Presenting:

Making better Appraisal & Development Decisions Using Decision Risk Analysis & Value of Information

by Pete Naylor

DAAG Conference 2017

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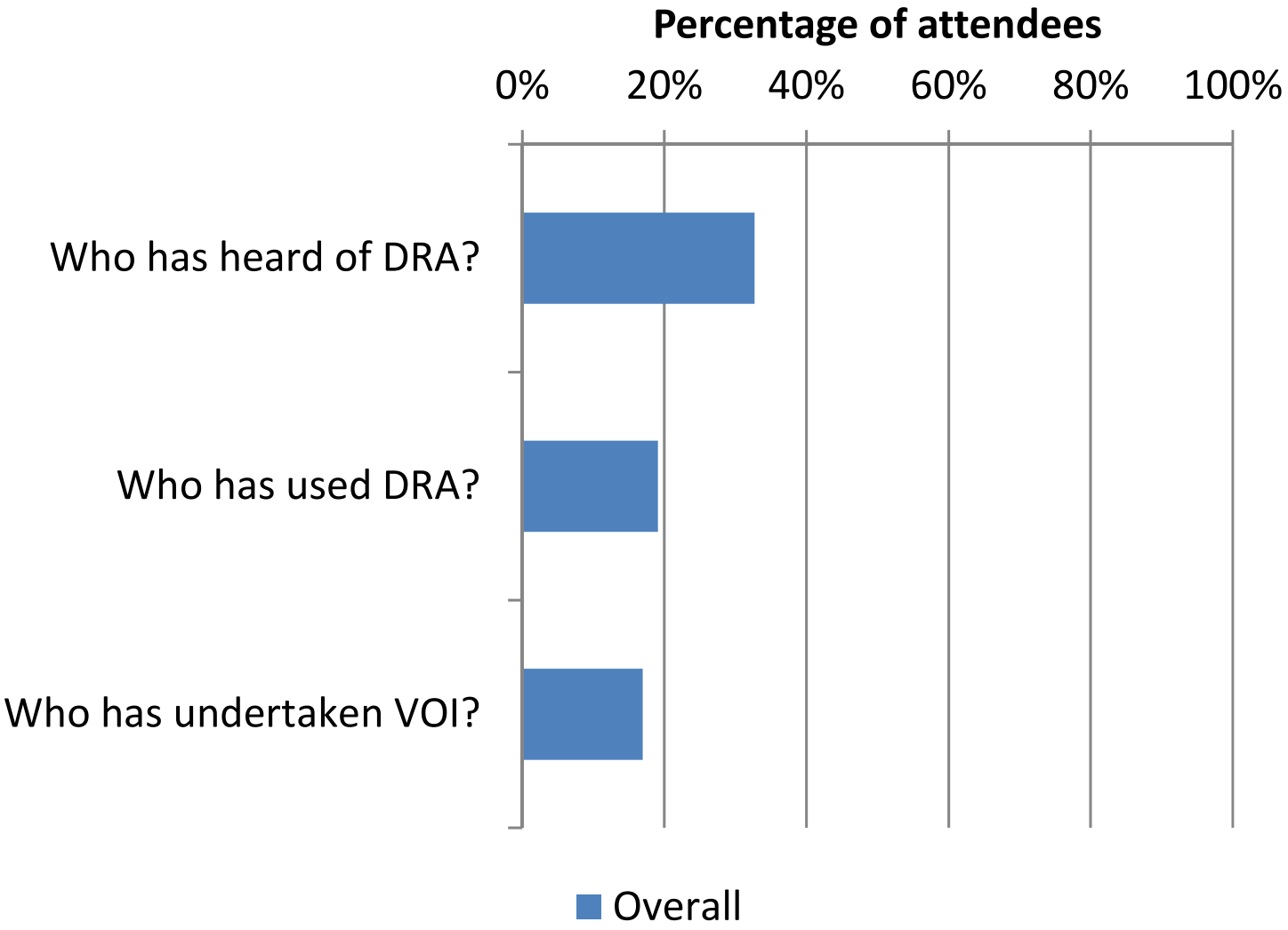
Aims of this presentation

- To introduce Decision Risk Analysis (DRA)
- To provide an understanding of ‘value of information’ (VOI) analysis
  - When?
  - Why?
  - How?

