Critical Success Factors and Forecasting Project Performance

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Outline

- Defining Project Success*
- Current Project Performance Trends
- Reasons for Failure
- Critical Success Factors for Improving Project Performance
- Innovations in Project Planning and Control
- Conclusions

*Portfolio Success is not addressed

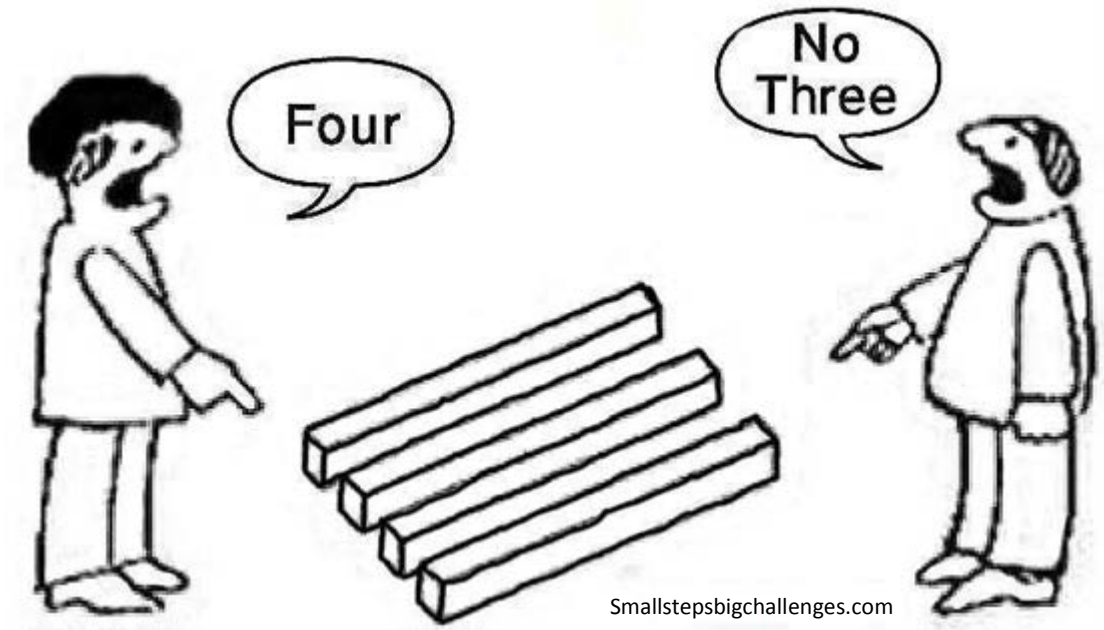
Wouldn’t it be great if every project was successful?

Q1: Experienced at least one very successful project?

Q2: How many would say that all of your projects turned out to be highly successful?

Defining Project Success

- **Success is in the eyes of the beholder**
  - **It's subjective and dynamic**
  - **Differs depending on perspective of each stakeholder (e.g., Owner, Designer, Contractor)**
  - **Can differ depending on perspective of those within an organization**



Measures of Project Success from Project Management Perspective*

Mainstream Measures

Budget (Cost), Schedule, Functionality, Safety, and Client Satisfaction

Other Measures

PM Team Satisfaction, Contractor Satisfaction (follow-on work and capabilities build-up), End User Satisfaction

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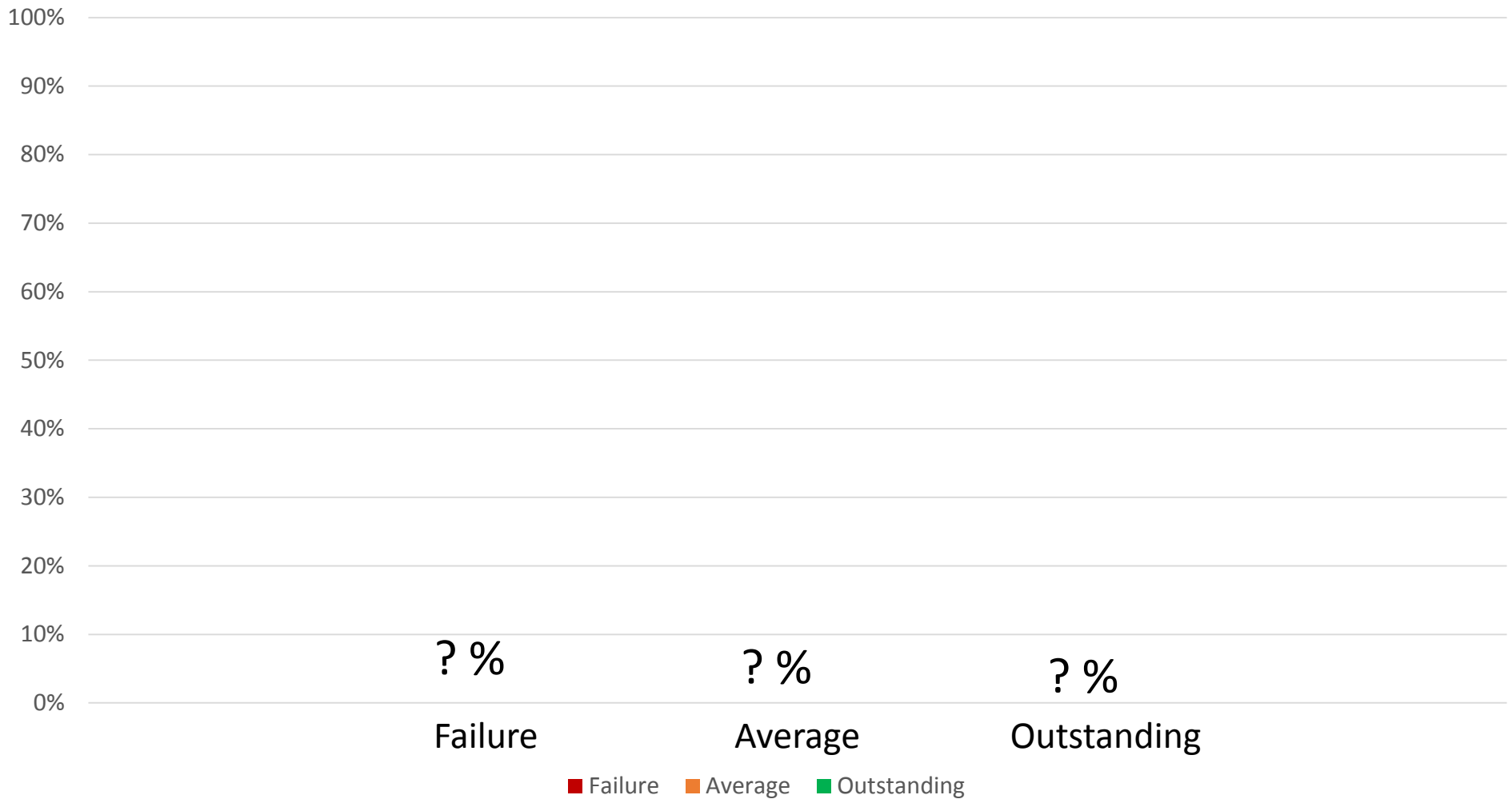
*Modified from Clive Lurie and David Ashley, “Determinants of Construction Project Success” Pilot Study

