PNWS-AWWA Water 2021 Virtual

Lessons from Mega-Projects for Your Midi-, Mini- and Micro-Projects

Mark Graham, P.E., PMP

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Stantec

What Makes a Megaproject?

Value: Over $1 billion
Duration: Takes many years to develop and build
Complexity: Involves multiple public and private stakeholders
Impact: Transformative, effects millions of people
Significance: Trend-making or trend-breaking, rather than trend-following

Panama Canal Expansion ($5 billion)

Boston “Big Dig” ($22 billion)

Boeing 787 (over $32 billion)

The “Iron Law of Megaprojects:” Over budget, over time, over and over again.

Sydney Opera House – 1,400% over budget, 10 years late

Channel Tunnel – 80% over budget, 1 year late, ridership 50% of projection

Flyvbjerg, 2011

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What Goes Wrong?

Reasons for Underperformance

Denver International Airport - $2 billion over budget, 16 months behind schedule. Actual traffic 55% of forecast in opening year

Technical

- Methodology
- Data
- Complexity
- Uncertainty

Behavioral

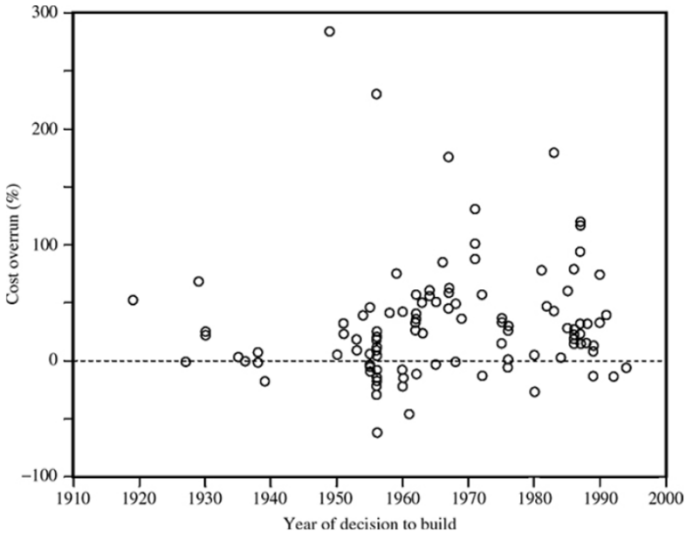
- Bias
- Deception
- Inertia

Technical Reasons for Underperformance

Methodology

Predictions for cost, schedule, and benefits are all consistently inaccurate:

- Use of deterministic methods
- Inadequate allowance for risk and uncertainty
- Insufficient data to validate models



Cost overruns on transportation projects in Denmark (Flyvbjerg, 2003)

Technical Reasons for Underperformance

Data

Information on similar projects is lacking

- Unprecedented size
- Unique technology
- Available data is ambiguous or biased

Very few projects perform comprehensive post-completion audits

"Rarely is there a simple truth about [megaprojects]. What is presented as reality by one set of experts is often a social construct that can be deconstructed and reconstructed by other experts."

- Bent Flyvbjerg (2003)

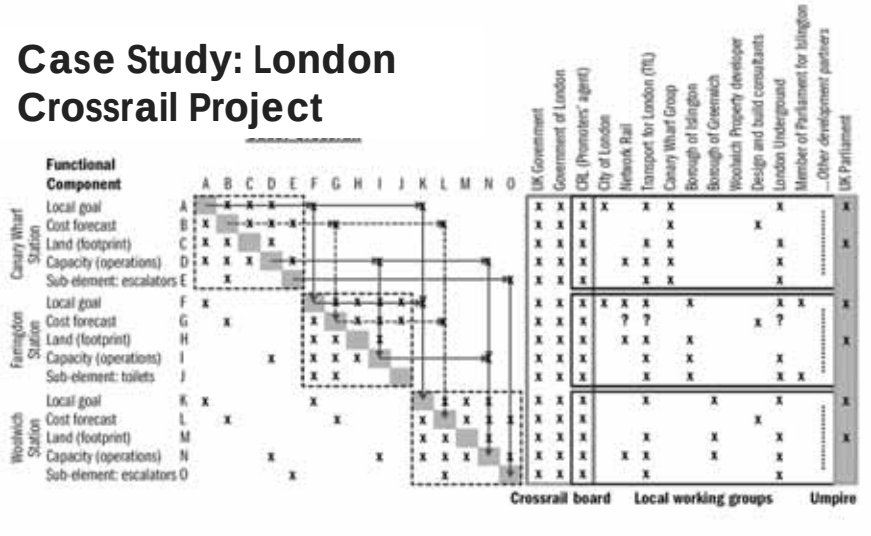
Technical Reasons for Underperformance

Complexity

Complexity is a defining feature of megaprojects, across many dimensions

- Objectives
- Stakeholders
- Technology
- Financing
- Environmental Impacts
- Ethics

