DECISION QUALITY

Case Study: Offshore Exploration Strategy— "Big Cheese Oil"

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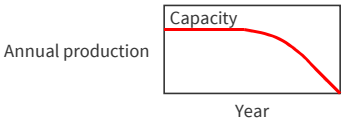
Agenda

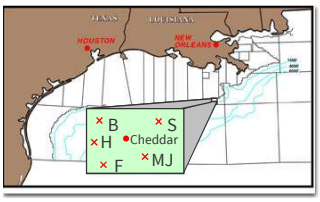
- Case Study Background
- Framing the Decision Situation
- Generating Alternatives
- Preliminary Evaluation
- Choosing the Best Strategy

Big Cheese Oil's (BCO's) Cheddar Basin is a major offshore exploration area.

- The existing Cheddar platform and wells are at capacity for the next several years.



- Several surrounding prospects exist:
  - Monterey Jack
  - Brie
  - Swiss
  - Feta
  - Havarti.



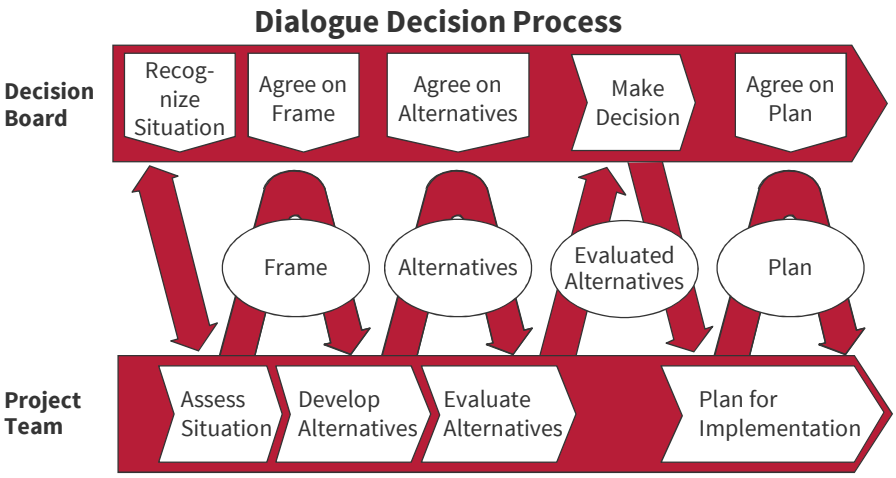
Illustrative map

- Leases will expire over the next few years.

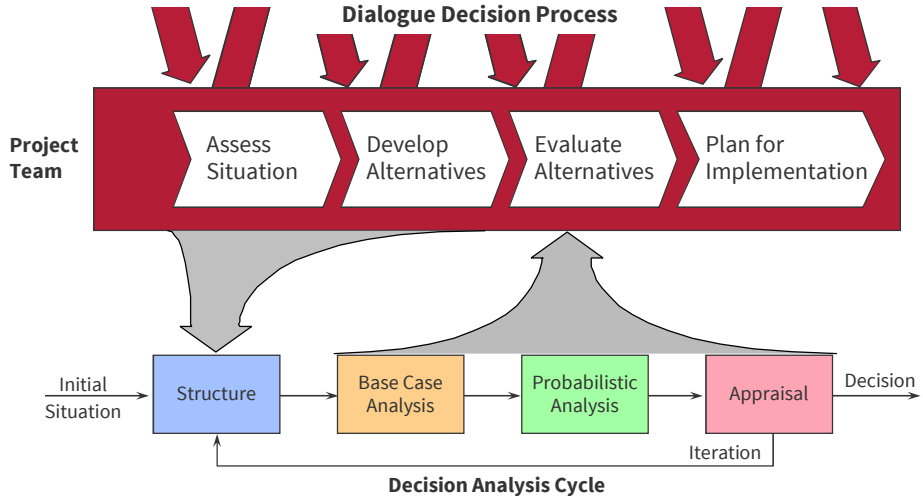
BCO needed to develop an integrated exploration and development strategy.

- When to drill prospects?
- What type of infrastructure?
- How to unitize the prospects?

Our project plan ensured periodic interaction with the decision-makers.