The Reality for basket of ALL Projects



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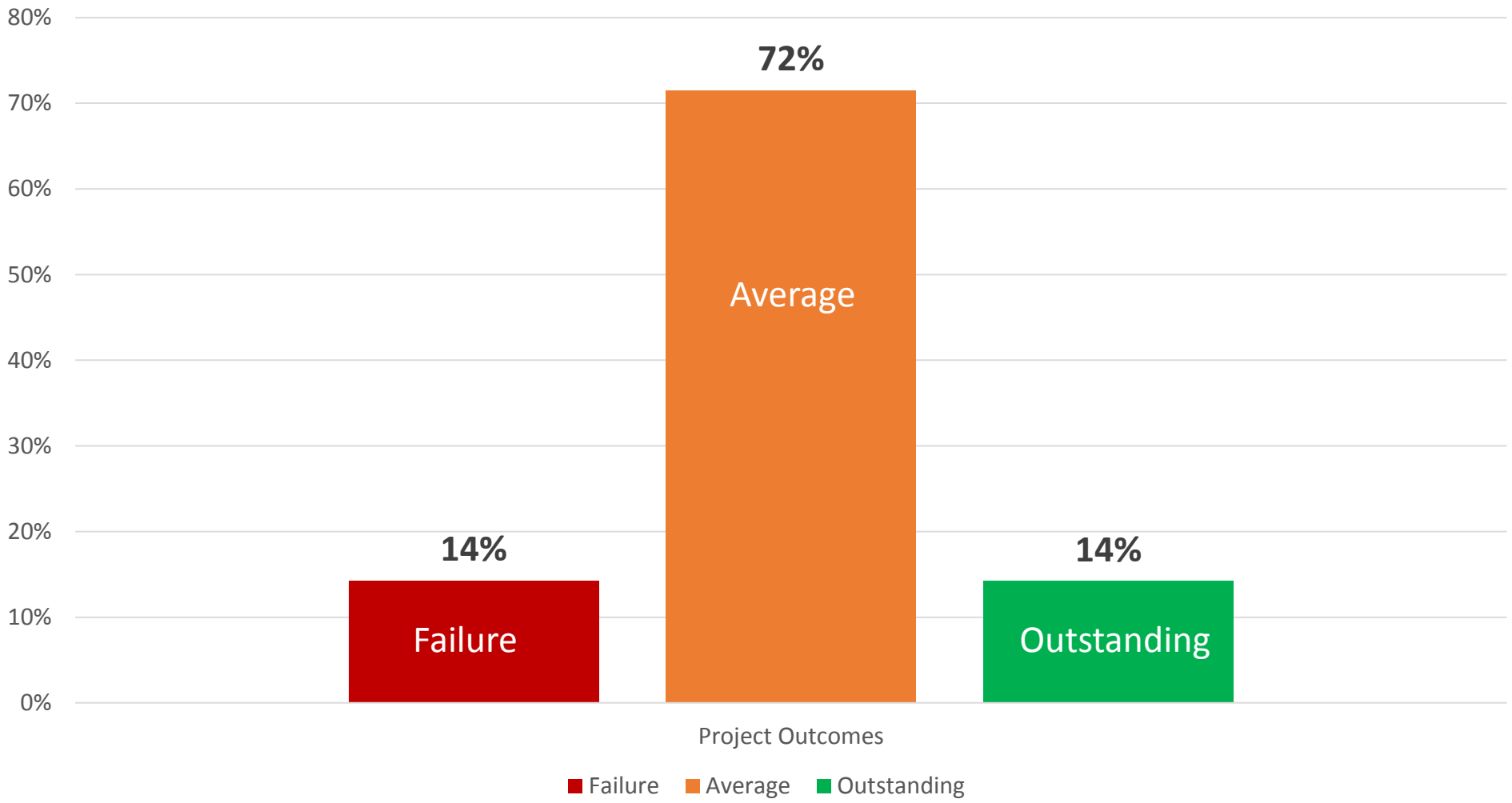
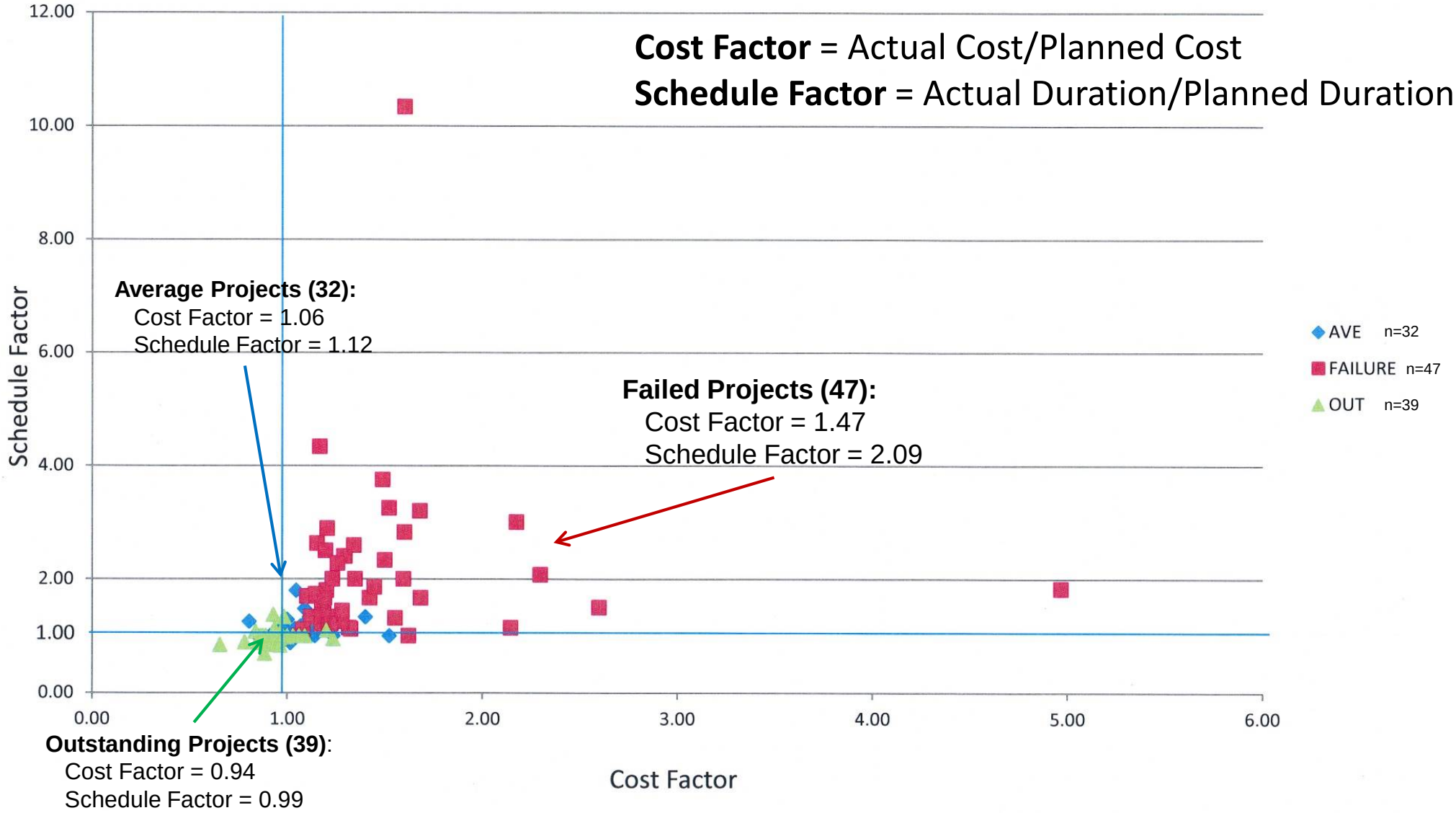


Improved Project Performance

Cost and Schedule Performance (118 Projects)

Cost Factor = Actual Cost/Planned Cost
Schedule Factor = Actual Duration/Planned Duration



How many **Mega Projects*** fail to meet authorized Cost and Schedule?

Original Contract

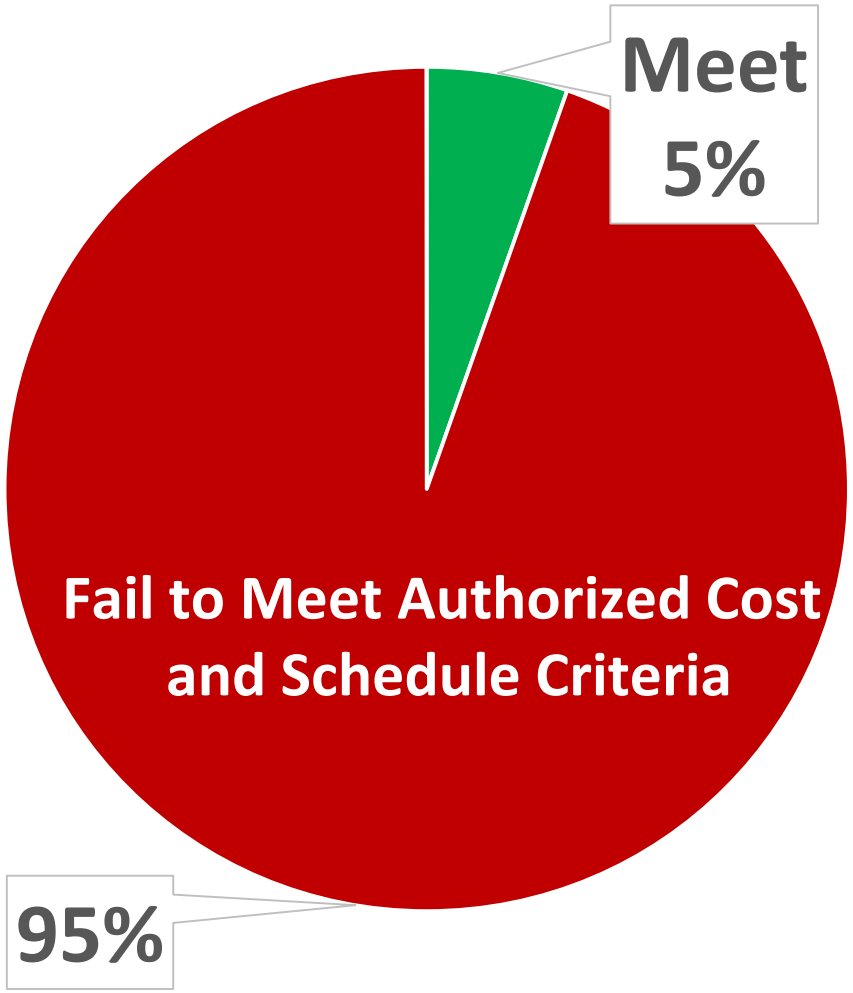
A. 65%
B. 75%
C. 85%
D. 95%

Completed Project

*Large, Complex Projects (size differs by organization)

Most of them!