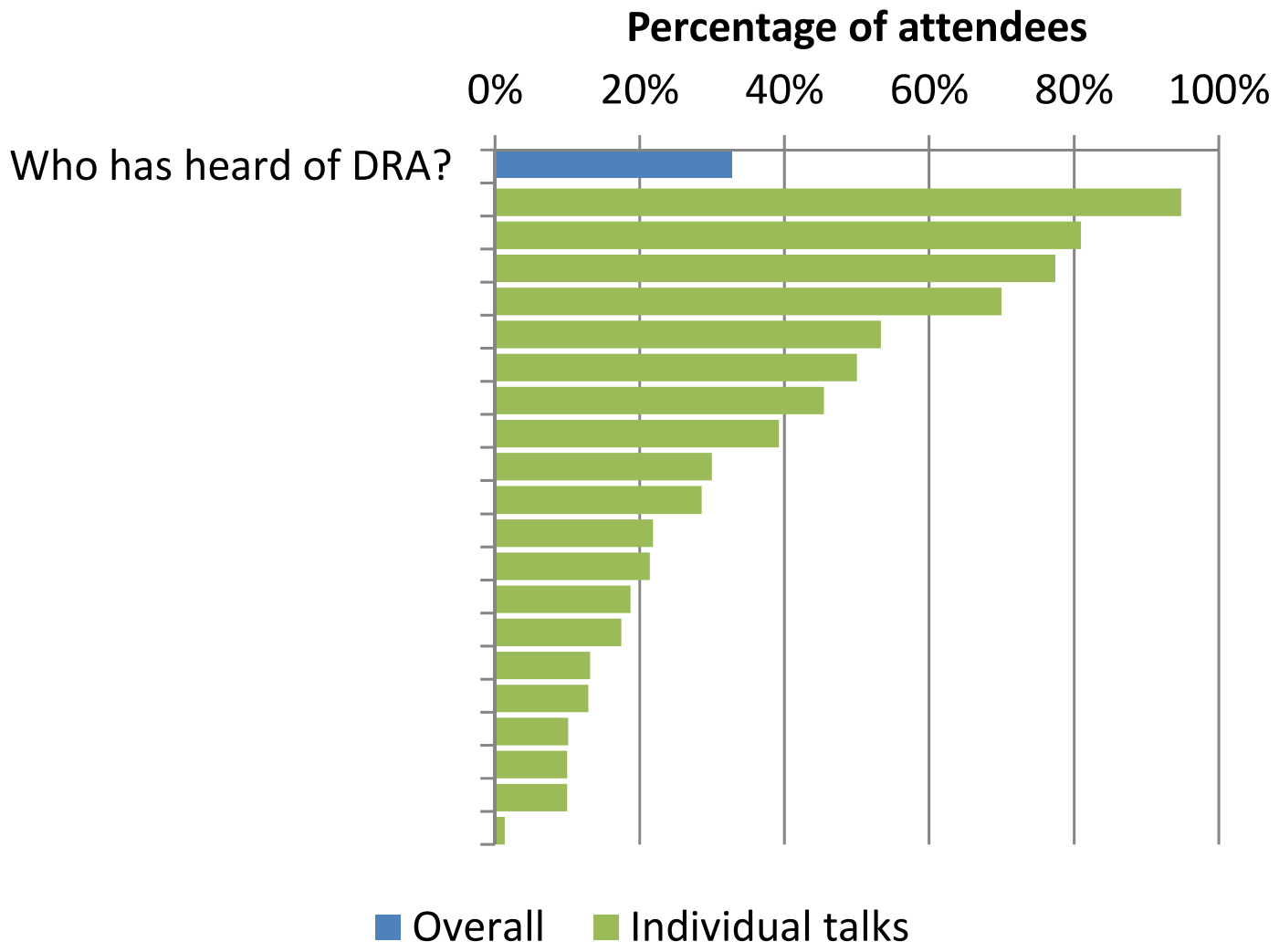
Statistics

- 1,051attendees
  - Maximum attendance 149
  - Minimum attendance 15
- 20 presentations
- 16 countries
- 1 straw poll
  - Who has heard of DRA?
  - Who has used DRA?
  - Who has undertaken VOI?

