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Requirements for Completion:

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Decisions are Your Destiny: Smart Prioritization of Interventions and Research **Can** Change the World

Tony Kenck

Practical Portfolio Management LLC

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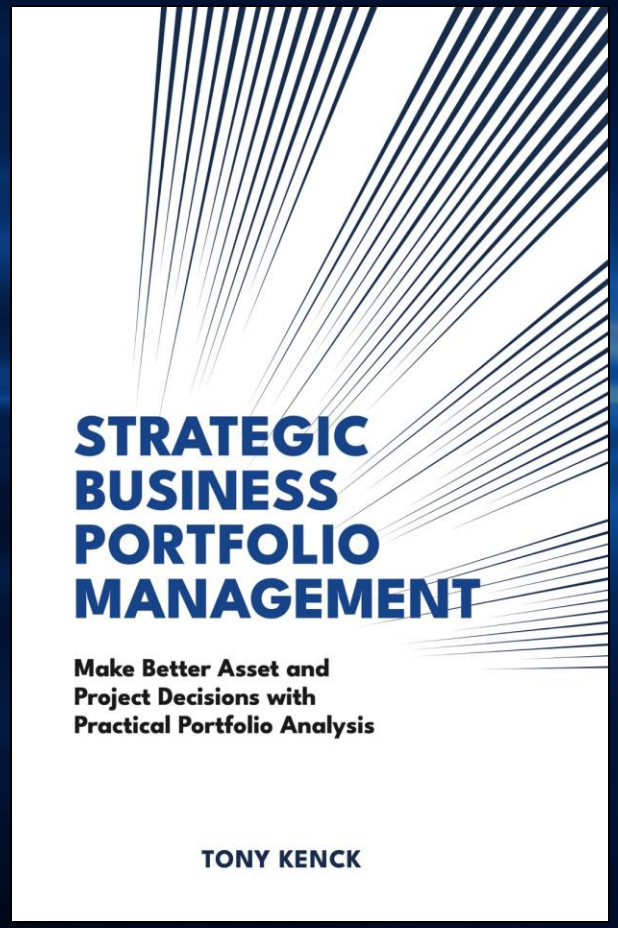
Abstract

- Even in the best of times, there is seldom enough time, attention, or money to do everything that is worth doing. Uncertainty plus a lack of resources have been magnified by changes in US Government policy and funding.
- Portfolio analysis and management provide a means to realize the maximum benefit from a set of interventions, projects, or research programs. It is common for effectiveness to increase by at least 30%.
- We'll cover the five critical success factors, with a focus on portfolio analysis methods. This talk will show you the path to make the decisions that drive the best results for your efforts.

Tony Kenck

- BSc Geophysical Engineering, Colorado School of Mines, 1979
- Joined Texaco in 1982 as an exploration geophysicist
- Exploration Risk team, exploration process development, and Economic and Decision Analyst roles in the mid-1990s, MBA 1999
- Merger, Chevron Int'l Upstream Planning in 2002, created tools and standards
- Manager, Planning and Portfolio in Chevron Corp. Business Dev. 2008-2016
- Champion, Instructor, and Advocate of Portfolio Methods in Chevron
- Founded Practical Portfolio Management 2020.
- Author of Strategic Business Portfolio Management



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What Are Asset Portfolio Analysis and Management

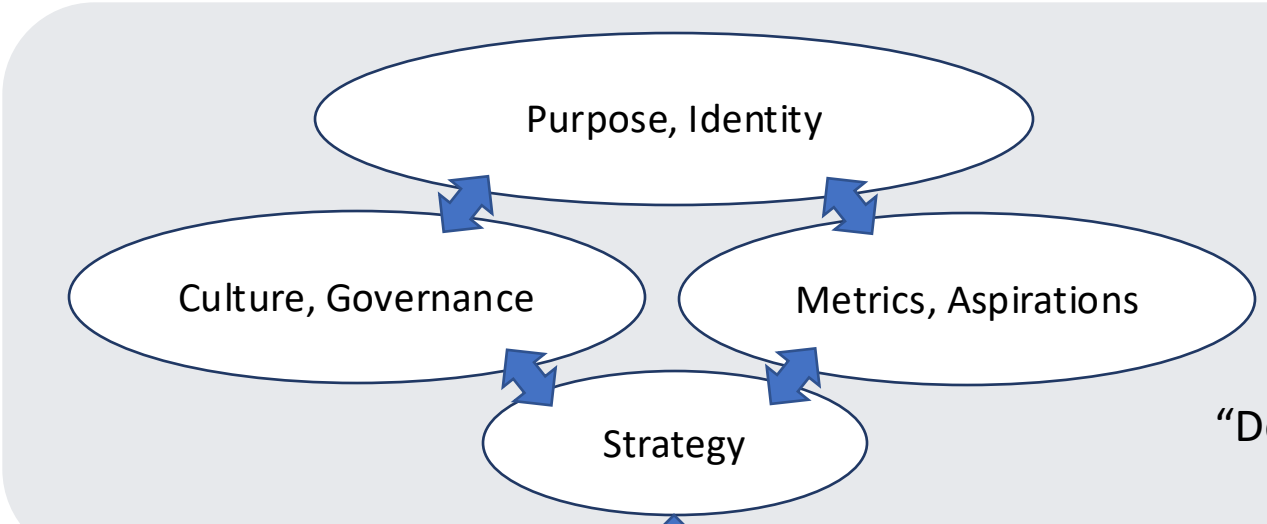
- Portfolio Analysis is a “hard” skill
  - Uses tools, methods, and systems thinking to inform better decisions by aligning investments with well-formulated organizational needs. It puts asset decisions into an organizational context.
- Portfolio Management is a “power” skill
  - Making asset, project, and strategy decisions—informed by Portfolio Analysis—that stick and improve the likelihood of reaching your organization’s goals.
- Portfolio analysis and management ensure that investment decisions align with and support your aspirations.

Who Benefits from Portfolio Management

- Personal and corporate investments, oil and pharmaceutical companies, baseball teams (Moneyball), environmental management efforts

- Research and development portfolios
  - Multiple possible research paths with costs, benefits, and probabilities of success
- Agencies
  - Multiple interventions with different costs, benefits, timing, and uncertainties
- NGOs
  - Do the decisions align with the mission and values of the organization?
- Individuals
  - Align projects with organizational and societal goals

The Strategic Execution Framework



Thinking
Organizing
Leadership

Focusing on Strategy
"Doing the right things"