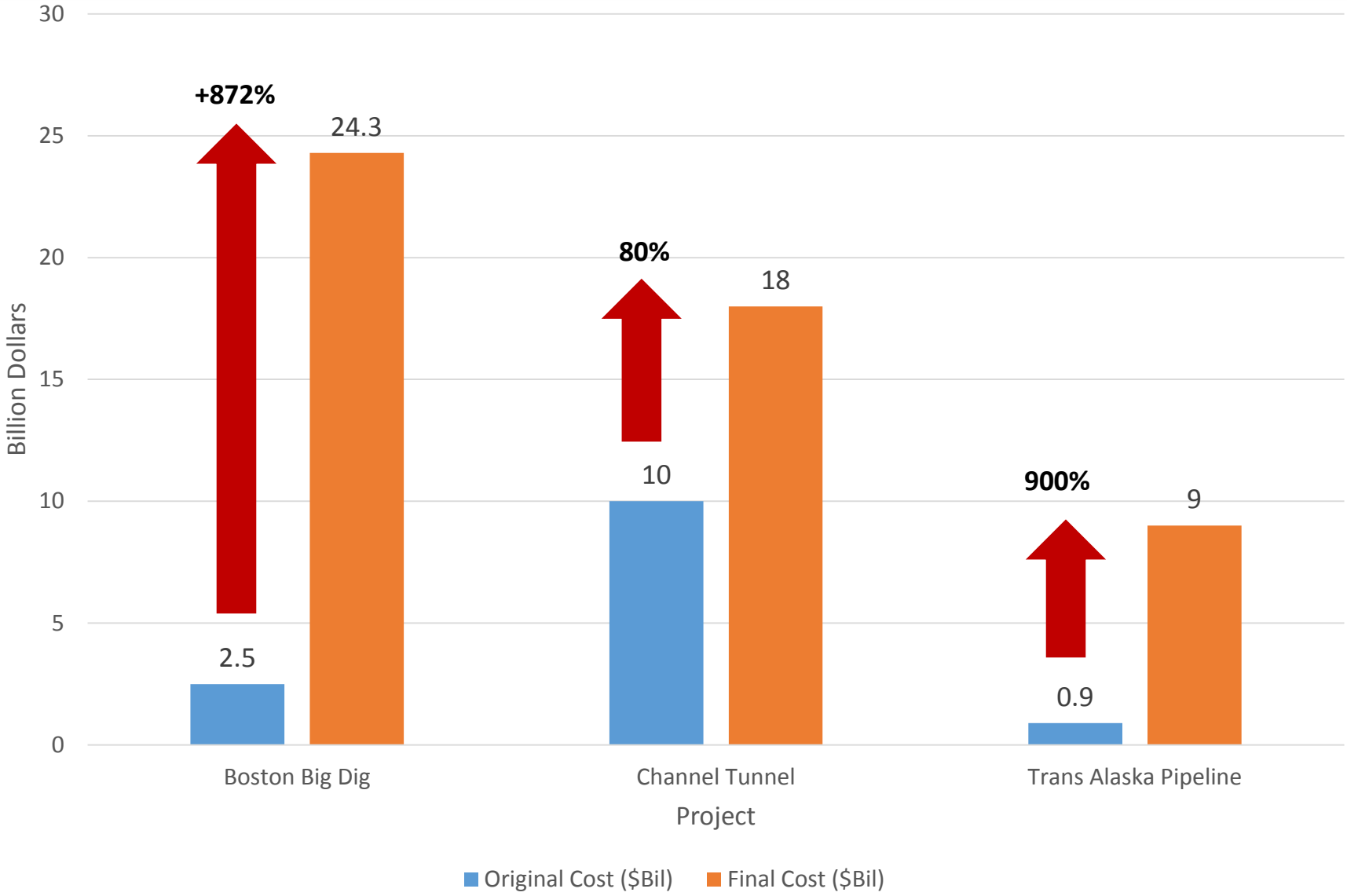
- Only about **one in twenty projects** meet both of these criteria. (CII 2012)



"As approximately **one out of ten** megaprojects is on budget, **one out of ten** is on schedule, and **one out of ten** delivers the promised benefits, then approximately **one in a thousand** projects is a success, defined as on target for all three."

- Bent Flyvbjerg

Examples


30
25
20
15
10
5
0
Billion Dollars
+872%
24.3
2.5
80%
18
10
900%
9
0.9
Boston Big Dig
Channel Tunnel
Trans Alaska Pipeline
Project
Original Cost ($Bil)
Final Cost ($Bil)

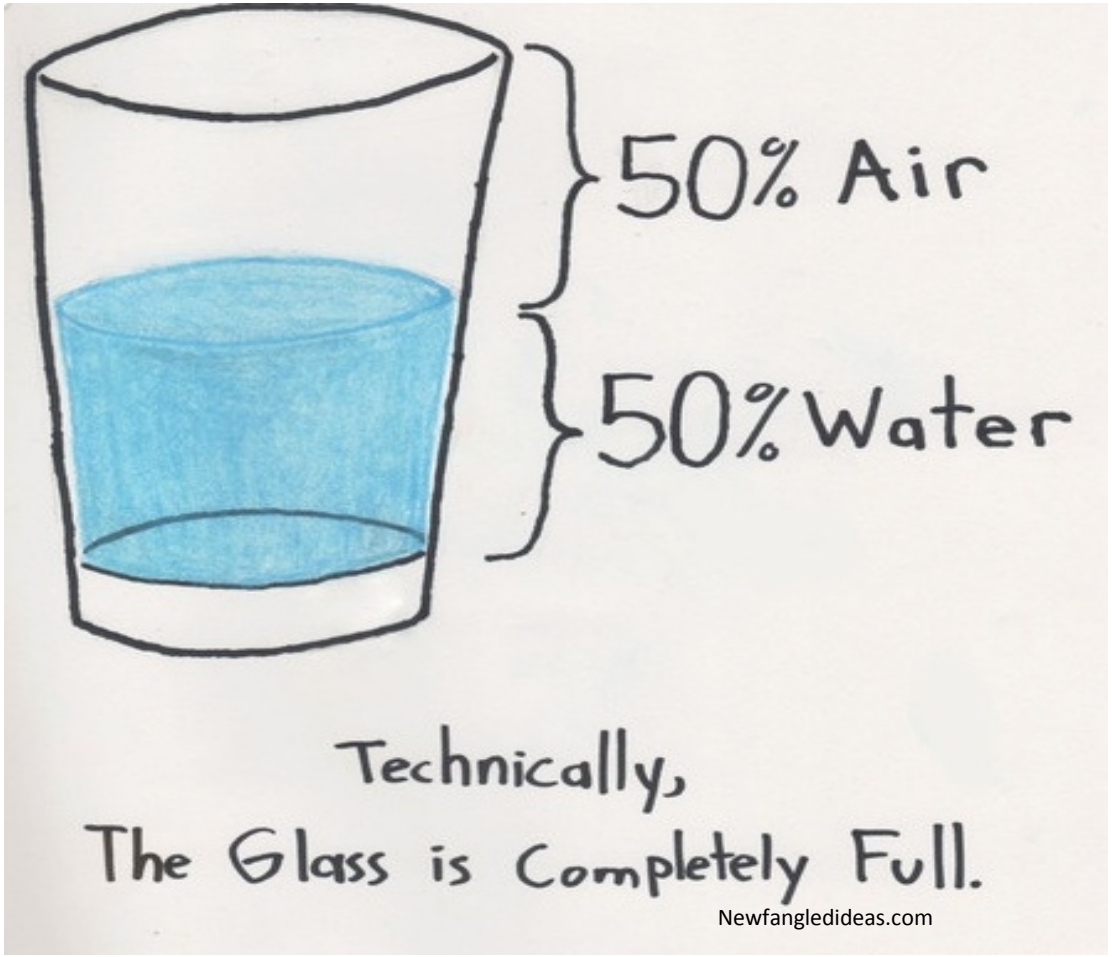

MEGASTRUCTURES
BOSTON'S BIG DIG


EURO TUNNEL


Infiniteunknown.net

Reasons for Failure (1)