Case Study: London Crossrail Project



118-kilometer high-capacity commuter train
Agreement required from 12 local working groups

Year	Cost Forecast	Completion Forecast
2001	£4.7 billion	2012
2008	£10.9 billion	2017
2015	£14.0 billion	2019

Source: Gil (2017)

Technical Reasons for Underperformance

Uncertainty

Initial assumptions are almost certain to change

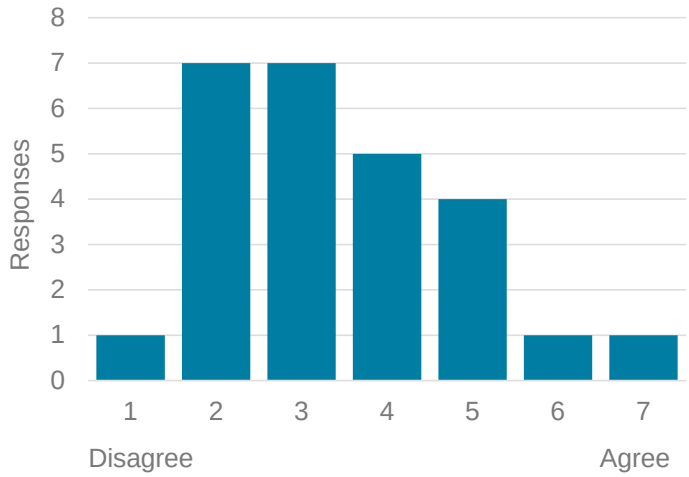
- Internal
  - Technology
  - Cost
- External
  - Stakeholders
  - Environmental Conditions
  - Market Conditions
  - Political Support

Behavioral Reasons for Underperformance

Bias

- Optimism Bias – Tendency to overpredict probability of positive outcomes
- Coordination Neglect – Failure to fully consider challenges of management and communication among multiple parties
- Promotor Bias – Alignment of analysis or recommendations with self-interest or client expectations

Survey Results



Q: In the Netherlands researchers hardly ever adapt calculations to support the results the client wishes to see.

Behavioral Reasons for Underperformance

Deception

- Belief that ignorance helps get projects started
- Graft, corruption and malice

“ We always knew the initial estimate was way under the real cost…If people knew the real cost from the start, nothing would ever be approved. The idea is to get going. Start digging a hole and make it so big, there’s no alternative to coming up with the money to fill it in.”

- Willie Brown, former mayor of San Francisco

San Francisco Transbay Terminal

Behavioral Reasons for Underperformance

Inertia

- Financial “point of no return” – more expensive to abandon the project than to complete it.
- “Sunk Cost” fallacy
- Personal and political investment by project champions

Cutter head for Bertha – tunnel boring machine for Seattle’s State Route 99 Tunnel. Repairing damage to the TMB delayed the project three years

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Why do we keep doing them?

Drivers of Megaproject Development

Flyvbjerg's "Four Sublimes"	
Technological	Excitement of pushing the envelope
Political	Prestige of building monuments
Economic	Benefits to labor and business interests
Aesthetic	Pleasure of an iconic and beautiful project

Golden Gate Bridge

Hoover Dam

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What can we learn?

Lessons from Megaprojects

How can we:

- Avoid Reasons for Underperformance?
- Leverage Megaproject Drivers?