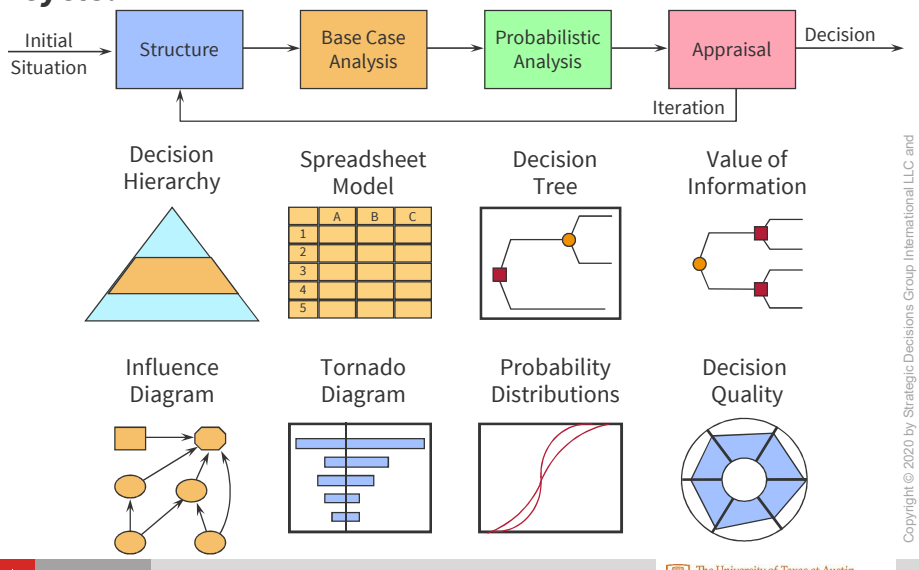


We used the decision analysis cycle to evaluate alternatives and reach the best decision.

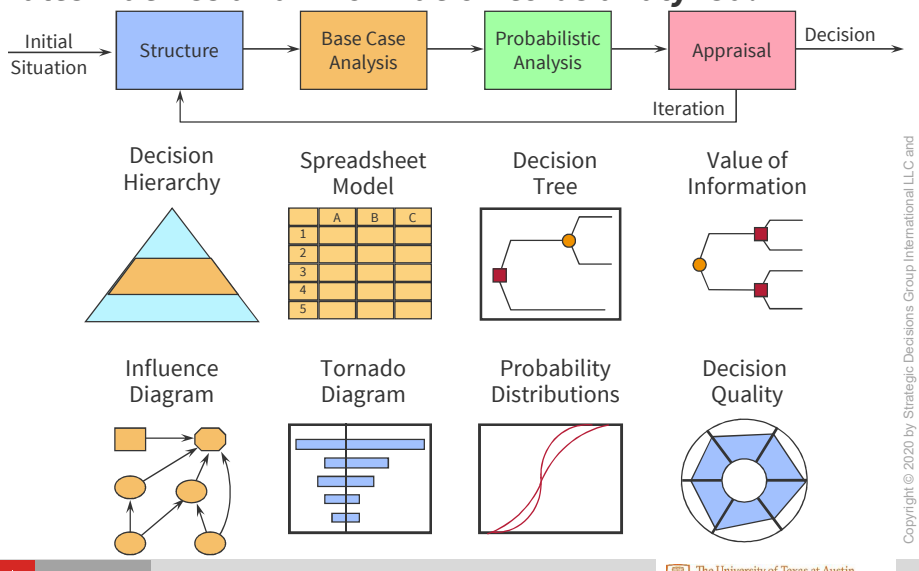


We will use the four-step DA cycle to describe how we conducted the evaluation.

A variety of tools assists in the decision analysis cycle.



In the first phase of the cycle, we structured alternatives and information to be analyzed.



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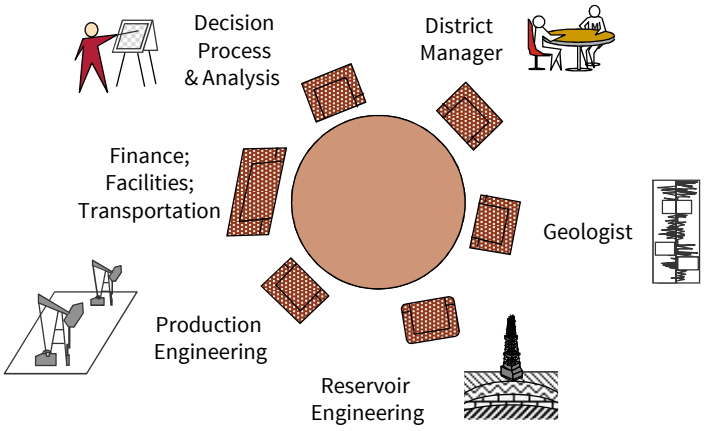
Framing

A project team was assembled, with business area specialists and a decision leader.