Portfolio:
Choice,
Priorities

Execution,
Capital Investment:
Programs, Projects

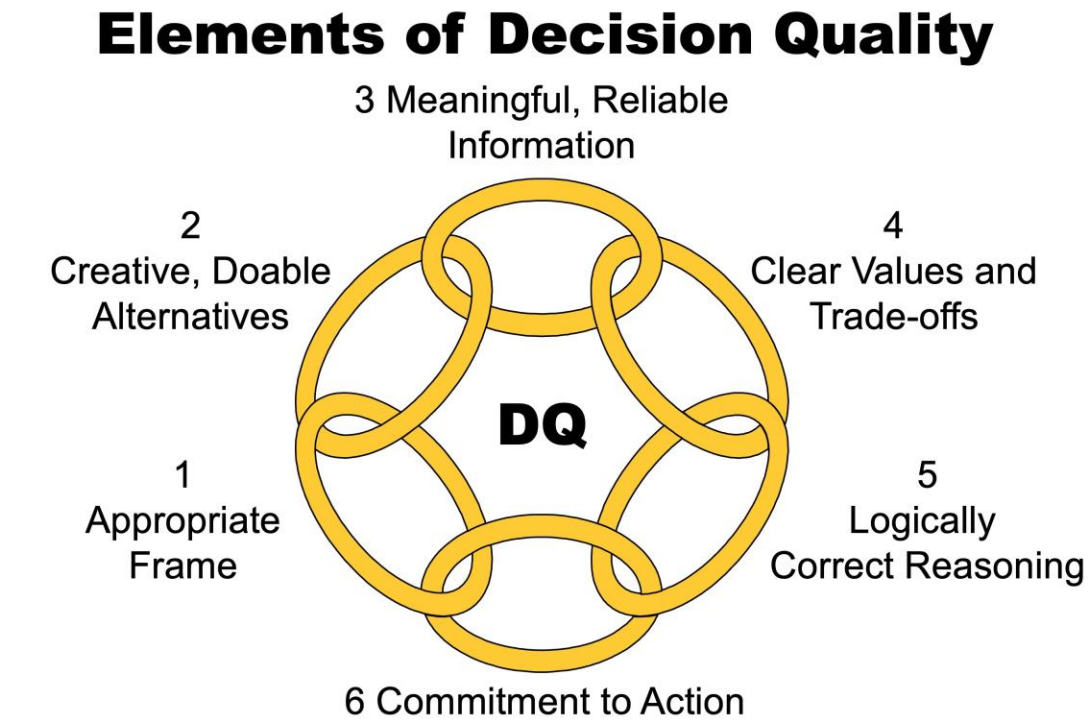
Operations

Doing
Executing
Management
"Doing things right"

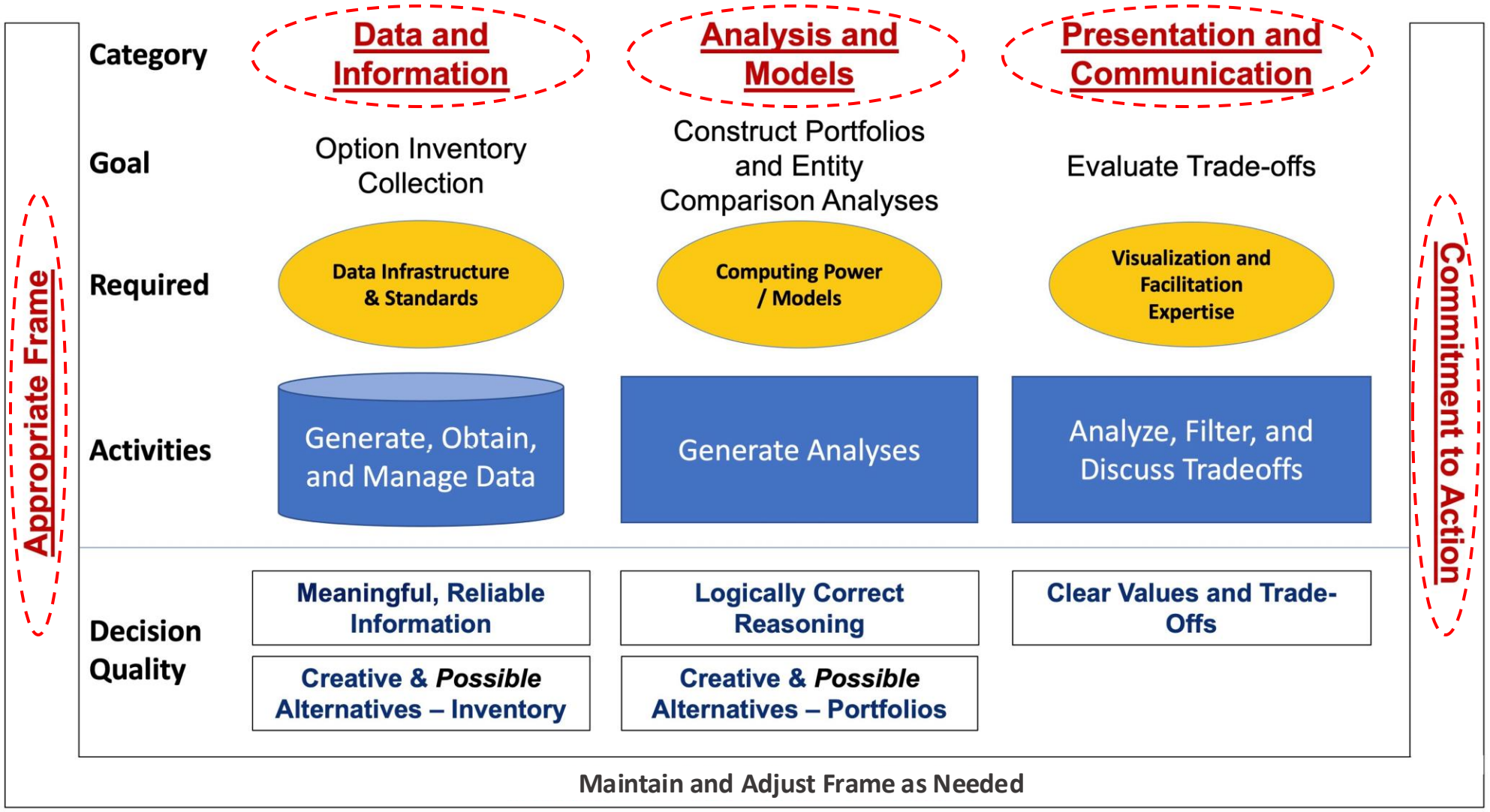
Aligning Actions with Strategy

Structured Decision-Making Leads to High Decision Quality (DQ)

- Many tools exist for structured decision-making, but the overall goal is high DQ
- A common framework for Decision Quality has six components
- This framework applies to both individual efforts and portfolio management



The Five Enablers of Portfolio



Methods – Standalone Analysis

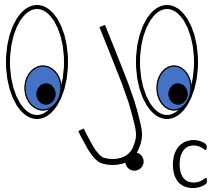
- Rigorously characterize the project or intervention by its costs, risks, uncertainties, and benefits over time.
  - It's a best practice to evaluate and consider different alternatives for scope, scale, and timing.
- Standalone analysis is foundational. All other methods use the output from Standalone

Then

- In many organizations, someone makes the call. Do it or not.

An Important Part of **Data** is to Have an Inventory of Possible Interventions

- A best practice for the individual perspective is to create differently focused alternatives for comparison beyond just yes or no.
  - Can include scale, scope, timing, phases, ramp up, or ramp down, or different spending and operational profiles over time.
  - If you have no choices, you are just executing your portfolio, not managing it
- After standalone analysis, rigorous portfolio analysis requires an inventory of opportunities or alternatives that can be done or not.



- Characterization does **not** need to be a perfect forecast; it **does** need to use consistent standards. Decision-makers must agree on comparability.

