



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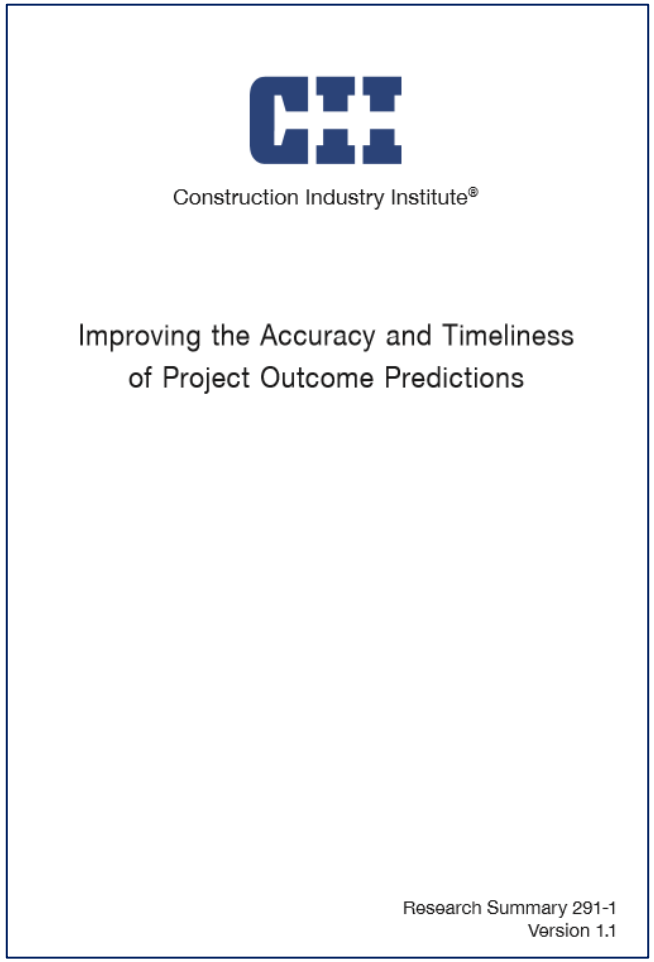
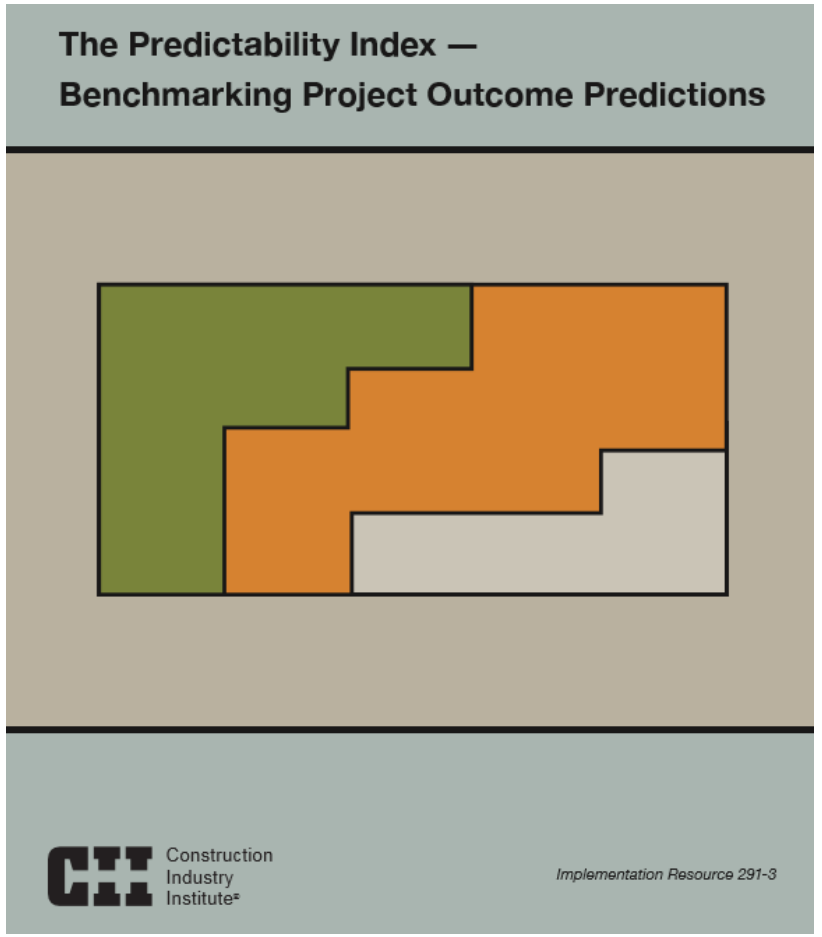
Common Causes of Low Predictability