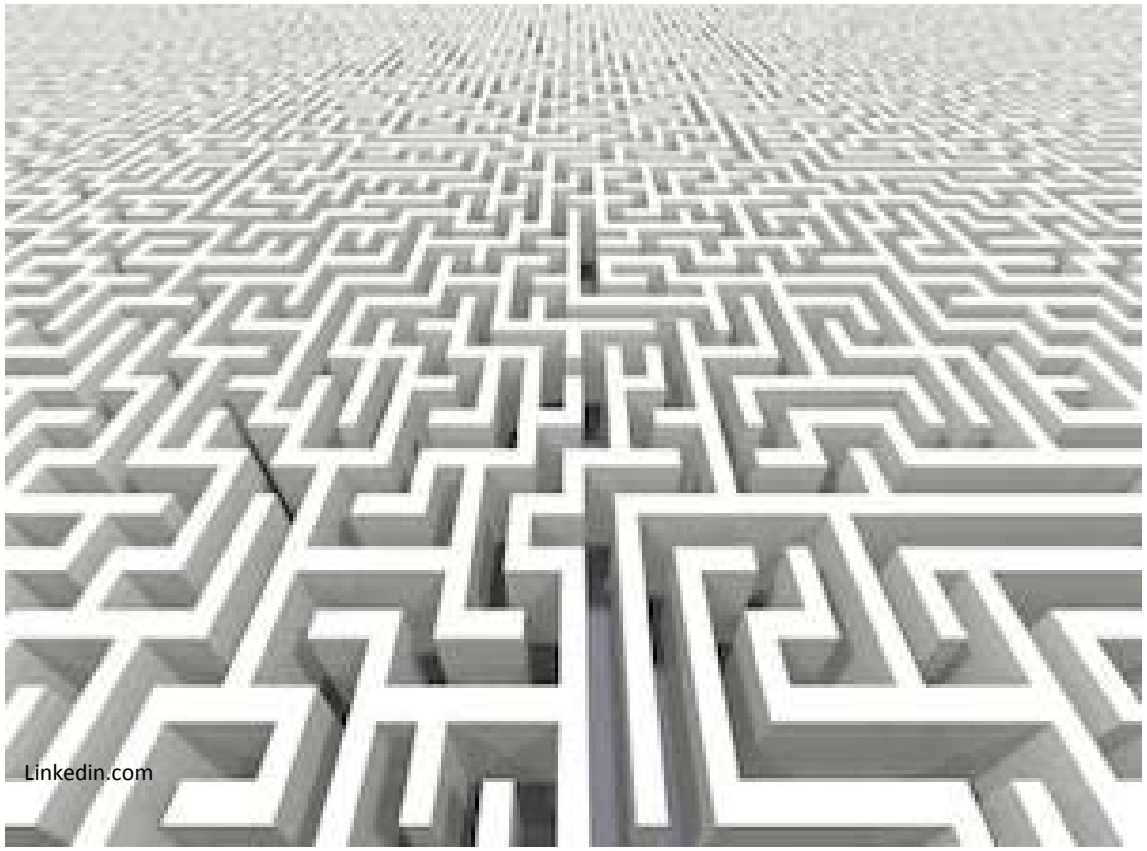
- **Over Optimism**
  - **"Optimism Bias" (Bent Flyvbjerg)**
  - **"Glandular Surge" (John Dalton)**



(1) Garemo, Matzinger, and Palter, "Megaprojects: The good, the bad, and the better," **McKinsey** & Co.

Reasons for Failure (1)

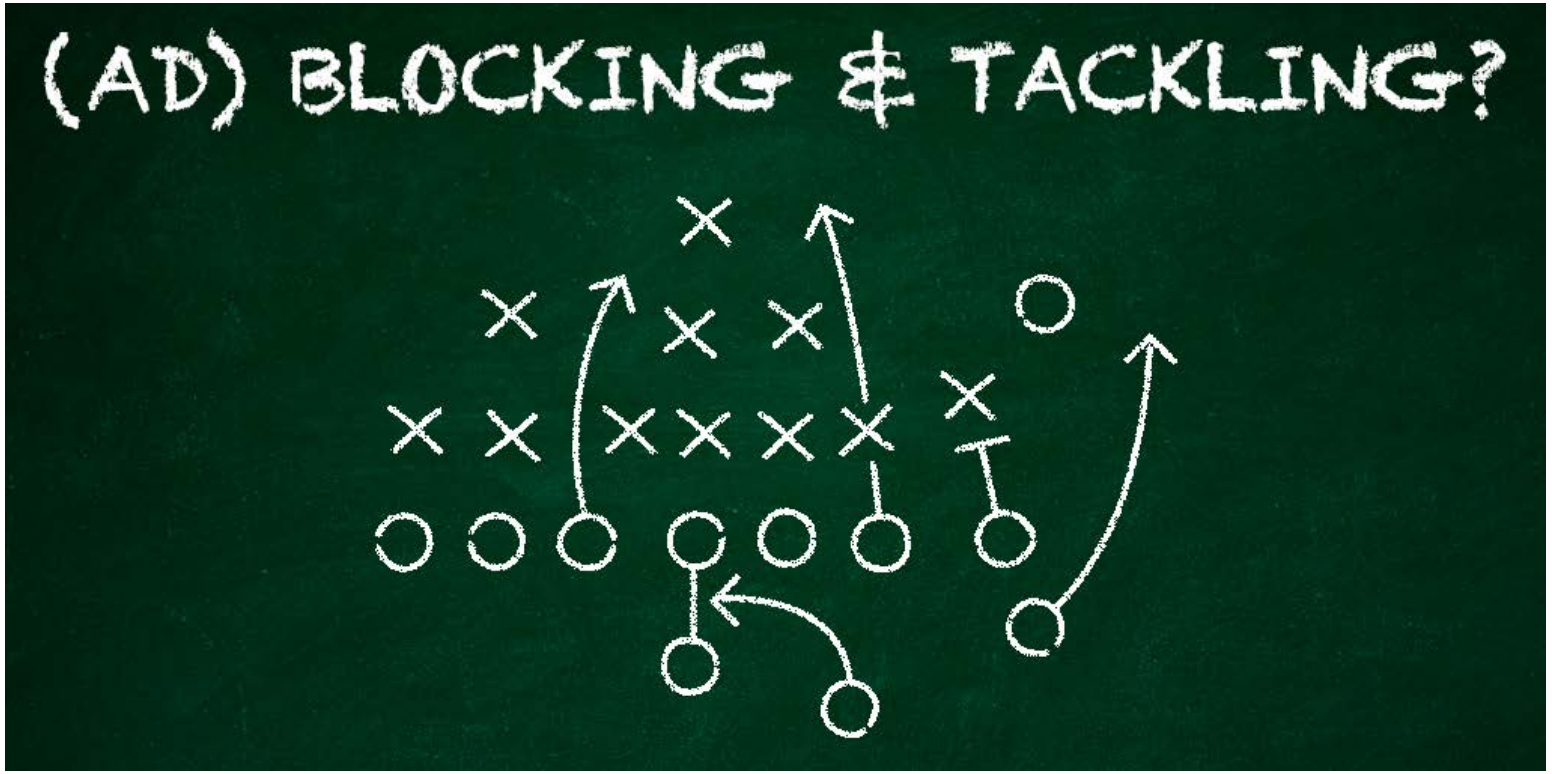
- **Over Complexity**
  - **"Difficult to define and even harder to quantify" (2)**
  - **"*Many interrelated parts* characterized in terms of the number of varied components in a project (e.g., tasks, specialists, sub-systems, and parts) (called *differentiation*) and the *interdependencies* between these components." (3)**
  - **Caused in part by "uncertainties and risks" (4)**



(1) Garemo, Matzinger, and Palter, "Megaprojects: The good, the bad, and the better," McKinsey & Co.
(2) Corning, P.A. (1998). "The synergism hypothesis" On the concept of synergy and its role in the evolution of complex systems." *Journal of Social and Evolutionary Systems*, 21(2), 133-172.
(3) Baccarini, D. (1996). "The concept of project complexity—a review." International Journal of Project Management, 14(4), 201-204.
(4) Bosch-Rekveldt, M. G. C. (2011). "Managing project complexity: A study into adapting early project phases to improve project performance in large engineering projects." *Delft Centre for Project Management*