The team had three months to complete its work.



Framing

The project team gathered background information about the situation.

- Cheddar platform operates at 30 MBOE/day capacity and the field has reserves of 70 MMBOE.
- Other prospects (beyond those named earlier) are too distant from Cheddar to be relevant for the decision.
- To access the five prospects, we would need to:
  - Build new platforms
  - Construct a subsea tie to Cheddar
  - Do nothing
- BCO has options to upgrade the Cheddar platform

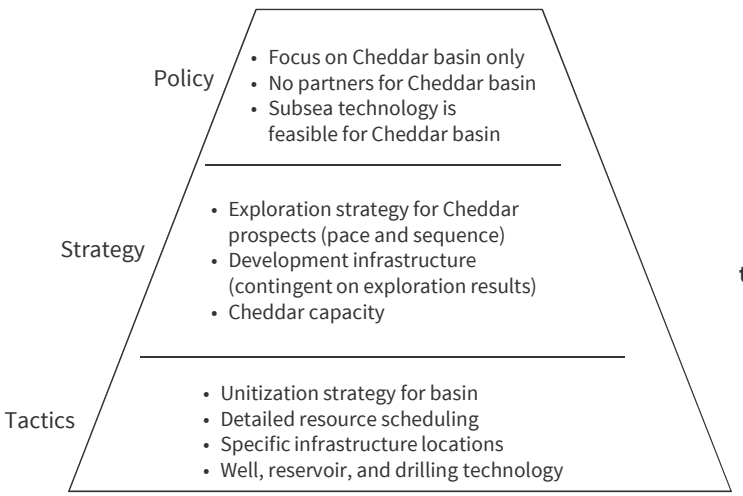
Framing

The team developed exploration and reserve information for the prospects.

Prospect	Years to Lease Expiry	Prob. of Hydro-carbons	Reserves (given presence of hydrocarbon) (MMBOE)		
			Low (1 in 10)	Base (median)	High (1 in 10)
Swiss	4	0.60	40	70	110
Monterey Jack	5	0.08	30	125	250
Brie	2	0.50	15	25	45
Feta	4	0.40	10	40	60
Havarti	4	0.30	10	35	55

Framing

A "decision hierarchy" focused the team on which strategic decisions to study.



Framing

The project team verified the appropriate value measures with the decision makers.

Decision Criterion	• Maximize expected net present value (NPV)
Discount Rate	• 10 percent (nominal)
Risk Attitude	• Risk neutral (expected value)
Other Value Issues	• Enhance subsea expertise

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Alternatives

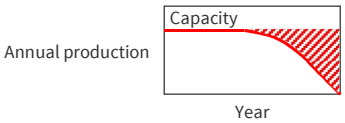
The team developed four strategies for evaluation.

Momentum

- Drill when necessary due to lease expiry; defer commitments

Co-develop with Cheddar

- Drill slowly, timing to fill Cheddar capacity as it becomes available



Upgrade Cheddar

- Increase capacity at Cheddar in order to accelerate production

Aim for New Platform

- Focus on finding enough reserves to justify building a new platform

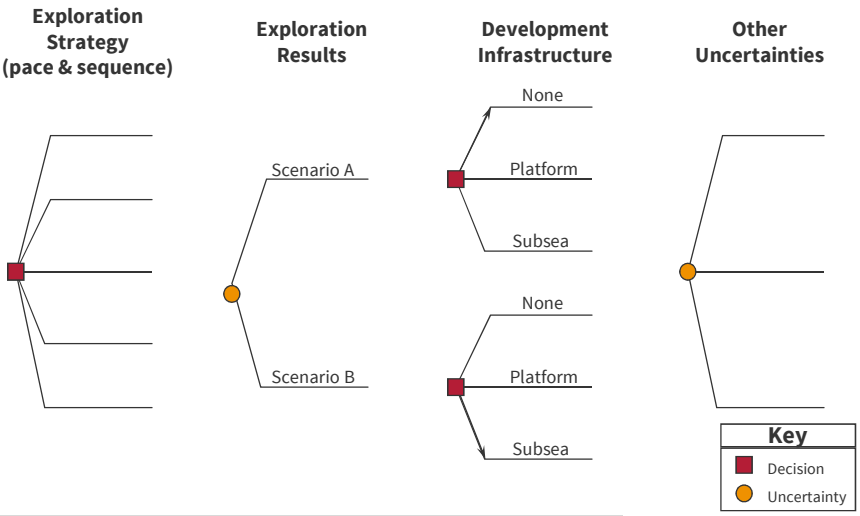
Alternatives

Each alternative is described by specific choices for each strategic decision.