Insufficient Effort or Attention	Low Maturity
• Improperly staffed (too many projects) • Process improvement and project controls are low priorities • Insufficient automation, high inefficiency	• Basic planning, estimating and risk management processes • Siloed organization and low levels of standardization (process / systems) • No Enterprise Projects Performance platform (rife use of Excel)
Optimism Bias	**Poor Transparency and Accountability**
• Benefits will be high, costs will be low • Early, inappropriate use of contingency • “Poor performance can be recovered in time to avoid overruns”	• Mixed motives for project approval and sustainability • Unwillingness to deliver bad news or kill bad projects • Multiple baselines and versions of the truth

CII Research Team 291





CII RT 291 Conclusions and Recommendations

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Conclusions and Recommendations

The engineering and construction industry currently utilizes a wide variety of non-standard practices, methodologies, and tools to predict project outcomes. These inconsistencies in approach and the absence of industry-validated, recommended practices have resulted in widely disparate abilities to meet the expectations of project sponsors. Some industry leaders argue that project teams simply lack the ability to make accurate predictions, leading them to withhold corrective actions until they have stronger data-based verification or additional indicators to substantiate outcome predictions. The lack of confidence in outcome predictions, or the suspicion of significant inaccuracies, undermines the project team's ability to be proactive in its adoption of corrective strategies. Research Team 291 was chartered to address this problem, and it has produced deliverables that enable project teams to become effective predictors.

This study has produced a comprehensive set of recommended practices for improving the accuracy and timeliness of project outcome predictions. The research team also developed a numerical index to measure cost and schedule predictability performance; this resource, the Predictability Index, indicates a project team's past ability to proactively and effectively address the events and surprises that have affected the accuracy and timeliness of its forecasts. Indeed, project teams cannot eliminate surprises (or all bad news), but they can—and should—mitigate the effect of such surprises with their early recognition, transparent and candid reporting, and full appreciation of the events that influence effective forecasting. To this end, project stakeholders are strongly encouraged to consider the importance of human behavior and organizational culture as explained in the research findings and as emphasized in the proposed predictability practices. This research proves that human behaviors and interpersonal team interactions, all influenced by the culture of the organization, have the most significant

Lack of confidence in outcome predictions undermines the ability to adopt corrective strategies.

This research proves human behaviors have *the* most significant influence on forecasting.

Early predictability adds value by enabling the proper response to surprises and changes.

Construction Industry Institute

70% of Projects

report ZERO budget variance prior to **50%** project duration

On average, variance reporting starts at **65% duration**

Common Causes of Low Predictability

Insufficient Effort or Attention	Low Maturity
	platform (rife use of Excel)
Optimism Bias	**Poor Transparency and Accountability**

Identifies areas for additional investment in people, processes and technology

Identifies issues with human behavior and organizational culture

Pillars of Predictability – People, Processes, Technology

Portfolio Management	Project and Contract Management	Project and Contract Controls	Performance Management	Predictability Measurement
Opportunity Scoring / Ranking	Iterative Planning / Estimating	Native and Automated Integration	Time-Phased Performance Baselines	Predictability Indices
Options Analysis	Integrated Communication and Collaboration	Multi-Method Cash Flow Management	Multi-Method Progress Measurement	Incentives Based on Predictability
Concept Estimating / Benchmarking	Integrated Change Management Workflow	Currency Variance Analysis	Productivity Analysis and Trending	Multi-Dimensional Analysis
Financial / Resource Optimization	Integrated Risk / Issues Management	Secure End-to-End Transparency	The “Living Forecast”	Corrective Actions
Project Development Stage Gate Workflows	Integrated Claims Management	Timely Reporting and Communications	Multi-Method Forecasting	Continuous Improvement