Reasons for Failure (1)

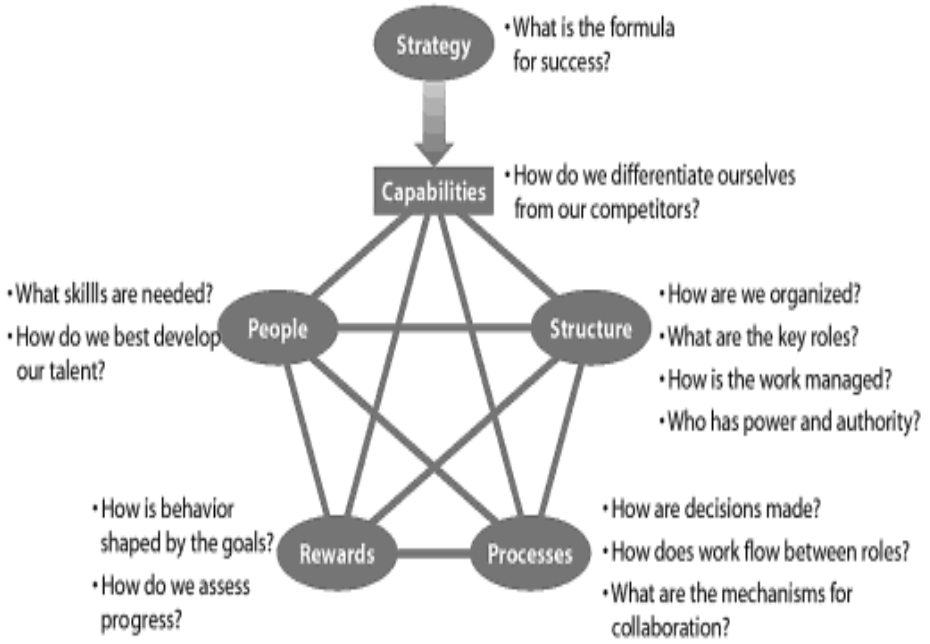
- **Poor Execution**
  - Incomplete Design
  - Lack of clear scope
  - Ill-advised short cuts
  - Mathematical errors in scheduling
    and risk assessment
  - Lack of adequate controls



(1) Garemo, Matzinger, and Palter, “Megaprojects: The good, the bad, and the better,” McKinsey & Co.

Reasons for Failure*

- **Weakness in Organizational Design and Capabilities**
  - Right staffing levels?
  - Proper management and oversight of project?
  - Good clarity on roles, responsibilities, and authority?
  - Adequate alignment of the program and project organizational structures?



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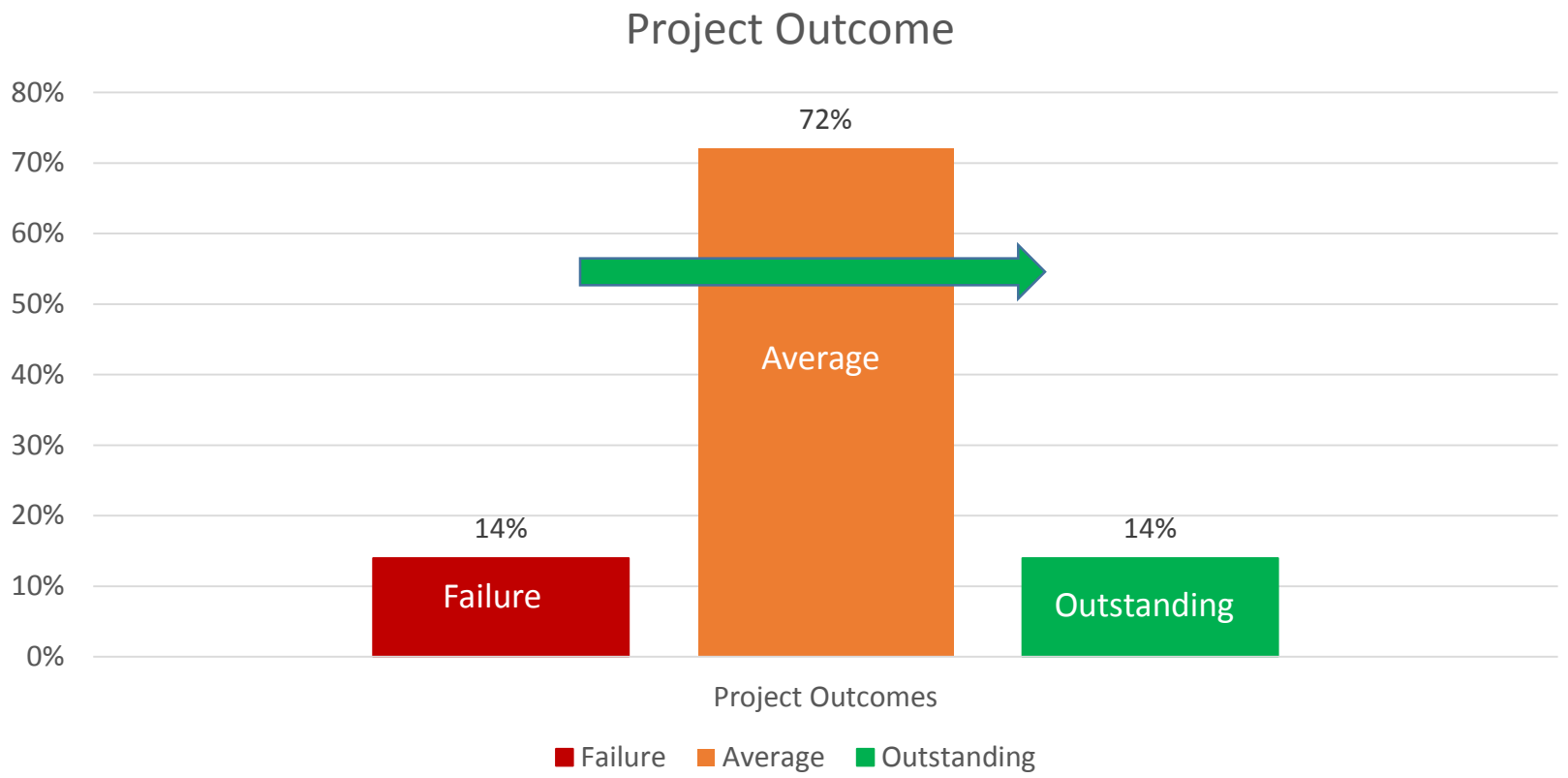
*Garemo, Matzinger, and Palter, "Megaprojects: The good, the bad, and the better," McKinsey & Co.

Critical Success Factors for Improving Project Performance

- **Hypothesis: One can achieve better construction project performance by knowing and implementing** factors linked to project success



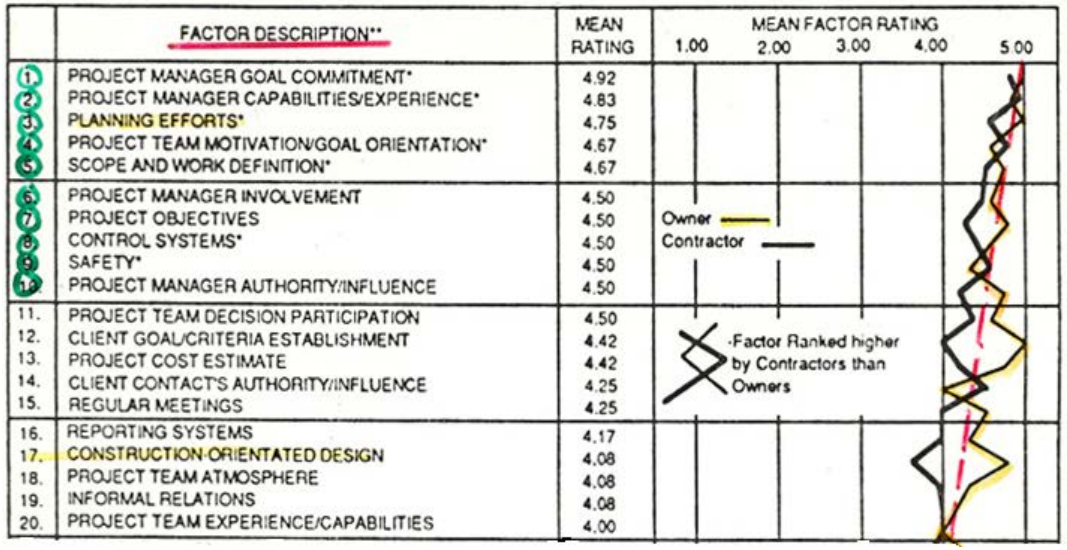
Critical Success Factors*

- What are the Critical Factors related to Project Success
- 2,000 potential factors reduced to 46