Strategy Theme	Exploration Strategy		Development Infrastructure	Cheddar Capacity
	Drilling Pace	Drilling Sequence		
Momentum	As slow as possible (~6 years)	Closest prospect to Cheddar first	None	Current
Co-develop with Cheddar	Moderate (~4 years)	Earliest lease expiration first	Platform	Increase
Upgrade Cheddar	As fast as possible (~2 years)	Largest reserves (Swiss & Monterey Jack first)	Subsea	
Aim for new platform			Note: Best option will be selected contingent on exploration results.	

Alternatives

The team treated the infrastructure choices as contingent decisions ("real options").



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  - Base Case Analysis
  - Probabilistic Analysis
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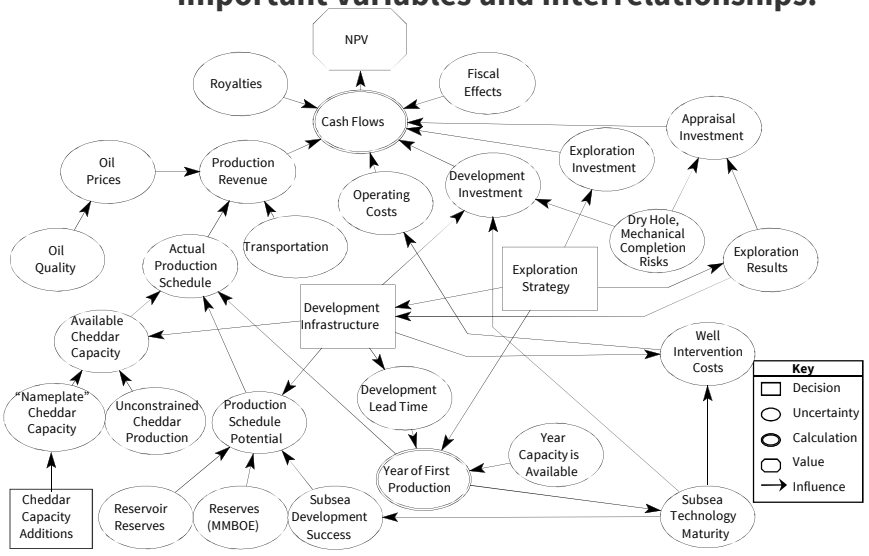
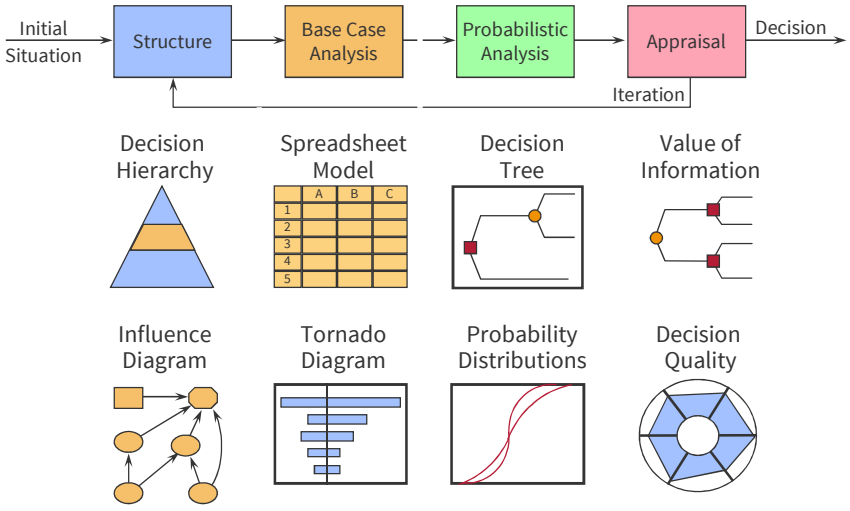
Base Case Analysis

Our "influence diagram" (model map) showed important variables and interrelationships.

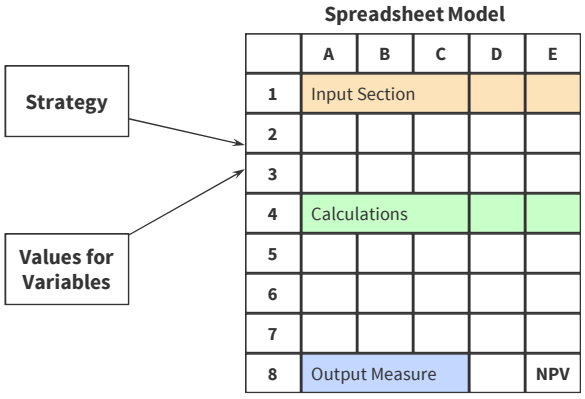


In the second phase, we produced a model and base case analysis of the decision.