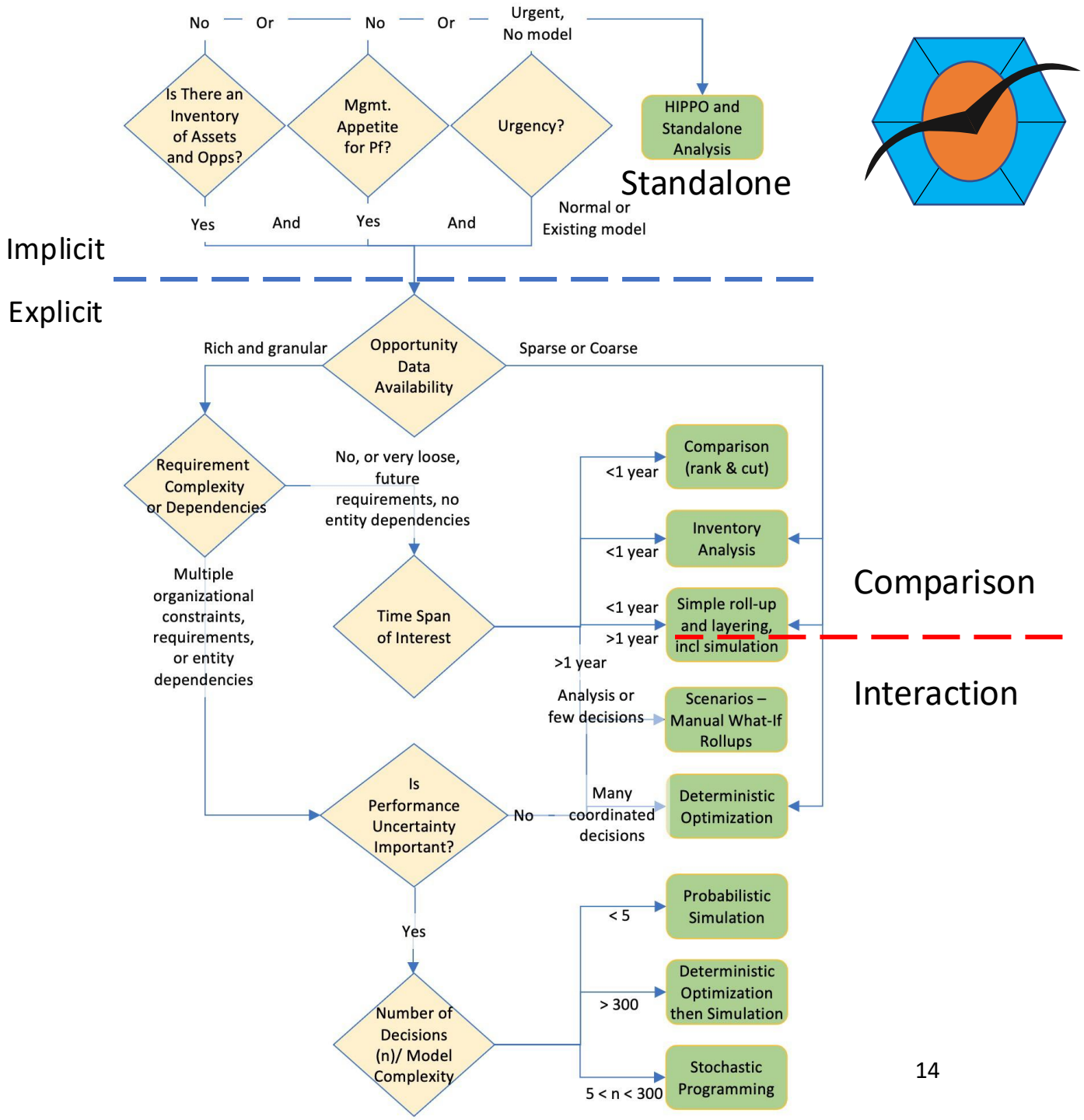
All Methods After Standalone Analysis Require an Inventory

This Decision Tree Helps Guide Us to the Most Appropriate Analytical Method

Start at the top and work down through the diamonds.

Explicit portfolio analysis begins when you have an inventory of comparably characterized efforts.

Interaction is where we explicitly consider a set of coordinated decisions, often in the presence of constraints and performance requirements

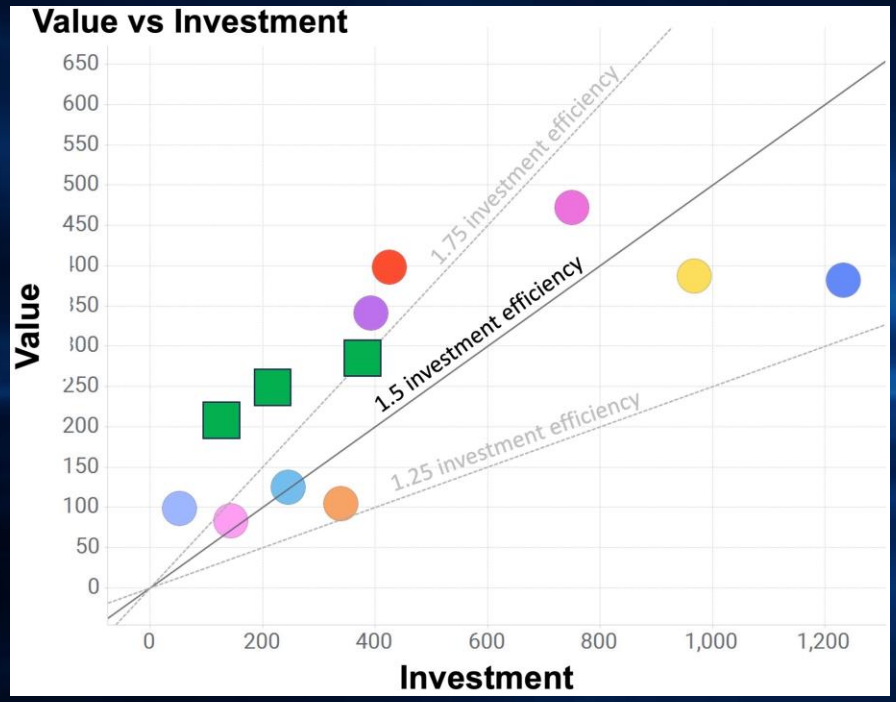


Beyond Standalone Methods – Comparisons

Sort By Benefit to Cost Ratio	Cumulative Value	Cumulative Budget
Opp 1	7.1	1.0
Opp 10	17.1	5.0
Opp 4	36.1	13.0
Opp 3	45.1	18.0
Opp 6	52.1	22.0
Opp 5	55.1	24.0
Opp 2	59.2	27.0
Opp 9	67.2	39.0
Opp 8	70.2	48.0
Opp 7	71.2	54.0

Rank and Cut

Do projects above, cut those below



Compare and Consider

You want to be high and to the left.

Low and to the right is “bad.”

Comparisons are Often Descriptive

- They show us our landscape—the totality of our projects, where they sit relative to the others, and where we may have some gaps.
- The next step is predictive, i.e. forecasts, which is largely outside the scope of this talk.
- Finally, we have prescriptive analysis, which helps us understand the consequences of our decisions and guides us to better ones.

Let’s do a thought experiment!