*Rory Salimbene and David Ashley, Determinants of Construction Project Success

Top 10 Project Success Factors*

1. **Project Manager Goal Commitment**
2. **Project Manager Capabilities/Experience**
3. **Planning Efforts**
4. **Project Team Motivation/Goal Orientation**
5. Scope and Work Definition
6. **Project Manager Involvement**
7. Commitment Mtg Project Objectives
8. **Control Systems**
9. **Safety**
10. **Project Manager Authority/Influence**



	FACTOR DESCRIPTION**	MEAN RATING
1.	PROJECT MANAGER GOAL COMMITMENT*	4.92
2.	PROJECT MANAGER CAPABILITIES/EXPERIENCE*	4.83
3.	PLANNING EFFORTS*	4.75
4.	PROJECT TEAM MOTIVATION/GOAL ORIENTATION*	4.67
5.	SCOPE AND WORK DEFINITION*	4.67
6.	PROJECT MANAGER INVOLVEMENT	4.50
7.	PROJECT OBJECTIVES	4.50
8.	CONTROL SYSTEMS*	4.50
9.	SAFETY*	4.50
10.	PROJECT MANAGER AUTHORITY/INFLUENCE	4.50
11.	PROJECT TEAM DECISION PARTICIPATION	4.50
12.	CLIENT GOAL/CRITERIA ESTABLISHMENT	4.42
13.	PROJECT COST ESTIMATE	4.42
14.	CLIENT CONTACT'S AUTHORITY/INFLUENCE	4.25
15.	REGULAR MEETINGS	4.25
16.	REPORTING SYSTEMS	4.17
17.	CONSTRUCTION-ORIENTATED DESIGN	4.08
18.	PROJECT TEAM ATMOSPHERE	4.08
19.	INFORMAL RELATIONS	4.08
20.	PROJECT TEAM EXPERIENCE/CAPABILITIES	4.00

… 46 Factors

*Clive Lurie and David Ashley, "Determinants of Construction Project Success" Pilot Study

Project Manager Goal Commitment*

- **Use of Monetary Incentives for Contractor PM**
- **Owner's perception of Contractor's PM …**
  - **Support by senior company management**
  - **Visibility and recognition**
  - **Growth potential**

Higher levels lead to better project performance

*Statistically significant factors

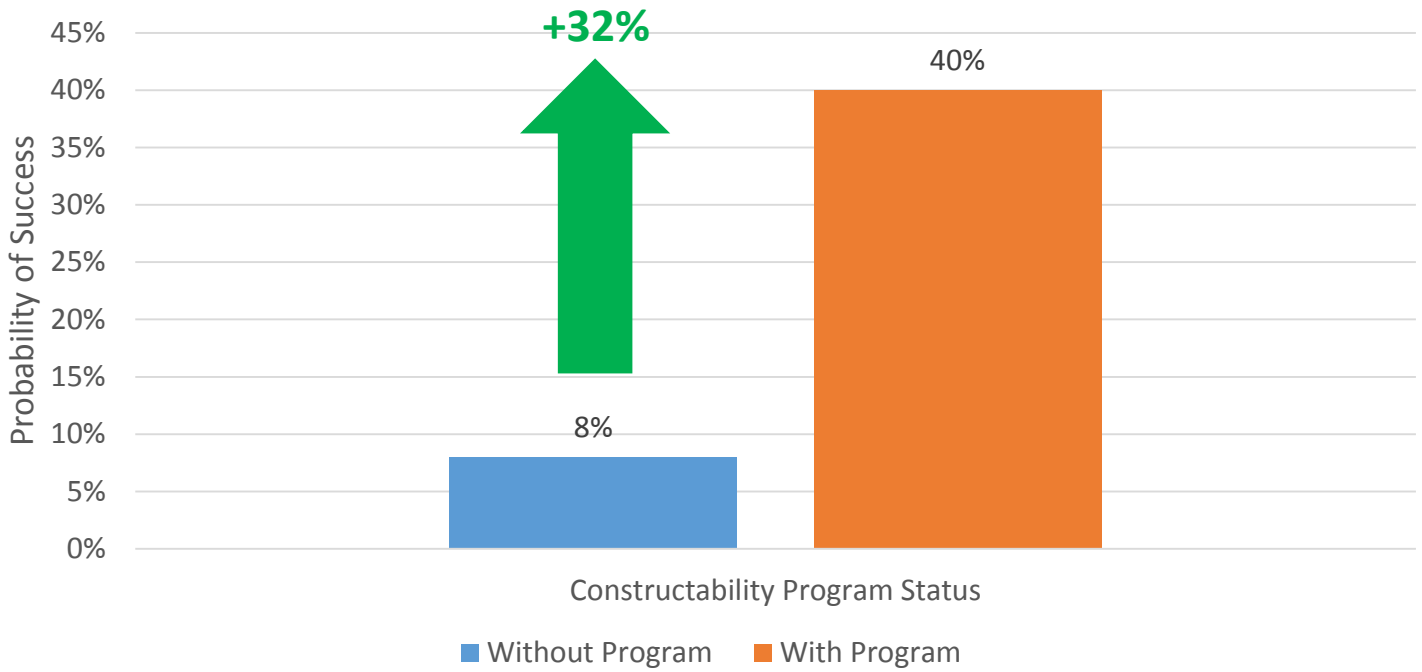
Project Manager Capabilities/Experience*

1. **Project Manager Technical Experience (# projects)**
   - **5.7 (better budget performance)**
   - **1.8 (worse budget performance)**
2. **Project Managers* with management-related education produced projects with better budget performance**

*Mix of both owner and contractor project managers

Planning Efforts

- **Front End Planning**
  1. **Implementing a Formal Risk Identification program produced projects with better budget performance**
  2. **Implementing a Constructability program produced projects with better budget performance**



Planning Efforts

- **Modularization (% total project cost)**
  1. **7.3% [outstanding]**
  2. **1.3% [average]**
- **Design Complete at Start of Construction (%)**
  1. **69.9% [better budget performance]**
  2. **51.0% [worse budget performance]**

Project Team Motivation/Goal Orientation

1. **Lower project team turnover for better projects (%)**
   - **7% (Outstanding)**
   - **14% (Average)**
   - **25% (Failure)**
2. **Higher Levels of:**
   1. **Designer contract incentives and penalties translated to projects with *better budget performance***
   2. **Owner and Designer Technical Experience translated to projects with *better budget performance***
   3. **Designer, Constructor, and Owner Technical Experience translated to projects with *better schedule performance***
3. **Co-locating teams improves schedule performance**