Base Case Analysis

A "base case" spreadsheet model calculates NPV given a strategy and a single value for each variable.



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Base Case Analysis

The model calculated an NPV of $110 million for the "Co-develop with Cheddar" alternative.

Assumptions

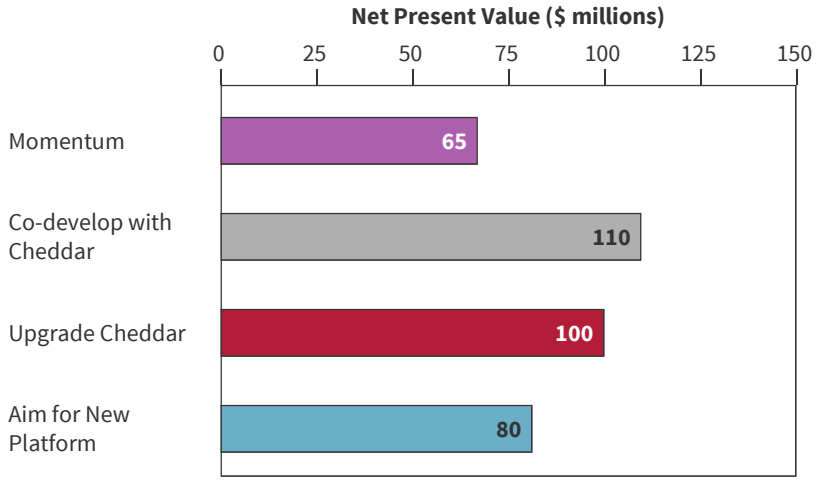
- Swiss and Brie—successful
- Other prospects dry
- Subsea completions
- All other variables at base case

	NPV—Co-develop with Cheddar ($ millions)
Revenues	320
Production Expenses	– 40
Income Tax	–100
Investment After Tax	–70
Total	110

Prospects

Base Case Analysis

Base case analysis* favors the Co-develop with Cheddar strategy.



* All variables set at their "base case" values.

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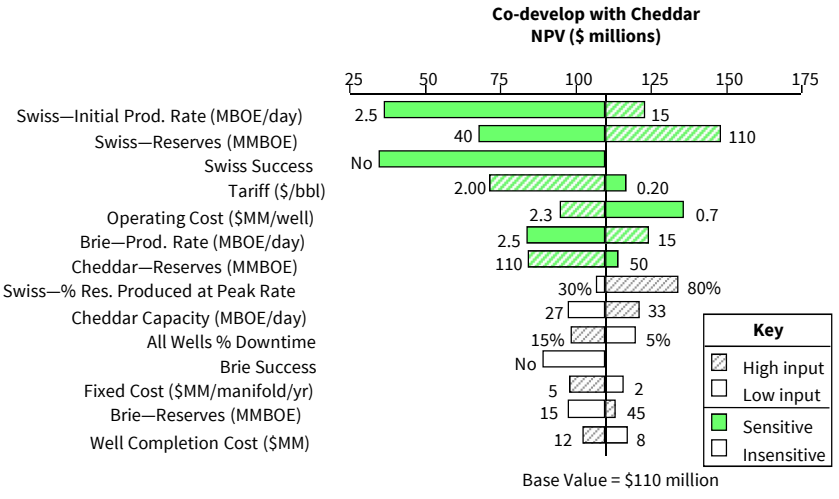
Probabilistic Analysis

A "tornado diagram" identified Swiss as the prospect with greatest uncertainty.



Probabilistic Analysis

The tornado analysis led to some important insights:

- Further analysis indicated the best exploration strategy is to drill in order of decreasing risked* reserves as Cheddar capacity becomes available.
- The upside potential of the Co-develop with Cheddar strategy is moderate because of limited Cheddar capacity.
- Major drivers of the value and risk of a Co-develop strategy include:
  - Swiss production rates, reserves and success
  - Tariff levels
  - Operating costs
  - Brie—production rate
  - Cheddar reserves (i.e., it produces for longer than expected)
- Tens of millions of NPV can be influenced by factors that are at least partially under our control.
  - Cheddar capacity
  - Operating cost

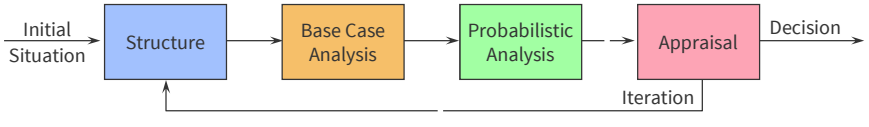
*Risked reserves: Expected value of reserves, taking into account drilling success and uncertainty in reserves.