An Asset Has Three Funding Alternatives

Consider a Single Asset with three alternatives:

Asset "Blue" Alternatives	Cost	Output	Output/Cost
Recommended	100	100	100%
High	125	105	84%
Low	75	80	107%

- The recommended cost and output are the team's recommendation, developed by:
  - looking at some needs and limits that have been communicated to the asset team,
  - comparing those with the options available to the asset.
  - weighing all the competing priorities and resource availability and puts forth a program that will be accepted

Add an Asset

Asset "Blue" Alternatives	Cost	Output	Output/Cost
Recommended	100	100	100%
High	125	105	84%
Low	75	80	107%

Asset "Green" Alternatives	Cost	Output	Output/Cost
Recommended	100	100	100%
High	125	125	100%
Low	75	75	100%

There is a 200 cost limit.

The GM of the two assets notices something…

Do you see a way to combine the two assets to get a higher output for the same 200 input?

There are 9 (3^2) Possible Combinations For These Two Assets

Blue	Green	Total Cost	Total Output
Rec	Rec	200	200
High	High	250	230
Low	Low	150	155
Rec	High	225	225
Rec	Low	175	175
Low	Rec	175	180
High	Rec	225	205
High	Low	200	180
Low	High	200	205

Asset "Blue" Alternatives	Cost	Output	Output/Cost
Recommended	100	100	100%
High	125	105	84%
Low	75	80	107%

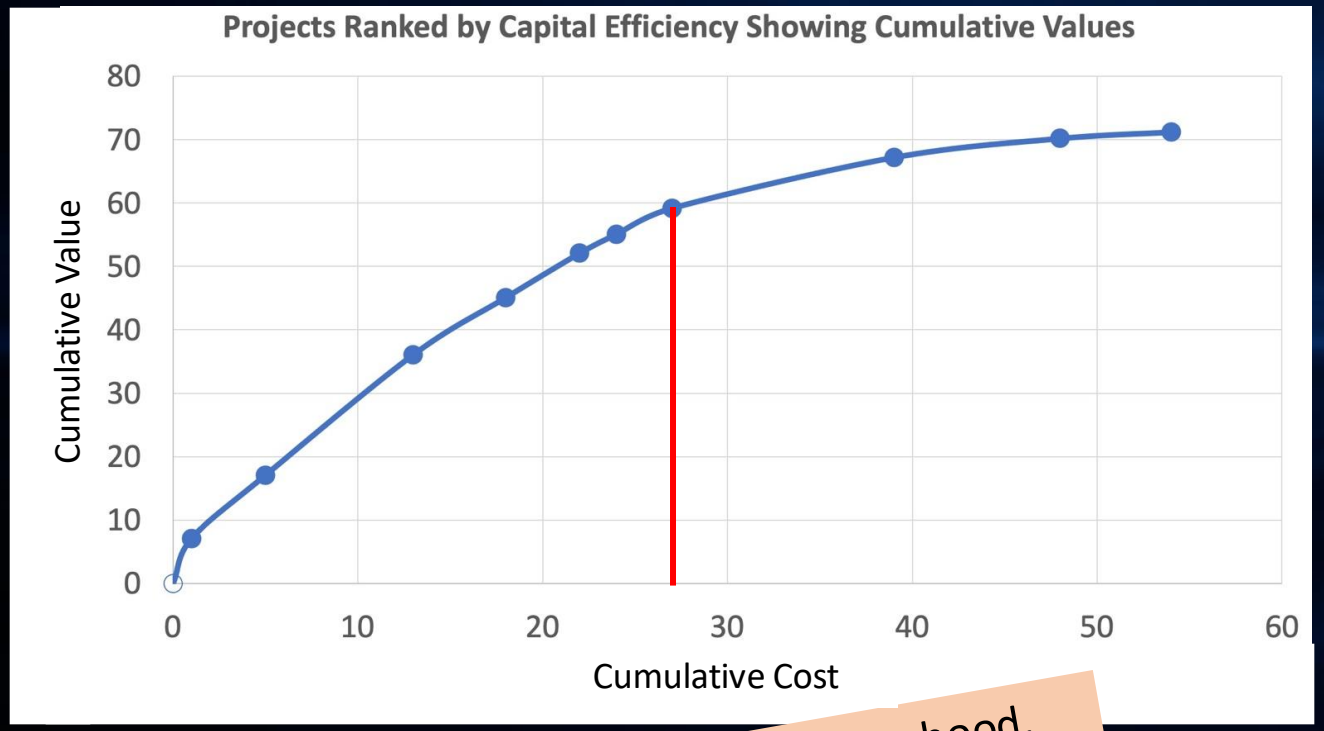
Asset "Green" Alternatives	Cost	Output	Output/Cost
Recommended	100	100	100%
High	125	125	100%
Low	75	75	100%

All Combinations below 200 cost reach less output. The three cases above 200 exceed the budget. Three cases are at 200 cost.

By selecting Asset Blue Low, and Asset Green High, the business can achieve an output of 205 for the same 200 input.

Methods – Interactions

Rank and Cut Is Really Simple Interaction (CFO Chart)



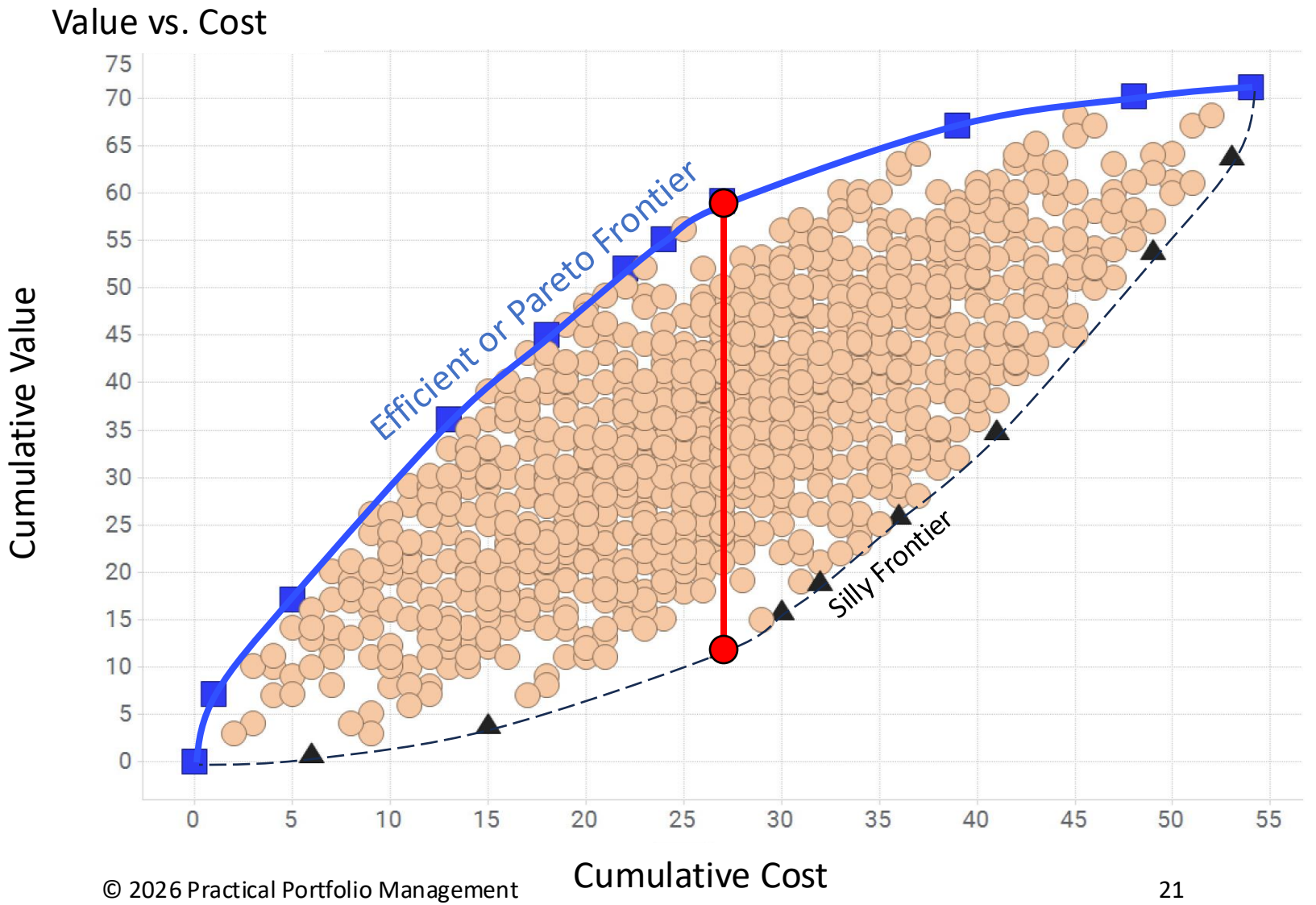
Let's look under the hood. Does anyone know offhand what 2^{10} is?