Enterprise Standards **Enterprise Productivity Platform** **Flexible Setup** **Real-Time Analytics**

Pillars of Predictability – Metrics and Culture

Predictability Measurement

Predictability Indices	• Adopt CII's Predictability Index to provide visibility into forecast update timeliness
Incentives Based on Predictability	• Use the Predictability Index to tie performance incentives to forecasting timeliness, not just outcome variance
Multi-Dimensional Analysis	• Aggregate Predictability by multiple dimensions to help pinpoint institutional issues
Corrective Actions	• Track corrective actions taken as a result of forecasting and predictability analysis
Continuous Improvement	• Review past performance during future lessons learned exercises and in early stages of future projects

Enterprise Standards **Enterprise Productivity Platform** **Flexible Setup** **Real-Time Analytics**

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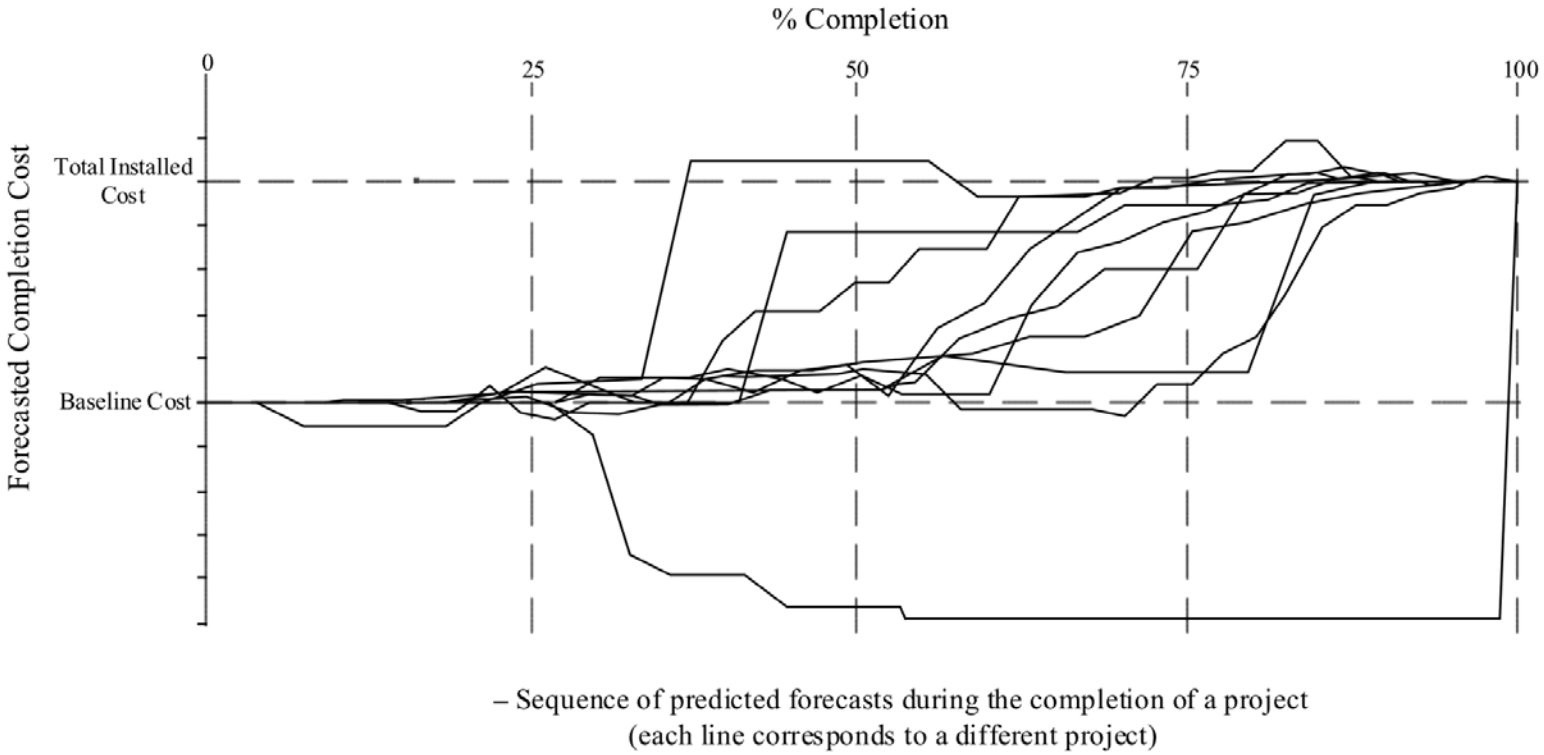
Pillars of Predictability – Metrics and Culture