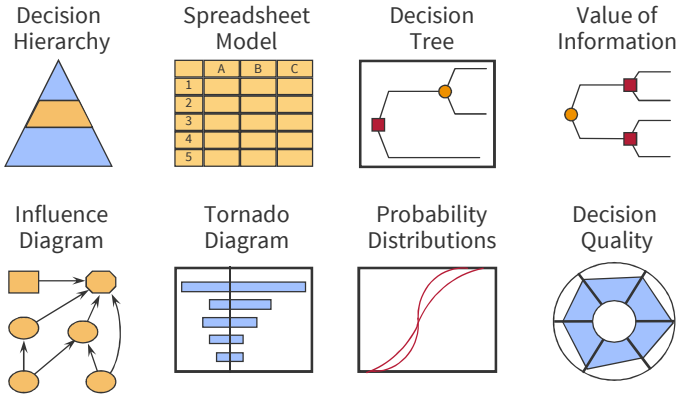
Probabilistic Analysis

With these insights plus decision board input, we refocused our alternatives on the Cheddar capacity decision.

Cheddar Capacity	Cost	Lead Time (first production)	Scope
No expansion	$0		
50% expansion	$70	3 years	Expand existing processing facilities
100% expansion	$110	4 years	Add a second processing facility and add second pipeline

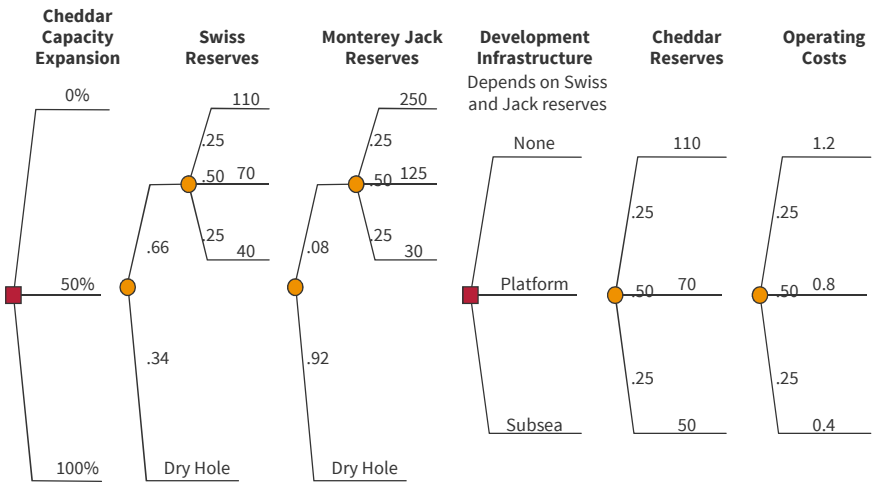
In the third phase of the cycle, we incorporated uncertainty into the analysis of the decision.





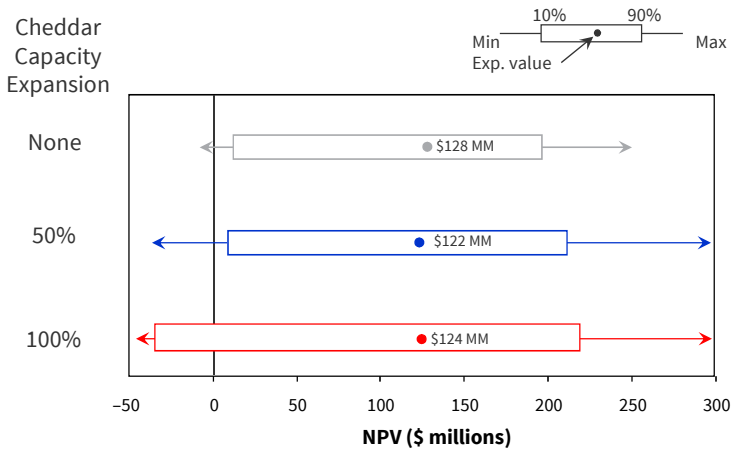
Probabilistic Analysis

A "schematic" tree shows the sequence of decisions and uncertainties analyzed.