- The projects interact through the **budget**. Every dollar we spend on one project is a dollar we can't spend on another.
- **Prescriptive** because we can fund the projects to the left of our budget line and ensure the highest efficiency portfolio
- Plotted as Cumulative Value vs Cumulative Cost
- Because we ranked by the ratio of the value to cost, these are the most "efficient" sets of decisions.
- What other decision sets (portfolios) are we leaving out.

Interactions

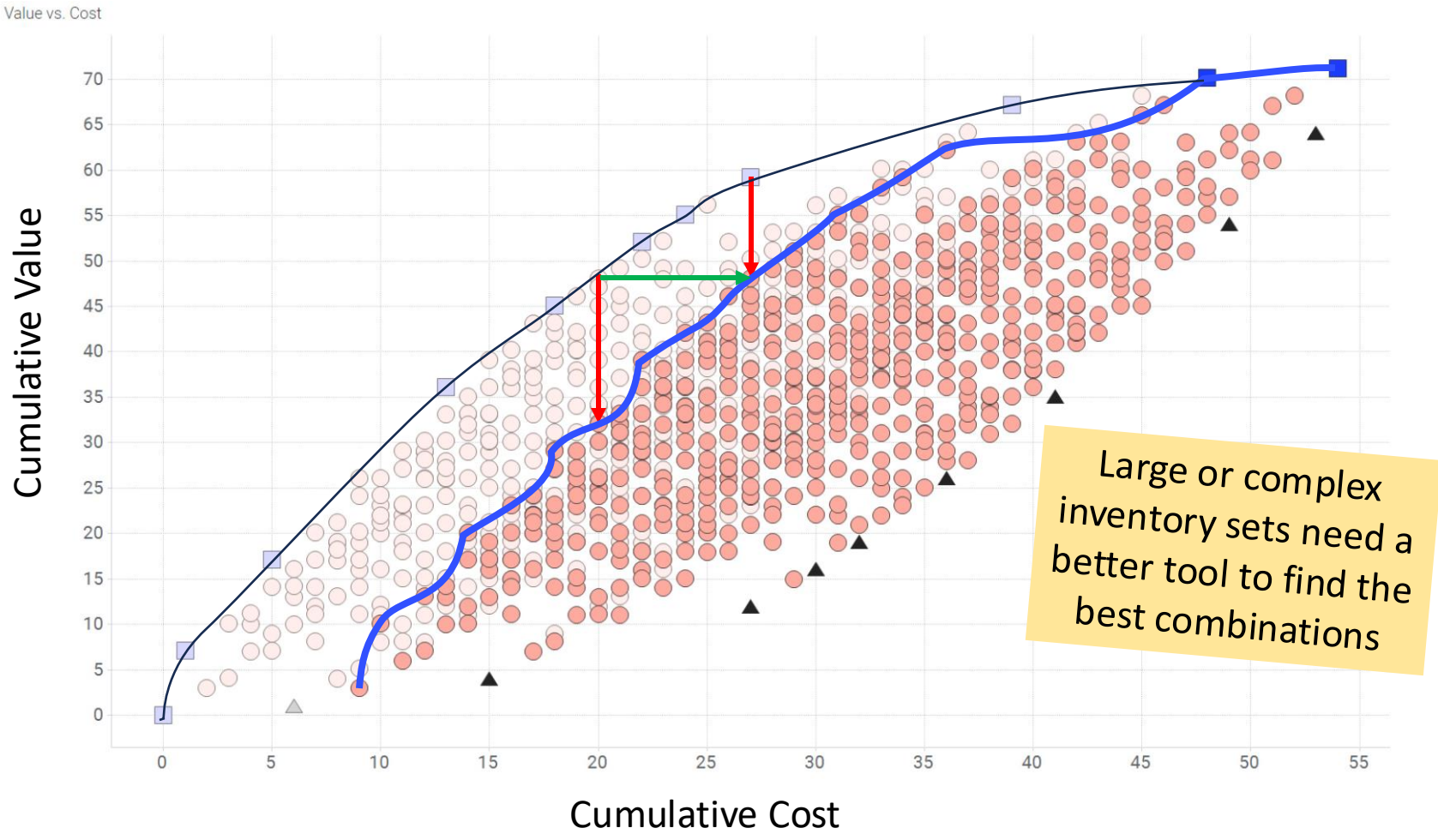
One-by-one decision-making can lead to inefficient spending

- 10 projects with simple yes-no decisions can combine in 1,024 ways
- Two frontiers define the envelope of possibilities
- At a cost of 27, you can end up delivering a total value of 12 or 59
- To be near the Pareto frontier, you must look at the big picture



The Impact of Non-Optimal Decision-Making

- The boss says, “We must include Opportunity 8.”
- The new efficient frontier moves down due to the constraint of including Opportunity 8
- At a budget of 20, the investment value drops from 48 to 32. At 27 budget, it goes from 59 to 48 at best.
- Is Opp 8 **that** essential?



The “Cloud of All Portfolios” works only in simple cases

- Several Factors drive more complexity
  - Time-series needs (budget and results), multiple benefits of an intervention, multiple goals to be fulfilled, phases, dependencies between interventions, alternatives, and the probability of success.
  - Also, the number of combinations. 2^n = 1024 for n=10 projects, 1 million for 20, 1 billion for 30
- Goal-seeking optimization with or without simulation is a possible solution.
- Optimization – An algorithmic process to select a coherent mathematical best answer solution in the presence of conflicting needs and drivers.