Predictability Measurement – Predictability Indices

Normalized Cost Timeliness (**NCT**) = Inverse Area Under Line

Cost Predictability (**CP**) = NCT x % Cost Deviation



– Sequence of predicted forecasts during the completion of a project
(each line corresponds to a different project)

NCT & CP available in EcoSys 8.3, Q3 2018

- Immediate benefits to EcoSys customers:
  - Applies to all existing projects in EcoSys
  - Provides view into predictability over time, by division, region, etc.
  - Identifies areas for improvement

- Source of ROI measurement:
  - Has predictability improved since implementing EcoSys?
  - Has improved predictability resulted in reduced cost/schedule variance?

Pillars of Predictability – Metrics and Culture

Pillars of Predictability – Metrics and Culture

Predictability Measurement – Predictability Indices

- CII RT 291 measured 135 projects, totaling USD $28.8BN
- From this they established a benchmark for Predictability

Table 6. Cost Predictability Threshold Values

	Cost predictability	
Cost performance	Minimum	Maximum
Very good	0	3.5
Good	>3.5	7.8
Poor	>7.8	15.2
Very poor	>15.2	None

Pillars of Predictability – Metrics and Culture

Predictability Measurement – Predictability Indices

- To focus on systemic issues (internal to the nature of the project), metrics should be normalized for:
  - Escalation
  - Capacity and product changes (owner changes)
  - Regulatory changes
  - Unforeseeable risk events
- This ensures project teams are not penalized for issues outside of their control
- RT 291 did not separate issues outside the control of the project team, so new benchmarks are necessary

Pillars of Predictability – Metrics and Culture

Predictability Measurement – Incentives Based On Predictability

- **Direct Incentives –** project bonuses tied to:
  - Budget, schedule, quality, safety
  - AND Predictable delivery