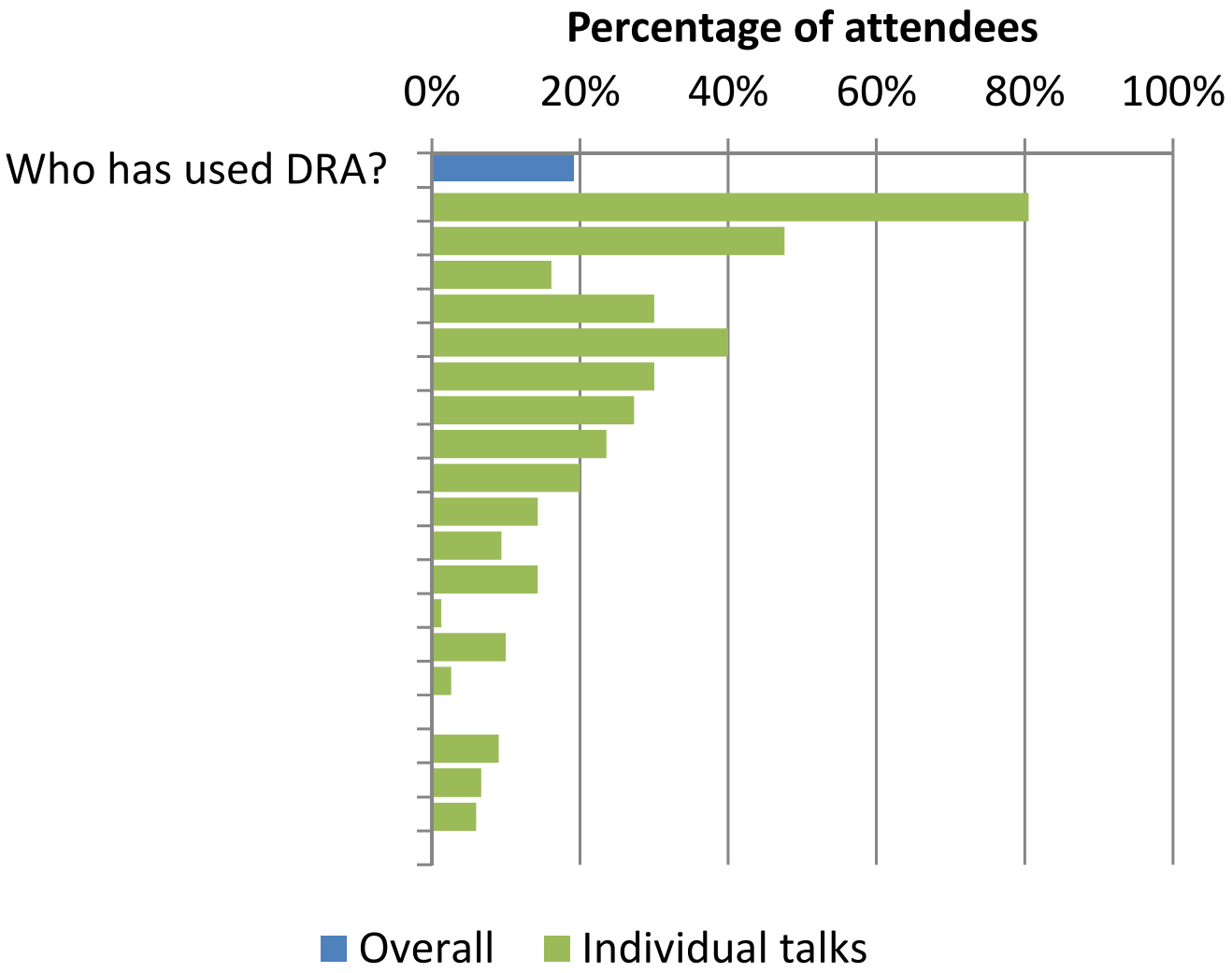
Overall responses



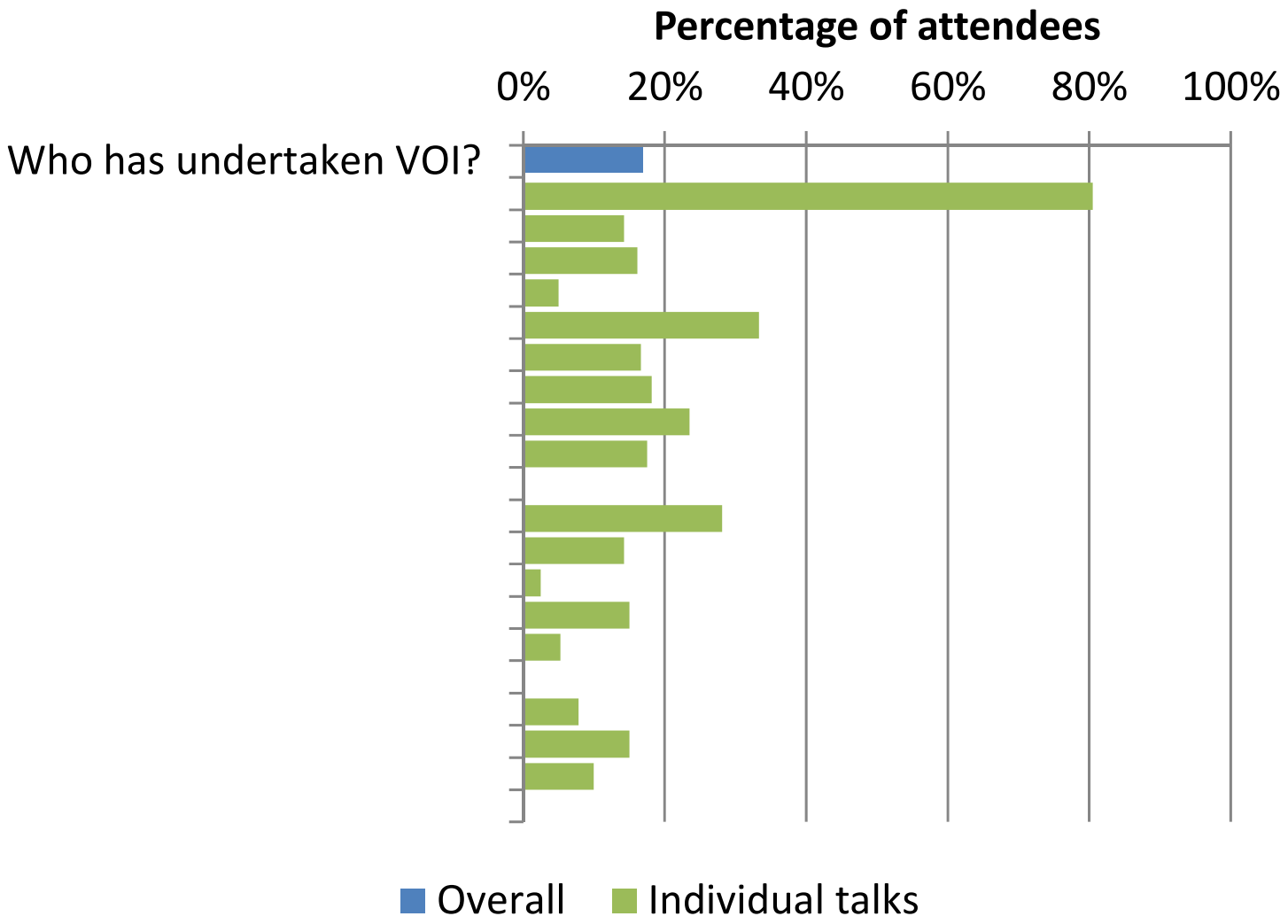
Who has heard of DRA?



Who has used DRA?



Who has undertaken VOI?



Detailed responses

Location	% of attendees: Who has heard of DRA?	Who has used DRA?	Who has undertaken VOI?	Comments
Overall	**33%**	**19%**	**17%**	
London, UK	95%	81%	81%	
Farmington, USA	81%	48%	14%	
Rio de Janeiro, Brazil	77%	16%	16%	
Lima, Peru (am)	70%	30%	5%	
Dublin, Ireland	53%	40%	33%	
Madrid, Spain	50%	30%	17%	
Mexico City, Mexico	45%	27%	18%	
Aberdeen, UK	39%	24%	24%	
Stavanger, Norway	30%	20%	18%	
Macae, Brazil	29%	14%	0%	
Miri, Sarawak	22%	9%	28%	
Campania, Romania	21%	14%	14%	
Lima, Peru (pm)	19%	1%	3%	
Budapest, Hugary	18%	10%	15%	
Duliajan, India	13%	3%	5%	
Manila, Philippines	13%	0%	0%	~80% were students
Hammamet, Tunisia	10%	9%	8%	Oil & Gas Summit
Seria, Brunei	10%	7%	15%	
Dhaka, Bangladesh	10%	6%	10%	
Edinburgh, UK	1%	0%	0%	Actuary Conference

SPE Distinguished Lectures relating to DRA

- 2015-16
  - The Value of Assessing Uncertainty (What You Don't Know Can Hurt You); *Duane McVay*
  - Making better Appraisal & Development Decisions Using Decision Risk Analysis & Value of Information; *Pete Naylor*
- 2016-17
  - Fooled by Randomness - Improving Decision Making With Limited Data; *James Gouveia*
  - Creating Value From Uncertainty and Flexibility; *Reidar Bratvold*

Aims of this presentation

- To introduce Decision Risk Analysis (DRA)
- To provide an understanding of ‘value of information’ (VOI) analysis
  - When?
  - Why?
  - How?