Let’s try a set of 11 projects with multiple benefits, funding levels, and dependencies

- Scoring system (1-5) for total benefit, including benefit weights
- Projects can be scaled in steps with fixed and variable costs
- Project K is an enabling technology prerequisite to 3 of the interventions
- Only 1 of Projects G and H can be selected (mutually exclusive)
- Funding is uncertain
- 42MM combinations exist for this data set

The Model

- Built in Excel
- Uses *What'sBest!* from Lindo systems
- Mixed Integer Linear Program (MILP)
- Solves in less than 1 second
- Took a day to build

Public Health 5 Factor Optimization

Case Description: Max Lives Saved 25k budget, 20% infant mort reduction, 50k dom viol reduction

Relative Weighting Factor: 1 | 1 | 1 | 1 | 1

Save Port

Baseline Score

Intervention	Lives saved	Increased QALYs	Infant Mortality Reduction	Improve Gender Equality	Reduce Domestic Violence	Total Score	Cost (000)	Selection	Scale	Bin Check	Dep.	Max Scale Check	0.5	0.75	1	1.25	1.5	1.75	2	2.5	3	3.5	4	4.5	5
A	5	0	0	0	0	5	3,552	1	2	=<=		2	0	0	0	0	0	0	1						
B	0	4	0	3	2	9	0	0	0	<=		4	0	0	0	0	0	0	0	0	0	0	0		
C	5	0	0	0	4	9	0	0	0	<=		3	0	0	0	0	0	0	0	0	0				
D	2	1	3	2	0	8	3,094	1	2	=<=	=<=	2	0	0	0	0	0	0	1						
E	0	2	1	5	3	11	0	0	0	<=		1	0	0	0										
F	2	2	0	2	4	10	5,068	1	2	=<=	=<=	2	0	0	0	0	0	0	1						
G	3	0	3	3	3	12	0	0	0	<=	=<=	2	0	0	0	0	0	0	0						
H	1	1	3	1	2	8	6,255	1	2.5	=<=		5	0	0	0	0	0	0	0	1	0	0	0	0	0
I	1	1	3	3	2	10	3,645	1	1	=<=	=<=	1	0	0	1										
J	2	2	2	5	5	16	0	0	0	<=		2	0	0	0	0	0	0	0						
K	0	0	0	0	0	0	3,207	1	1	=<=		1			1										
	21.5	9.5	16.5	13.5	15.0	76.0	24,821	6	10.5																
							<=																		
							25,000																		

Baseline Value

Intervention	Lives saved	Increased QALYs	Infant Mortality Reduction	Improve Gender Equality	Reduce Domestic Violence
A	5,126	1,012	0.00%	0.00%	0
B	938	114,207	0.24%	3.97%	2,221
C	5,570	1,717	0.96%	0.00%	4,632
D	2,474	36,108	3.84%	2.13%	0
E	721	56,674	1.86%	5.58%	4,781
F	2,840	59,667	0.00%	2.98%	4,068
G	1,369	2,777	3.20%	2.39%	1,792
H	1,058	48,304	3.86%	1.43%	2,350
I	1,387	45,604	3.99%	3.62%	2,876
J	2,772	66,711	2.60%	5.44%	5,939
K	0	0	0.00%	0.00%	0
Total	24,912	359,938	0.21325	0.174015	16,887
	=>=		>=		>=
	15,000		20%		5,000

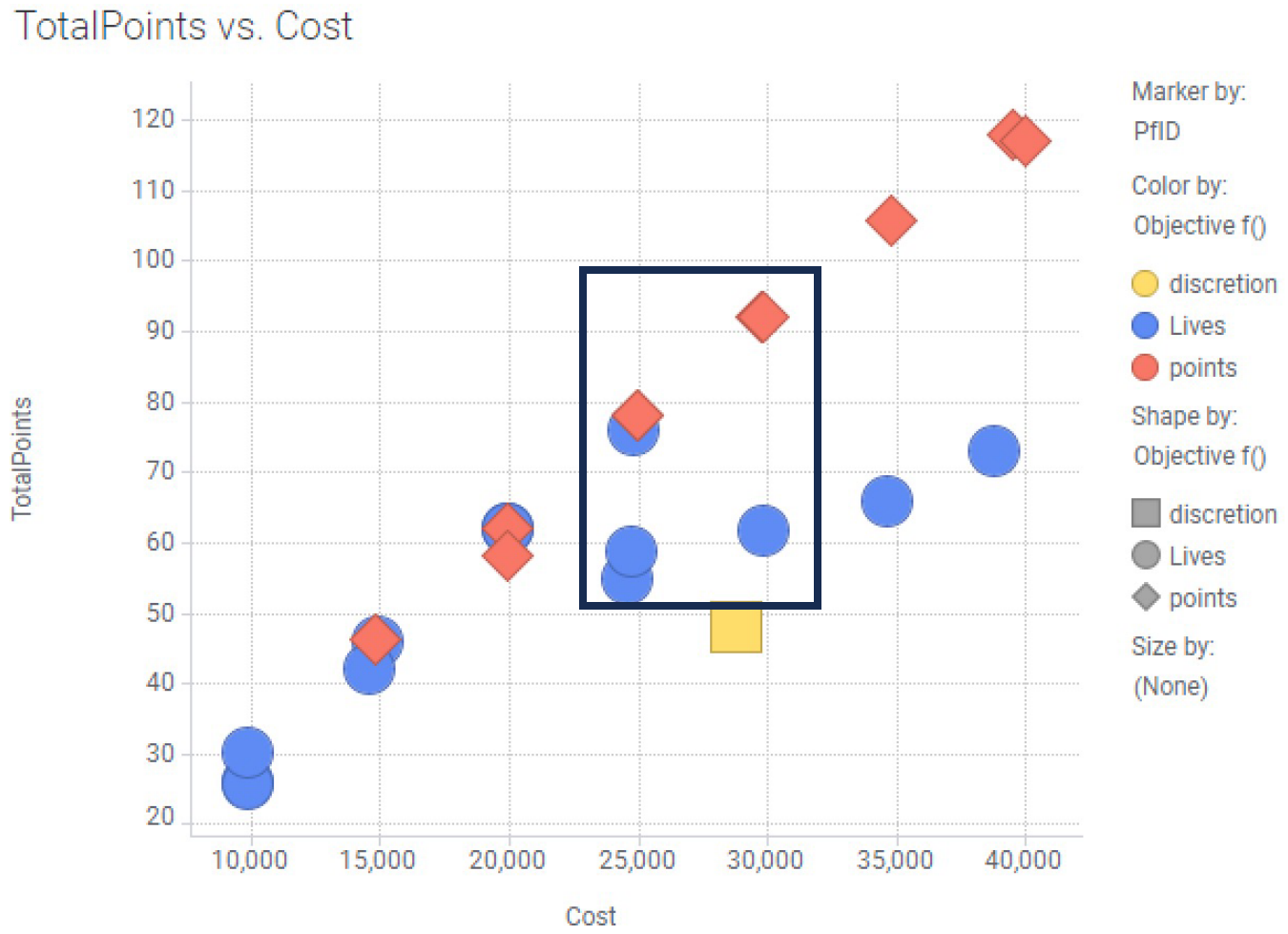
Generate 25 Portfolios Including the Manual Base Case

Used a Total Points calculation (orange diamonds) and Total Lives Saved (blue circle) as the objective (maximization) functions.