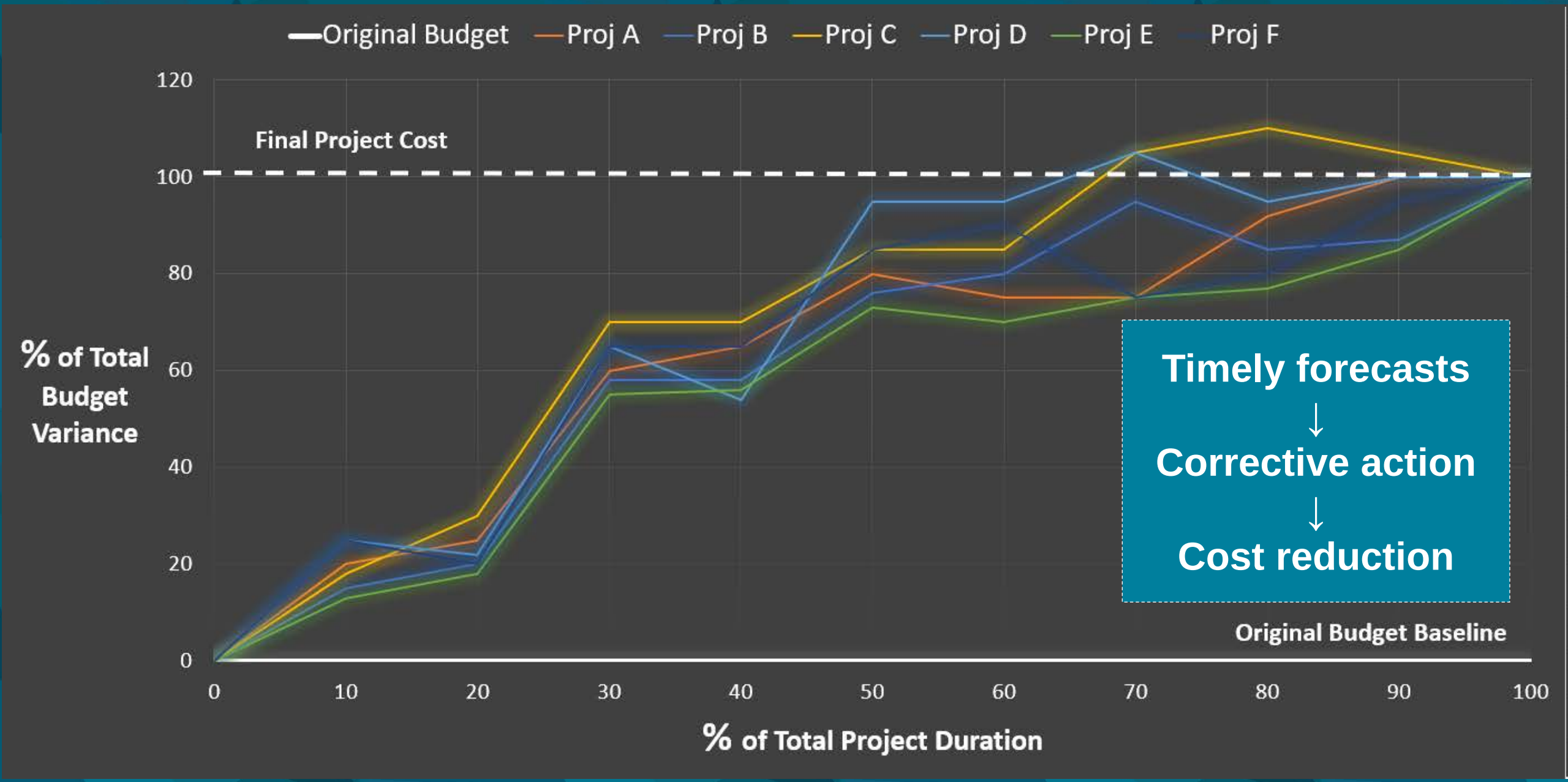
- **Indirect Incentives** – career paths tied to:
  - High predictability
  - Implies reliability, diligence, integrity and competence

Benefits of High Predictability

Proactive/Corrective Decision-Making	Cost and Schedule Reduction

• Early warnings of overruns stimulates corrective action:
  • Value engineering
  • De-scoping
  • Modifying the business case
  • Killing the project
	• Early corrective action or scrutiny can and should reduce overall cost and schedule
	• Avoids opportunity cost

Management Confidence/Trust	**Heightened Capital Efficiency**
• Increased likelihood of retention / promotion • Award of future projects	• Optimized ROCE and fiscal year performance • Avoids finance charges due to poor cash management and surprises


Original Budget
Proj A
Proj B
Proj C
Proj D
Proj E
Proj F
120
100
80
60
40
20
0
Final Project Cost
% of Total Budget Variance
Timely forecasts
↓
Corrective action
↓
Cost reduction
Original Budget Baseline
0
10
20
30
40
50
60
70
80
90
100
% of Total Project Duration

What if predictability was included as bid qualification criteria?

Could Potentially Identify…

Are Predictability Metrics too powerful and revealing to adopt?

Should we lead or be led in adopting Predictability Metrics?

Poor Performers

Lowball Bidders

Unscrupulous Individuals or Companies

Using Past Predictability with Predictive Analytics

Predictability is a backward looking metric…

We can turn it into a Predictive Analytic by applying Artificial Intelligence to:

1. Big Data Benchmarks of Predictability Index and other metrics
2. Standard parameters and attributes (e.g. RT 291, PDRI, ICMS)
3. Risk and issues
4. Unstructured Status Information
5. Other data sets (e.g. team competence assessment

Conclusions

- World-Class Enterprise Projects Performance can only be achieved by:

Adopting ALL of the Pillars of Predictability, enabled by an Enterprise technology platform

↓

Combines out-of-the-box best practices with customer-centric data and business processes

↓

Automate integration and predictability analytics

↓

Promote transparent, proactive behaviors

Q&A

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