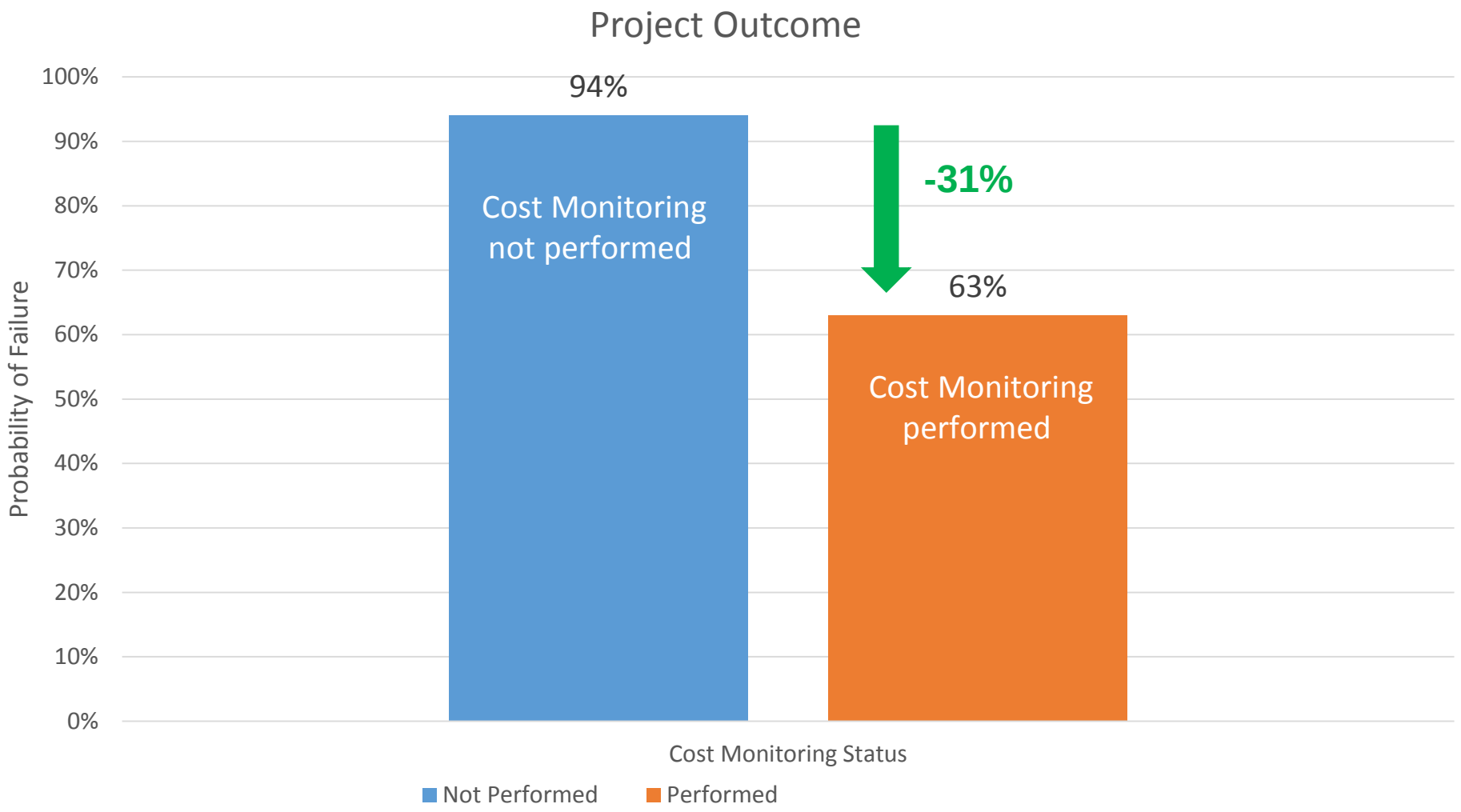
Project Manager Involvement

1. **Early Contractor Project Manager Involvement (%)**
   - **15% (Nonfailed Projects)**
   - **5% (Failed Projects)**
2. **Project Manager located at the site improved schedule performance**

Control Systems

1. Cost Monitoring Performed by both Contractor AND Owner
2. Control System Cost (% total project cost)
   - 2.1% (better budget performance)
   - 0.9% (worse budget performance)
3. Projects that used Liaison Personnel experienced better budget performance
4. Projects with more control meetings (~5/wk) had a better chance of achieving outstanding project performance
5. Projects with more budget updates had better schedule performance (# updates per year)
   - 16.3 (better)
   - 10.7 (worse)

Importance of Cost Monitoring by Owner*



*Jeffrey S. Russell and Edward J. Jaselskis, "Predicting Construction Contractor Failure Prior to Contract Award"

Use Core Project Control Metrics*

Forecasting

Category	*Metric*
Performance Forecasting	Variance at Completion
	Estimate at Completion (CPI)
	Estimate to Complete (CPI)
	To Complete Performance Index (EAC-CPI)
	Budget at Completion
Performance Assessment	Cost Performance Index
	Schedule Performance Index
Progress Measurement / Data Collection	Physical Percent Complete
	Earned Value
	Planned Value
	Actual Cost

Diagnostic

Category	*Metric*
Schedule Diagnostics	Baseline Execution Index for Critical Path
	Number of Critical (or Near Critical) Paths
	Schedule Variance
Cost Diagnostics	Unit Rate
	Cost Variance
	Procurement Cost Variance
Physical Progress Diagnostics	Efficiency or Productivity Index
	Ratio of Actual to Planned Progress
	Percent Key Deliverables Completed on Time

* Construction Industry Institute Research Team 322, Improving Project Progress and Performance

Safety

1. Outstanding projects had better safety performance
2. Contractors with lower EMR (0.66) had higher profitability
3. Stronger upper management attitude toward safety (9.2/10 vs 7.4/10)
4. More safety meetings between upper management and field safety representatives (13.4 vs 5.9 per year)
5. Better safety training and orientation for new foremen (4 hrs vs 1.4 hrs)
6. More GC safety coordinator meetings with subcontractors (3.5 vs 1.8 per month)
7. Lower project team turnover (3.8% vs 9.6% per year)
8. Informal site safety inspections (16.3 vs 7.4 per month)

Project Manager Authority/Influence

1. **Higher PM Design Authority resulted in better budget performance**
2. **Higher PM Budget and Control Authority resulted in better schedule performance**

Innovations in Project Planning and Control

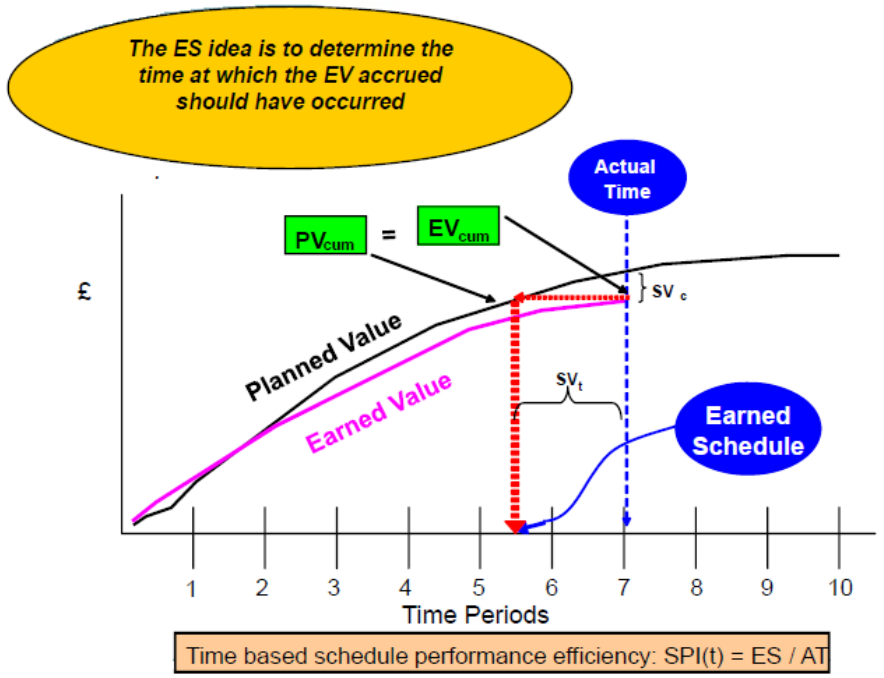
Innovative Project Control Metric: Earned Schedule--SPI(t)

- **Limitations using EVM for Schedule Performance Measurement**
  - Schedule indicators (SPI and SV) are **flawed for late projects**
  - **EVM uses cost as a proxy** for assessing schedule performance
- **Earned Schedule**
  - Earned Schedule **uses time for assessing schedule performance**
  - Provides more accurate indication of schedule performance even on late projects

Earned Value Management

SV = EV – PV
SPI = EV/PV

EV = Earned Value ($)
PV = Planned Value ($)