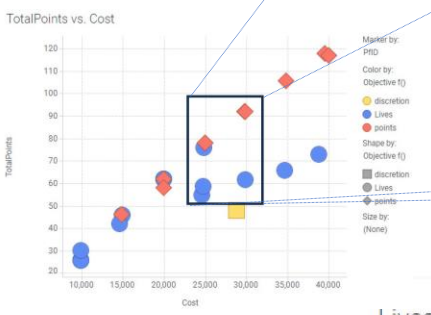
The yellow square is the program submitted by the political, non-quantitative process.

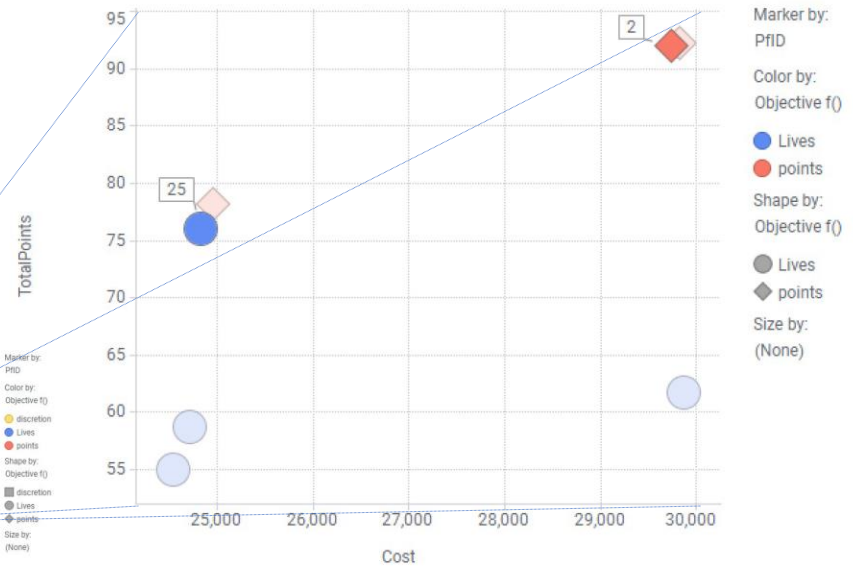
High and to the left is good. The submitted program (yellow square) is far from the Pareto frontier of these two axes.

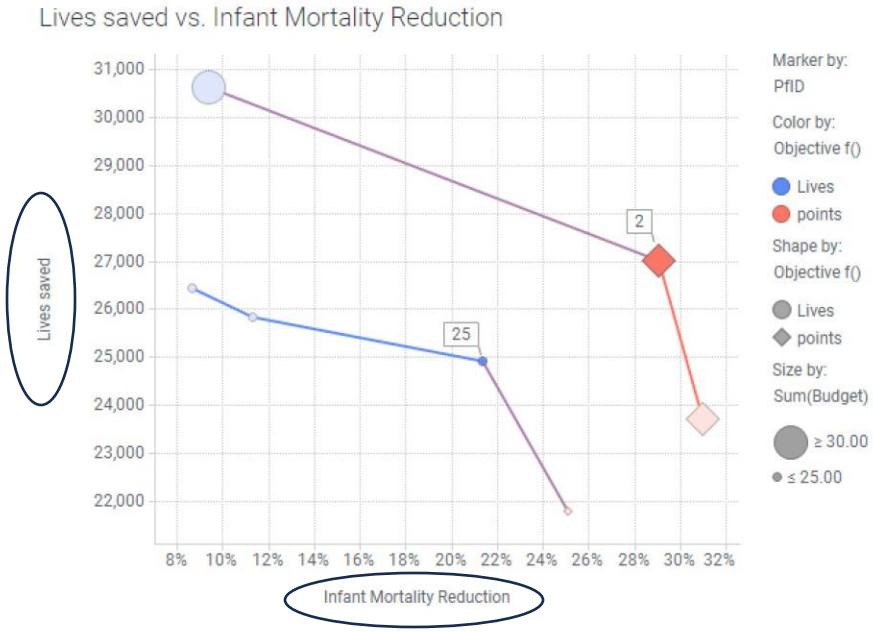
Let's zoom into the 25-30,000 cost range