Reasons for Underperformance	
Technical	Methodology Data Complexity Uncertainty
Behavioral	Bias Deception Inertia

Megaproject Drivers	
Technological	Excitement of pushing the envelope
Political	Prestige of building monuments
Economic	Benefits to labor and business interests
Aesthetic	Pleasure of an iconic and beautiful project

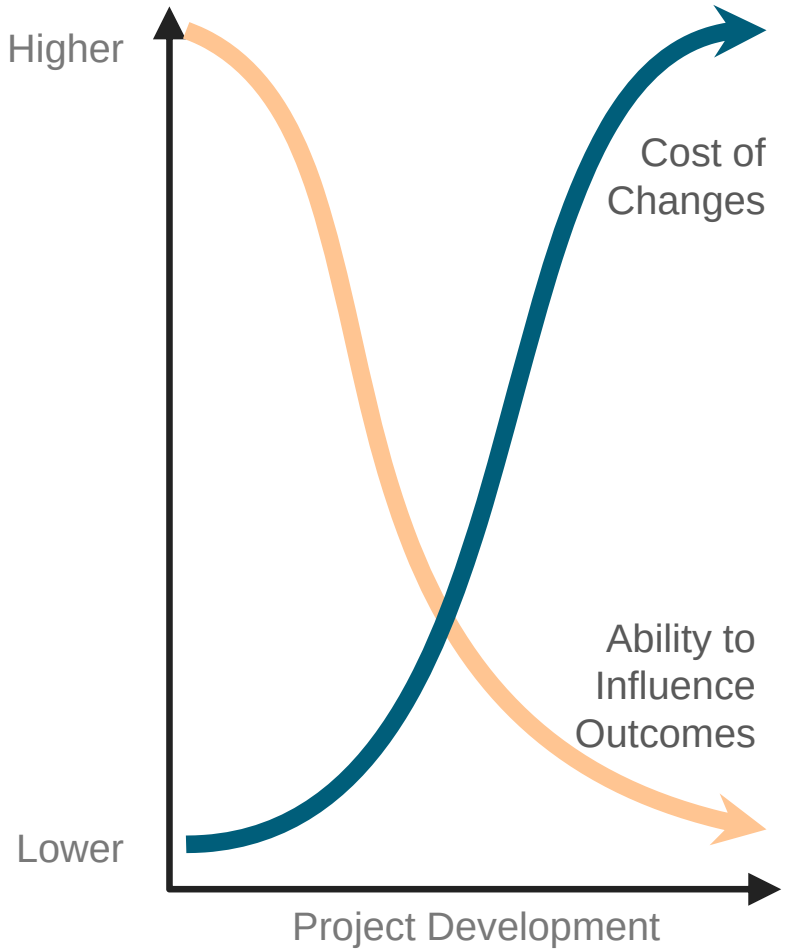
Accept Uncertainty

Avoid Technical and Behavioral Problems

- Experiment and explore options early, when the cost of making changes is low
- Pursue parallel paths