What is Decision Risk Analysis?

- A structured process to help stakeholders optimise their decision making in the face of risks & uncertainties
- Involves a combination of
  - Facilitation
  - Modelling
- Term first used by Ron Howard in 1966

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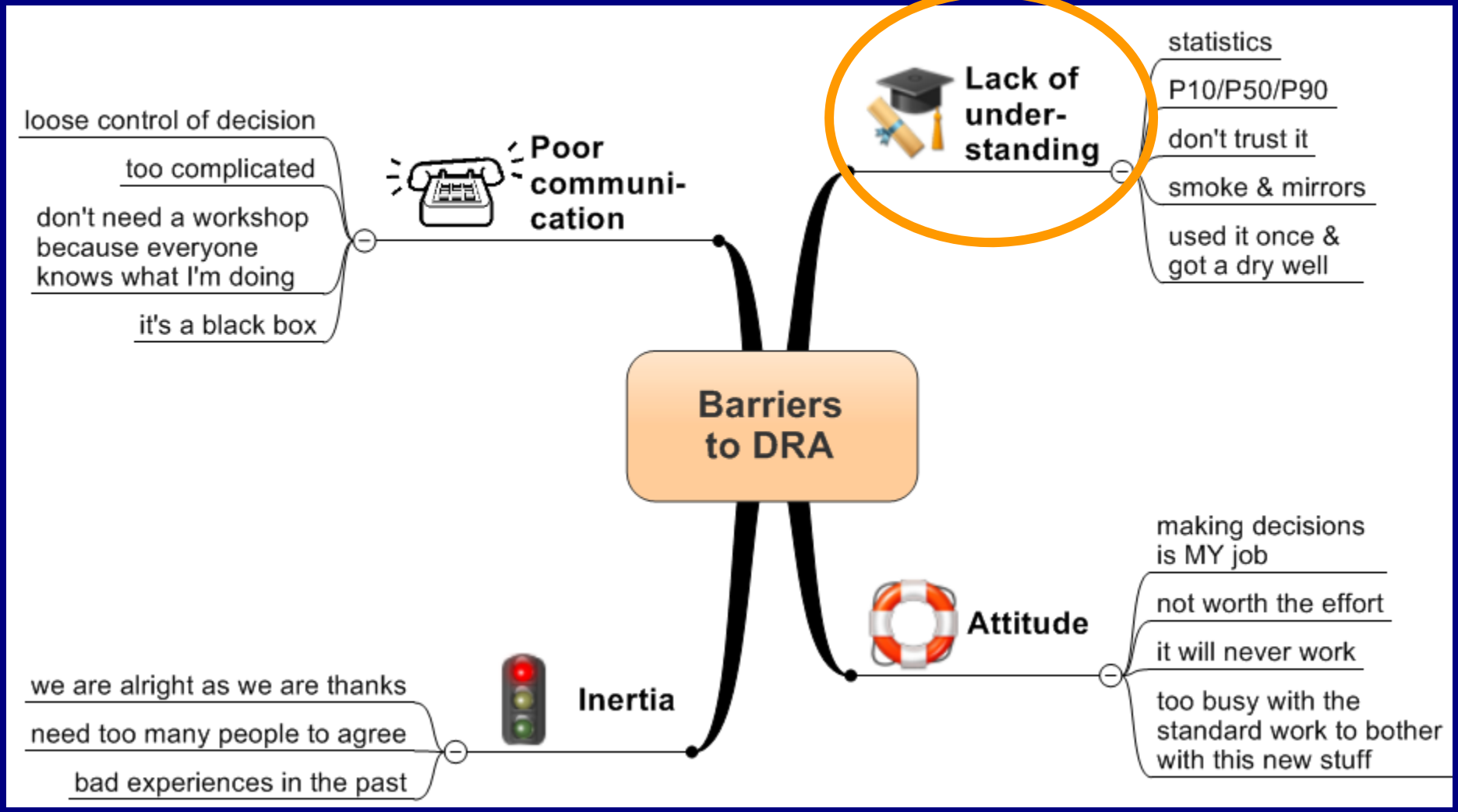
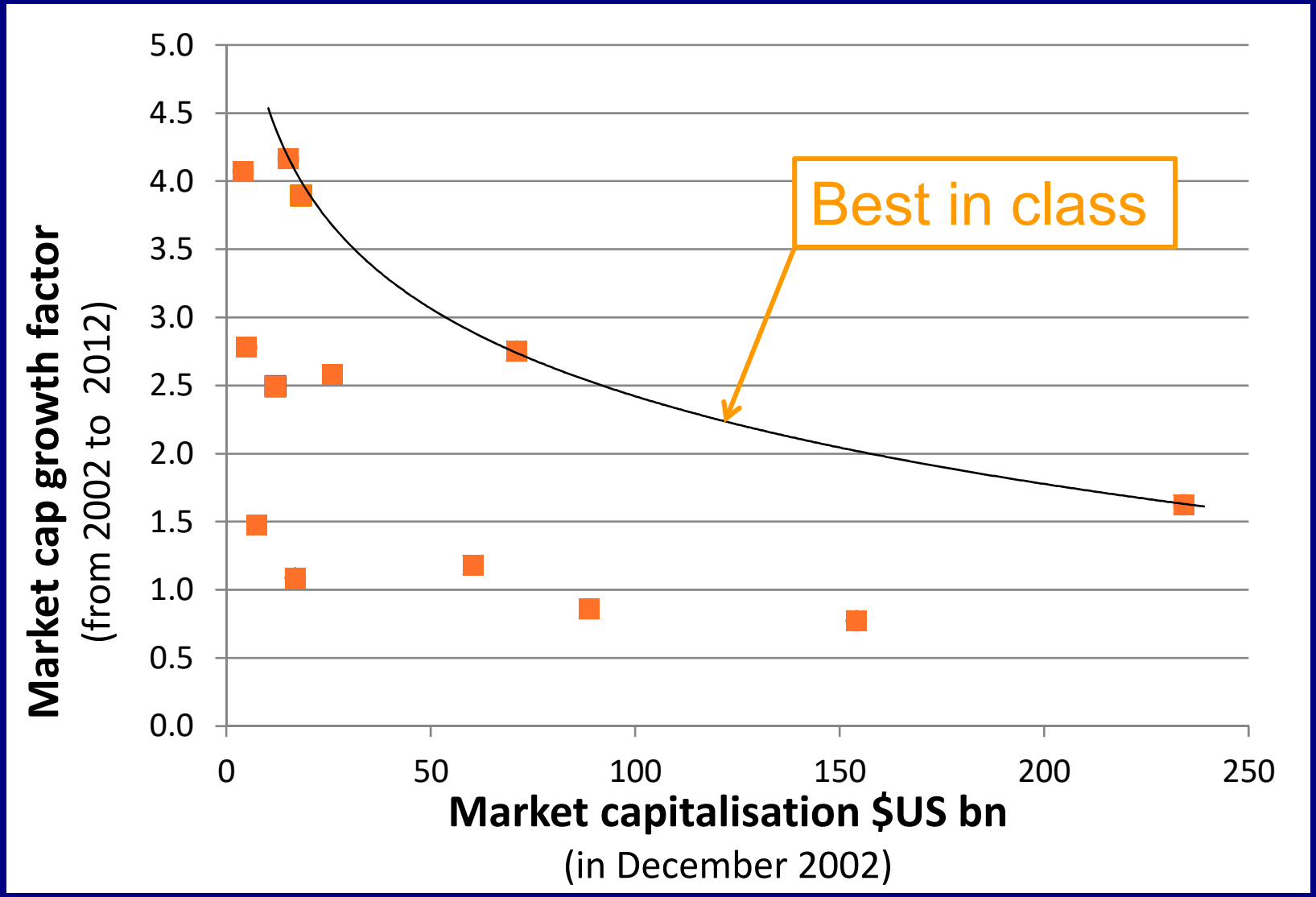
Why is DRA not used more widely?

Barriers to using DRA



How can you deliver superior performance…?