Probabilistic Analysis

Probabilistic analysis illustrated the risk the company faced for each choice.



The three strategies had similar expected values, but 100% expansion show significantly more downside risk.

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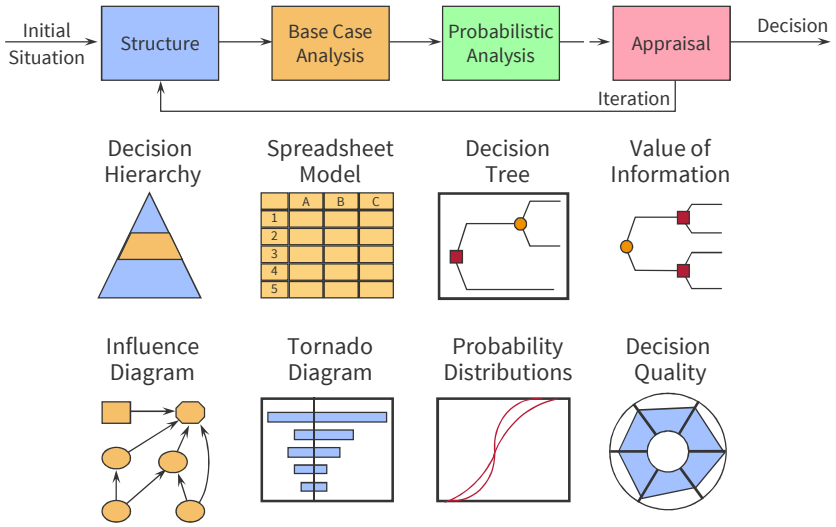
We used appraisal tools to gain further insight.



Recommended Strategy

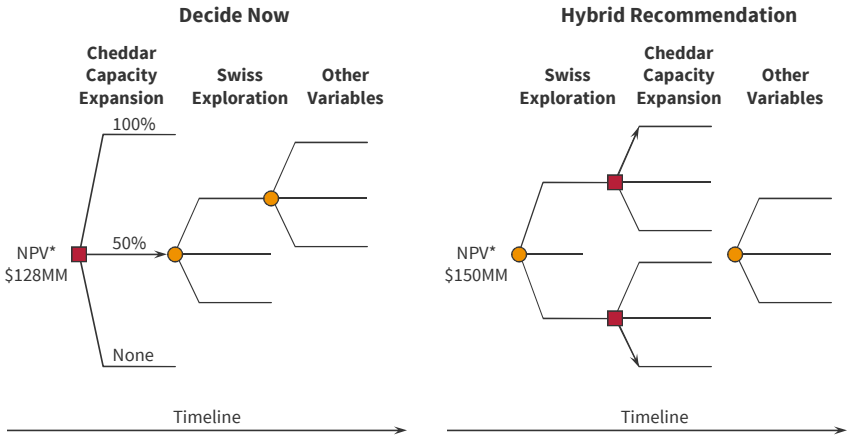
We analyzed the value of obtaining perfect information on uncertainties before deciding on Cheddar expansion.

Uncertainty	Value of Perfect Information Cheddar Expansion Decision ($ millions)
Swiss Reserves	22
Brie Reserves	3
Oil and Gas Prices	0
Cheddar Reserves	0
Platform Cost	0
All Uncertainties	29

Knowing what's waiting for us at Swiss and Brie would help us make the right capacity expansion decision at Cheddar.

Recommended Strategy

This suggests a "hybrid" alternative that postpones the Cheddar capacity decision.



* Net present value of profit after tax

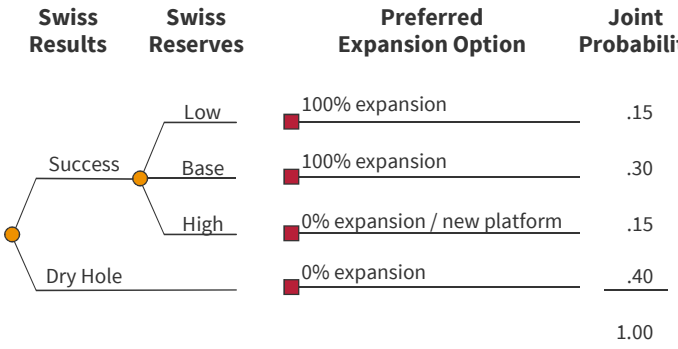
Recommended Strategy

Consequently, the team developed a hybrid strategy:

- Drill Swiss as early as possible.
- Begin immediately on early low-cost engineering on 100 percent expansion at Cheddar.
  - Be ready to proceed rapidly when Swiss results are clear.
- Drill Monterey Jack, Brie, Feta, and Havarti in that order once capacity is available.