Capture Drivers

- Embrace uncertainty as a technological challenge



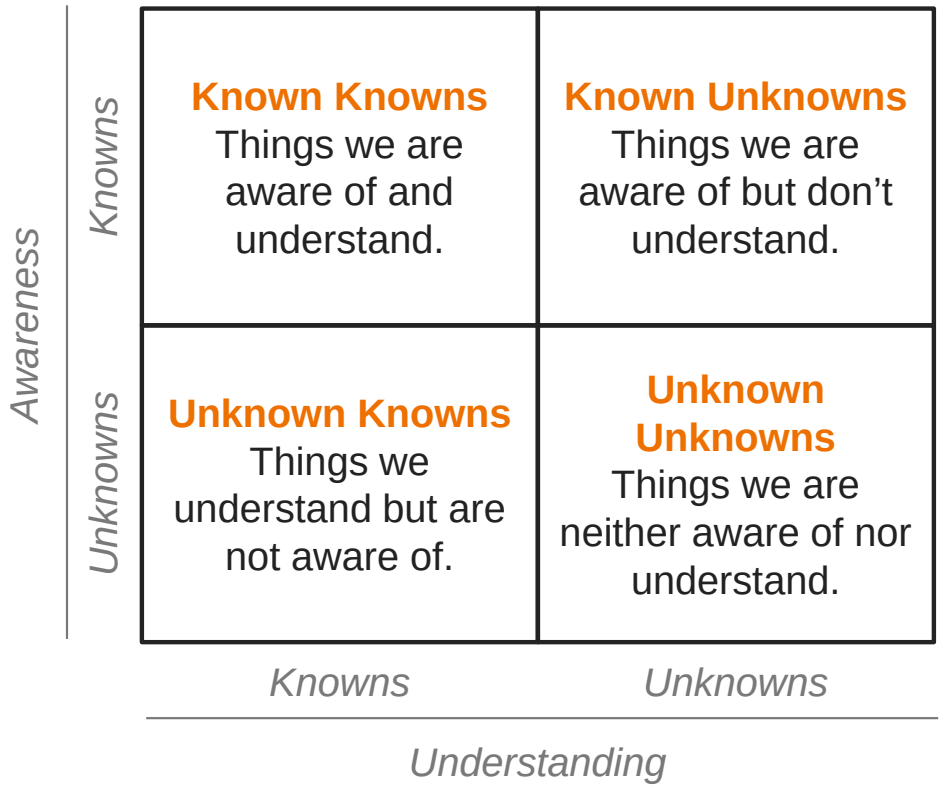
Demonstrate Humility

Avoid Technical and Behavioral Problems

- Engage stakeholders early and often
- Question all assumptions and biases (especially your own)
- Evaluate past success and failure of methodologies used

Capture Drivers

- Identify new technological challenges



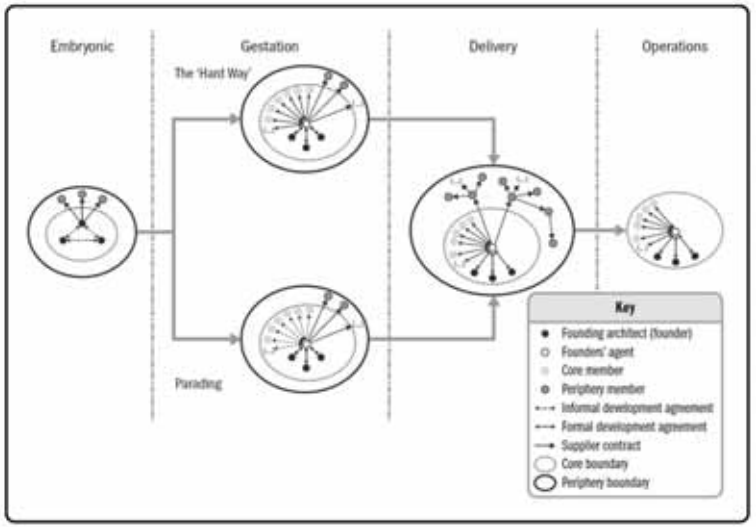
Embrace Complexity

Avoid Technical and Behavioral Problems

- Invest time early in project to understand the scope of the project
- Recognize Coordination Neglect bias – develop organization structures that meet project needs

Capture Drivers

- Recognize and communicate the broad benefits of the project
- Define complexity as a challenge, not an obstacle



Ideal megaproject meta-organizational developmental paths
Gil (2017)

Behave Ethically

Avoid Technical and Behavioral Problems

- Reduce bias

Capture Drivers

- Enhance the political prestige of those involved with the project

Engineers' Creed

As a Professional Engineer, I dedicate my professional knowledge to the advancement and betterment of public health, safety, and welfare.

I pledge:

- To give the utmost of performance;
- To participate in none but honest enterprise;
- To live and work according to the highest standards of professional conduct;
- To place service before profit, the honor and standing of my profession before personal advantage, and the public welfare above all other considerations.

In humility, I make this pledge.

Build a Megaproject-Class Team

Avoid Technical and Behavioral Problems

- Skills, talent and experience to identify and overcome technical challenges
- Commitment to recognize and correct for personal and institutional biases

Capture Drivers

- Achieve technological excitement, political prestige, and economic benefits
- Produce an iconic and beautiful project, at any scale

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Abstract	CEU Relevancy
With unfortunate regularity, megaprojects around the world have failed to meet budget, schedule and performance expectations. Governments, consulting firms and professional organizations such as the Netherlands, McKinsey & Company and the Project Management Institute, have studied the root causes of megaproject failure and developed recommendations to improve the odds of success on future megaprojects. In this presentation, I will summarize some of the key findings of these studies and how they can apply to the types of projects members of our Section perform regularly.	The Project Management Institute (PMI) defines a project as "a temporary endeavor undertaken to create a unique product, service or result." By this definition, water system O&M staff and managers perform many projects every year--from replacing a metering pump to preparing a capital budget. By using strategies for more successful project delivery, staff and managers are more likely to successfully complete projects on-time, within budget, and with the expected level of quality.

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