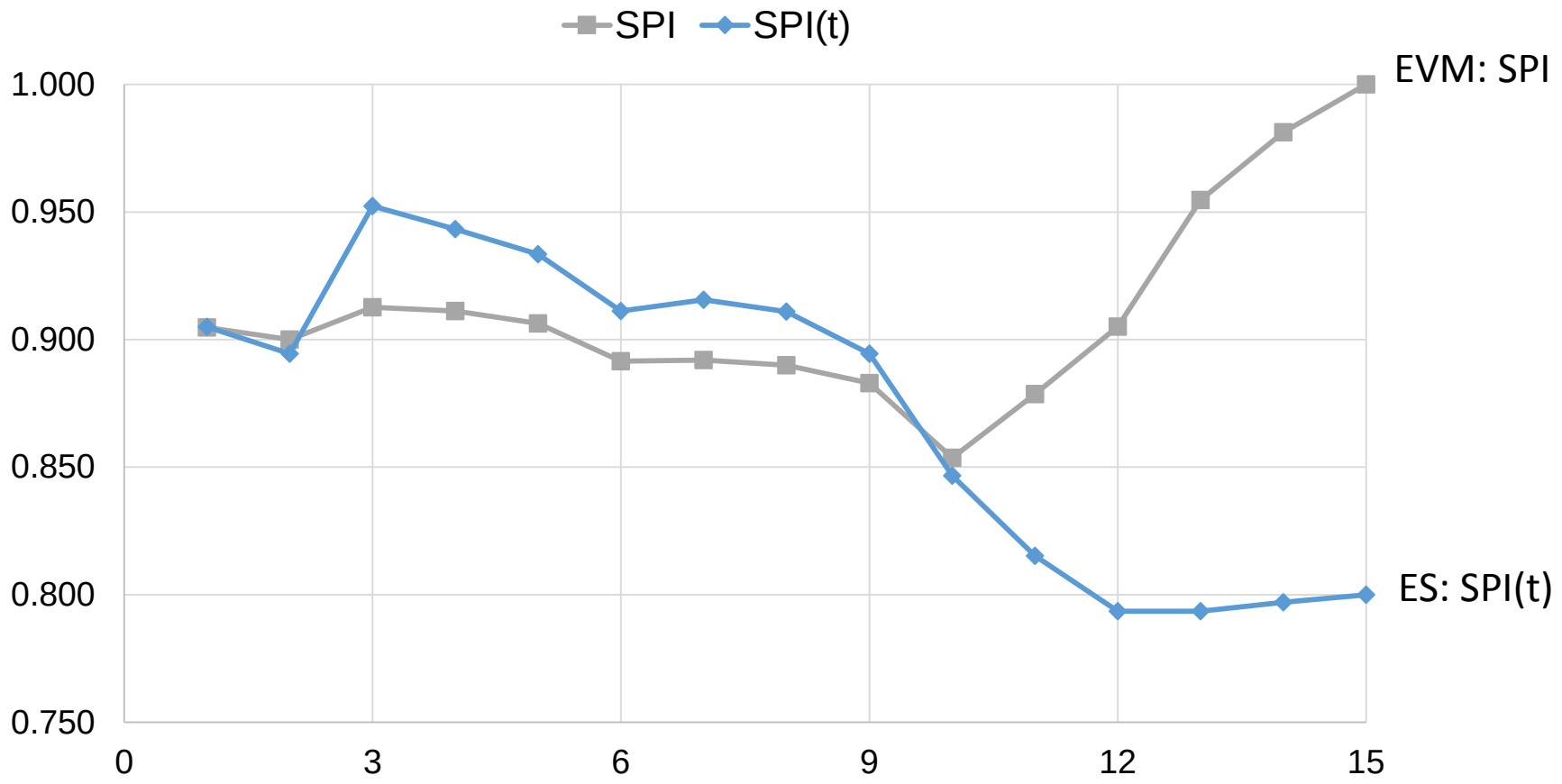


Earned Schedule

SV(t) = ES – AT
SPI(t) = ES/AT

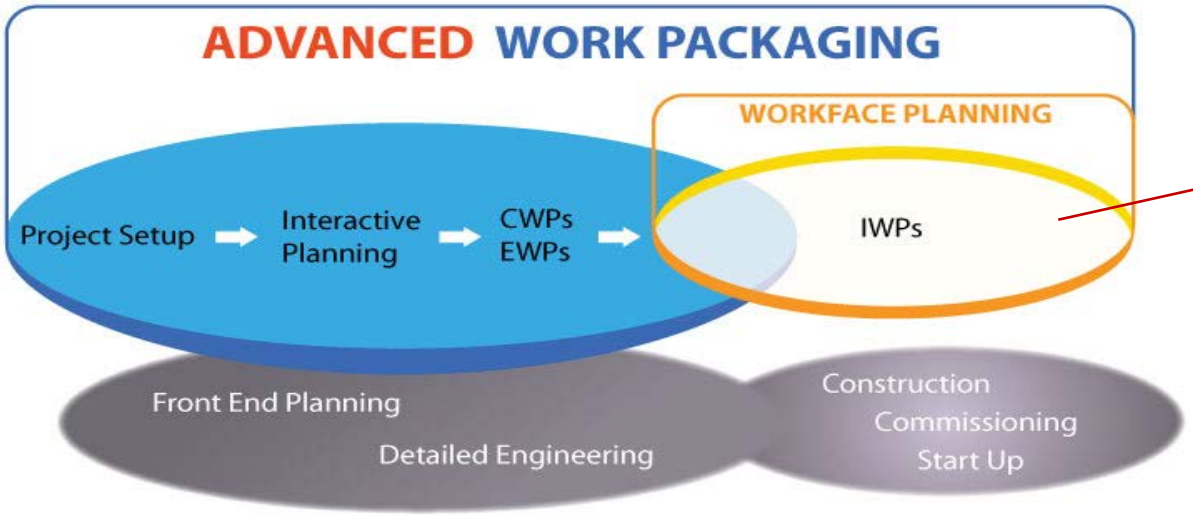
ES = Earned Schedule (months)
AT = Actual Time (months)

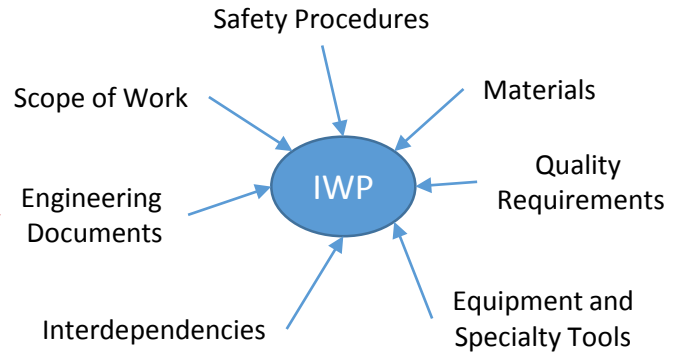
Earned Schedule vs Earned Value Management



Advanced ("Enhanced") Work Packaging (AWP)

"AWP guides the dissection of project scope so that it supports the execution of Workface Planning in the field. … starts with the processes upstream of the Construction Work Packages and aligns Engineering Work Packages with Procurement Work Packages" (1)





"Aim is to ultimately give each Foreman an installation Work Package (IWP) at the start of each week that is 'ready to go'" (1)

*CII Performance Improvement Workshop, April 2-4, 2014

"Better integration of E-P-C"

Information Management is key

(1) Geoff Ryan, *Even More Schedule for Sale*, 2017

Advanced Work Packaging Resources

- **Research Reports and Books**
  - *Advanced Work Packaging* Implementation Resource 272-2 Volumes I, II, and III, 2003. Construction Industry Institute
  - *Validating Advanced Work Packaging as a Best Practice: A Game Changer* (RT-319), 2015. Construction Industry Institute
  - *Even more Schedule for Sale*, Geoff Ryan
- **Advanced Work Packaging Software**
  - *ConstructSim* (Bentley Systems)
  - *Smart Construction* (Hexagon)
  - *iConstruct* (Autodesk)

Integration of DOE and Construction Industry Institute (CII) Best Practices*

- **Front-End Planning**
  - DOE G 413.3-12 Chg 1 (PDRI)
  - DOE G 413.3-4A Chg 1 (TRA)
  - DOE P 451.1 (NEPA)
- **Team Building**
  - DOE G 413.3-18A Chg 1 (IPT)
- **Partnering**
- **Constructability**
- **Planning for Startup**
  - DOE O 425.1D Chg 1
  - DOE G 413.3-16A Chg 1
- **Material Management**
- **Dispute Resolution**
- **Quality Management**
  - DOE G 414.1-2B (Admin Chg 2)
- **Lessons Learned**
- **Project Risk Assessment**
  - DOE G 413.3-7A Chg 1
- **Planning for Modularization**
- **Alignment**
- **Change Management**
  - DOE G 413.3-19 Chg 2
- **Zero Accident Techniques**
  - DOE G 440.1-1B Chg 1
  - DOE G 440.1-7A
  - DOE O 450.2 Chg 1
- **Benchmarking and Metrics**
- **Advanced Work Packaging**

U.S. DOE Root Cause Analysis and Corrective Action Plan Closure Report February 2011

Refer to CII Knowledge Base: https://kb.construction-institute.org/Best-Practices

Benefits of Best Practice Implementation*

- $1 spent on **Front End Planning** led to a $3-7 ROI
- Use of CII's **PDRI** tool has a $24/1 benefit to cost ratio
- Use of **Constructability programs**
  - **Reduces total project cost 1 to 11 percent**
  - **Reduces total project schedule 5 to 10 percent**
  - **Consistent, documented, quantified benefit/cost ratios of 10:1**
- Use of **Zero Accident Techniques** reduces the Total Recordable Incident Rate for Contractors by 54% and Owners by 64%
- Improved **Supply Chain Management** can provide savings of 4-8%
- Use of **Advanced Work Packages** can improve field productivity by up to 25% and reduce Total Installed Cost by 10%.

*Research performed by the construction academics for the Construction Industry Institute

Conclusions

- If we know so much about achieving project success then why is it so difficult?!
- Develop appropriate strategies for addressing reasons for poor performance (overly optimistic, complexity, poor execution, and weaknesses in organizational design and capability)
- Implement Best Practices
- Having a little luck doesn't hurt either!

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Questions