Recommended Strategy

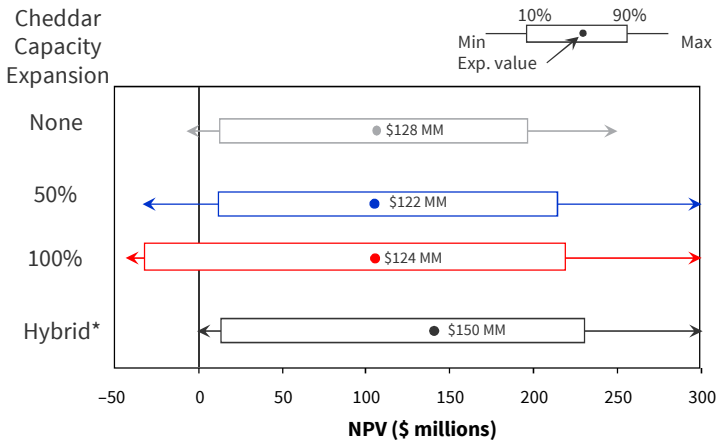
The recommendation included full contingency plans.



The expansion decision is a good example of a "real option," which provides the right but not the obligation to exercise each expansion choice.

Recommended Strategy

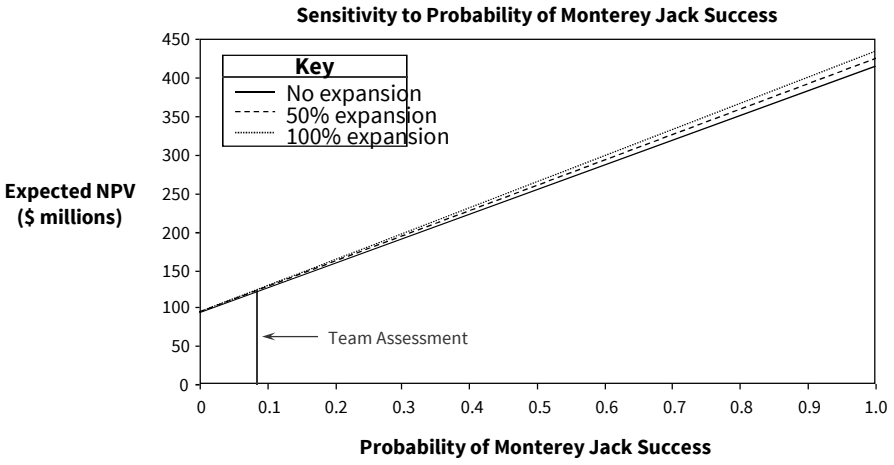
The "hybrid" capitalize on the upside with minimal exposure to the downside.



Hybrid: Drill Swiss first and add Cheddar capacity as necessary. Drill the others as capacity is available. Value gain: $22 MM.

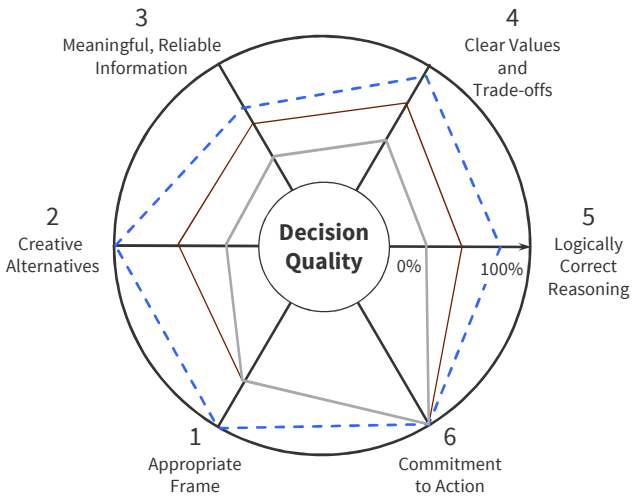
Recommended Strategy

We also explored whether the strategy was sensitive to probability assessments.



Recommended Strategy

After three sessions, the decision-makers certified the quality of the analysis.



In summary, the analysis had numerous benefits for the project team and decision-makers.

- The complete probabilistic analysis indicated the risk and return of each strategy.
- Analysis of divergent opinions ended many debates.
- The process identified new creative options to reduce risk. This created $22 Million added value potential.
- Buy-in and commitment to action were obtained in working sessions with the decision-makers.