Practical Portfolio Management



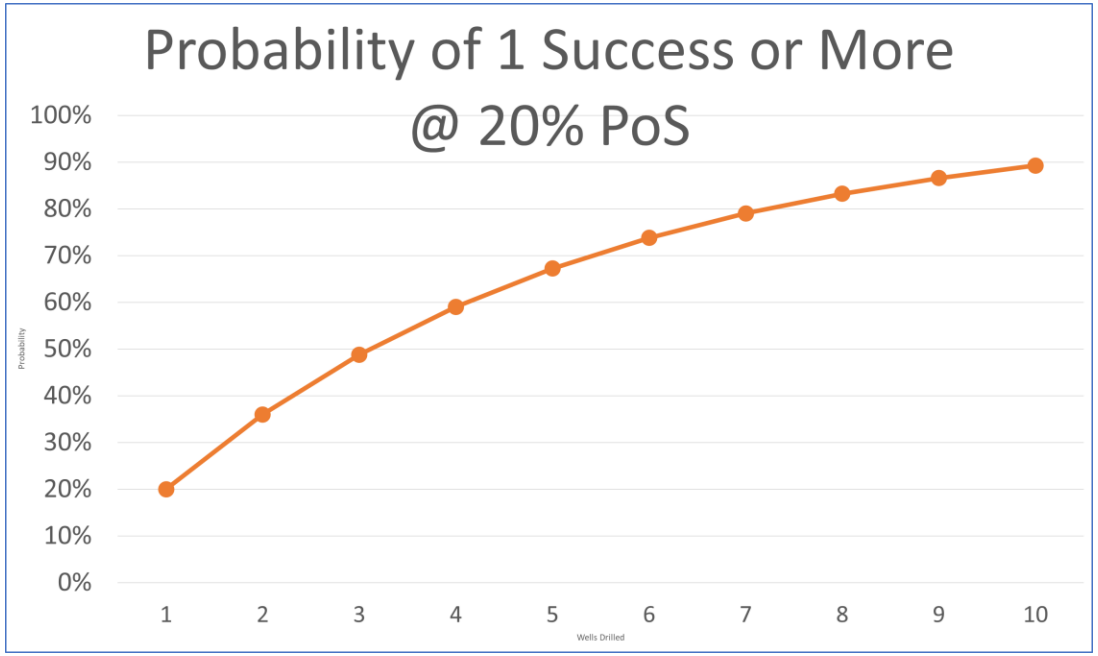




Points create "tension" in the tool, but we care about real numbers

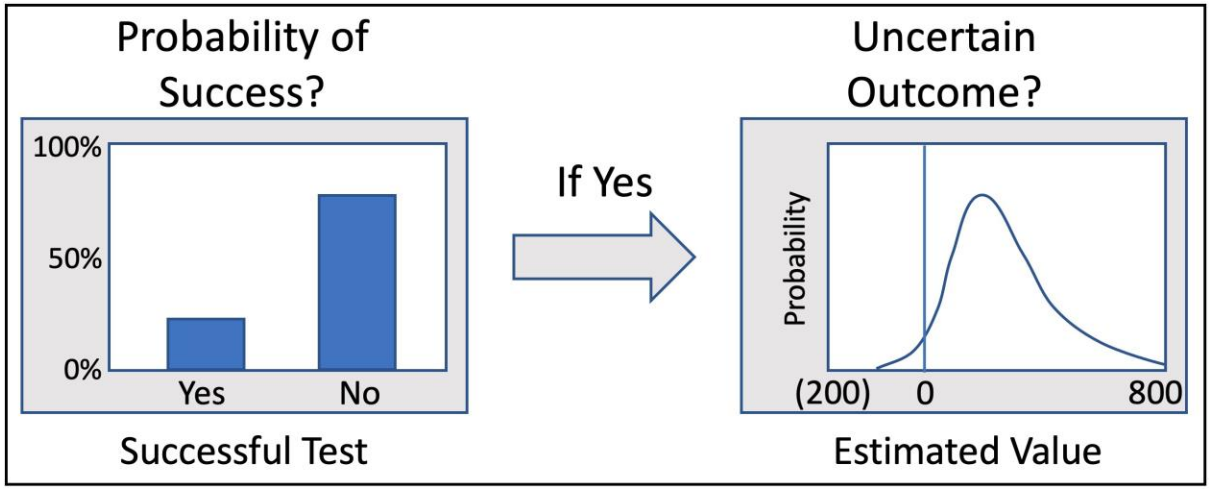
The Role of Probability and Uncertainty

Many efforts are not certain to succeed at the forecasted cost and benefits. Below is the impact of Probability of Success



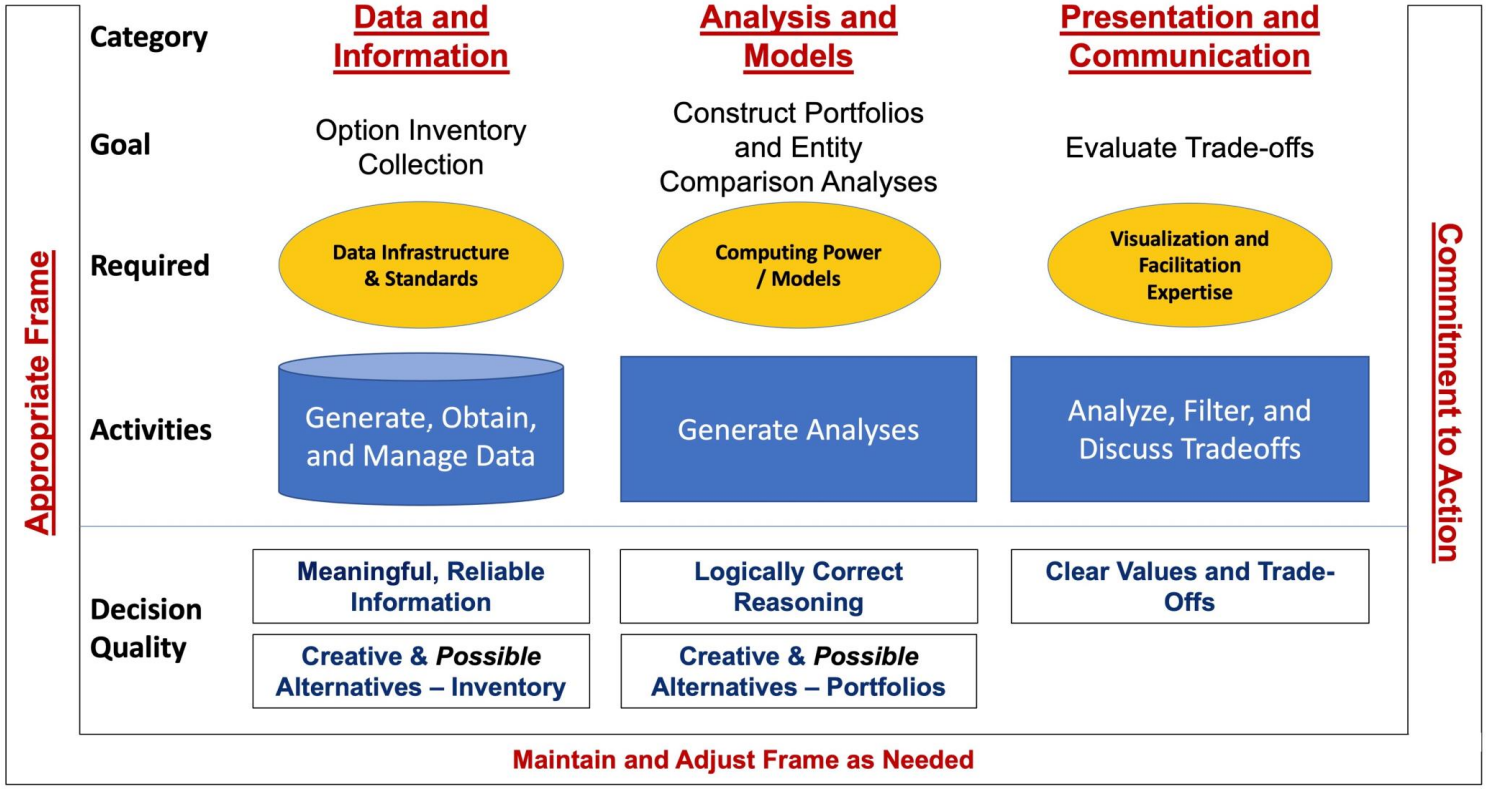
But there's also variability in the outcome.

Monte Carlo simulation with optimization can help solve this type of problem.



The Importance and Difficulty of Management Commitment to Change

- In the examples, we assumed an appropriate frame and commitment to managing the portfolio using these methods.
- Those are not always givens.
- Remember Ignaz Semmelweis.



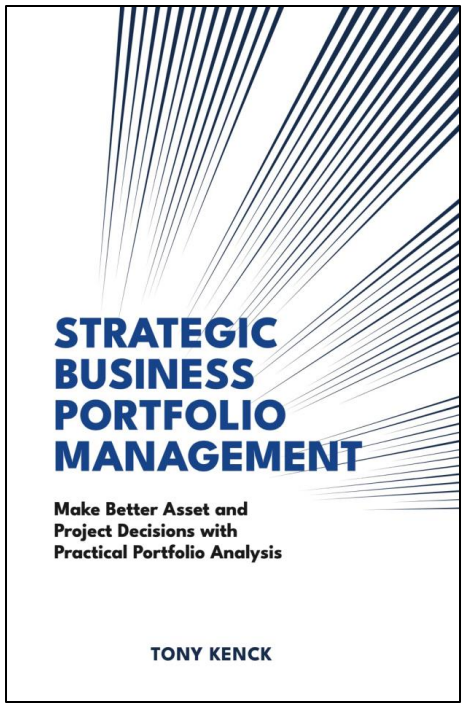
Conclusions

- Portfolio perspectives make tradeoffs transparent to the decision-makers.
- Portfolio management that incorporates the tenets of decision quality will lead to decisions better aligned with your organization's purpose.
- Methods and values are determined by and documented in the frame.
  - Standalone analysis is better than nothing. Comparison is better than Standalone. Interaction is better than Comparison. But use the decision tree to guide you.
- Optimization allows the quick solution of even insanely complicated scenarios
- Oftentimes, probability and uncertainty must be a part of the frame. Portfolio analysis was invented to deal with uncertainty.
- Do not ignore change management. For any of this to work, all the pieces must be in place

Strategic Business Portfolio Management

Available at

https://www.practicalportfoliomanagement.com/



Questions, Demos, or Discussion?

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