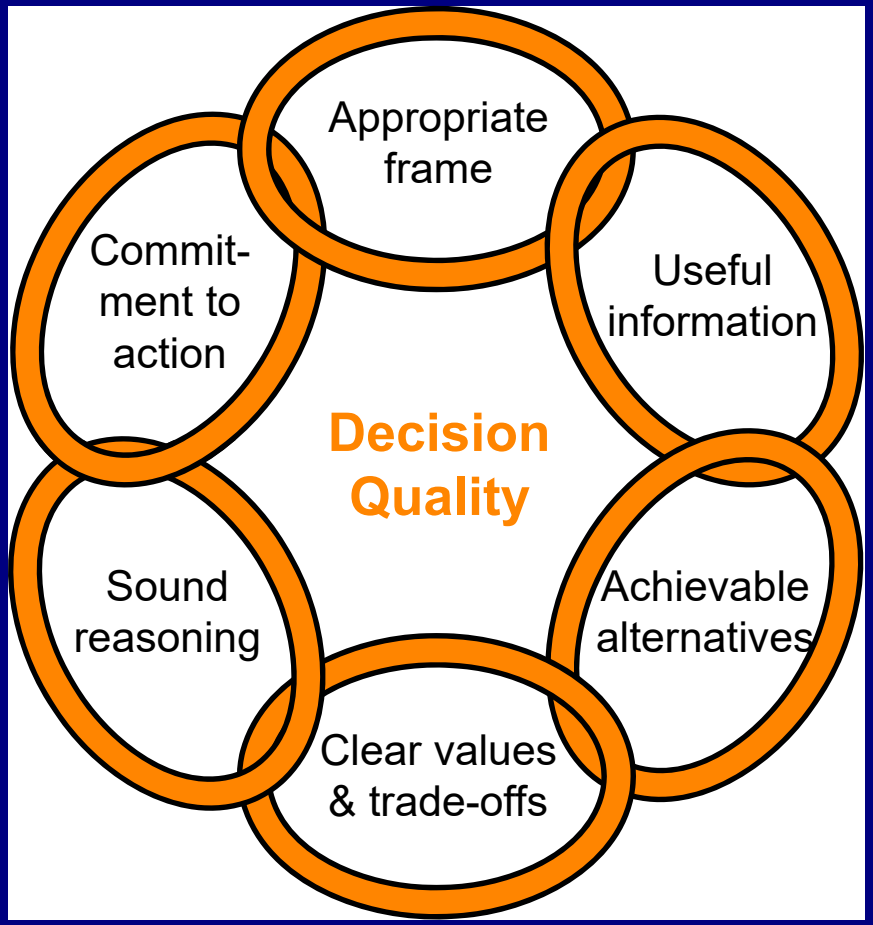


…focus on delivering Decision Quality

A great answer to the wrong question is useless

Secure consensus amongst stakeholders

Too complex for intuition?



Allow for risks & uncertainties correctly

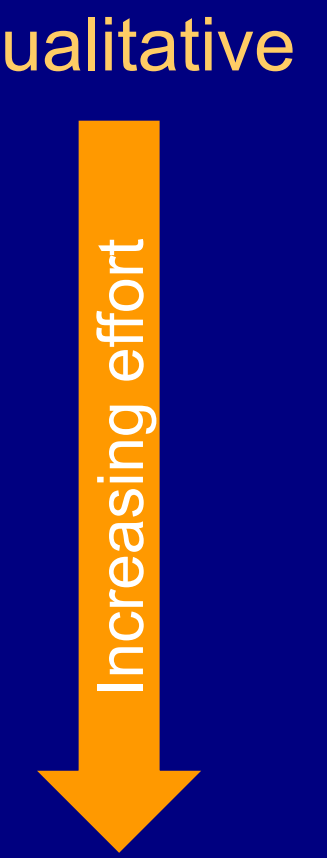
If there is only one choice then there is no decision

Eg: early production vs NPV

Matheson & Matheson 1998

A range of decision making approaches are available

- Voting
- Threat/benefit log
- Weighted ranking
- Absolute ranking
- Probability x impact ranking
- Cost/schedule risking
- Value of information analysis
- Fully integrated asset modelling



When might VOI analysis be valuable?

- Facing multiple decision options
- Outcomes are uncertain
- Opportunity to acquire additional information
- Information costs money and/or time

Is the additional information worth the cost?

Why might VOI analysis be valuable?

- The additional information might reduce future uncertainties
- The best decision option might change in the light of the new information

If no decisions change, think carefully about acquiring the new information

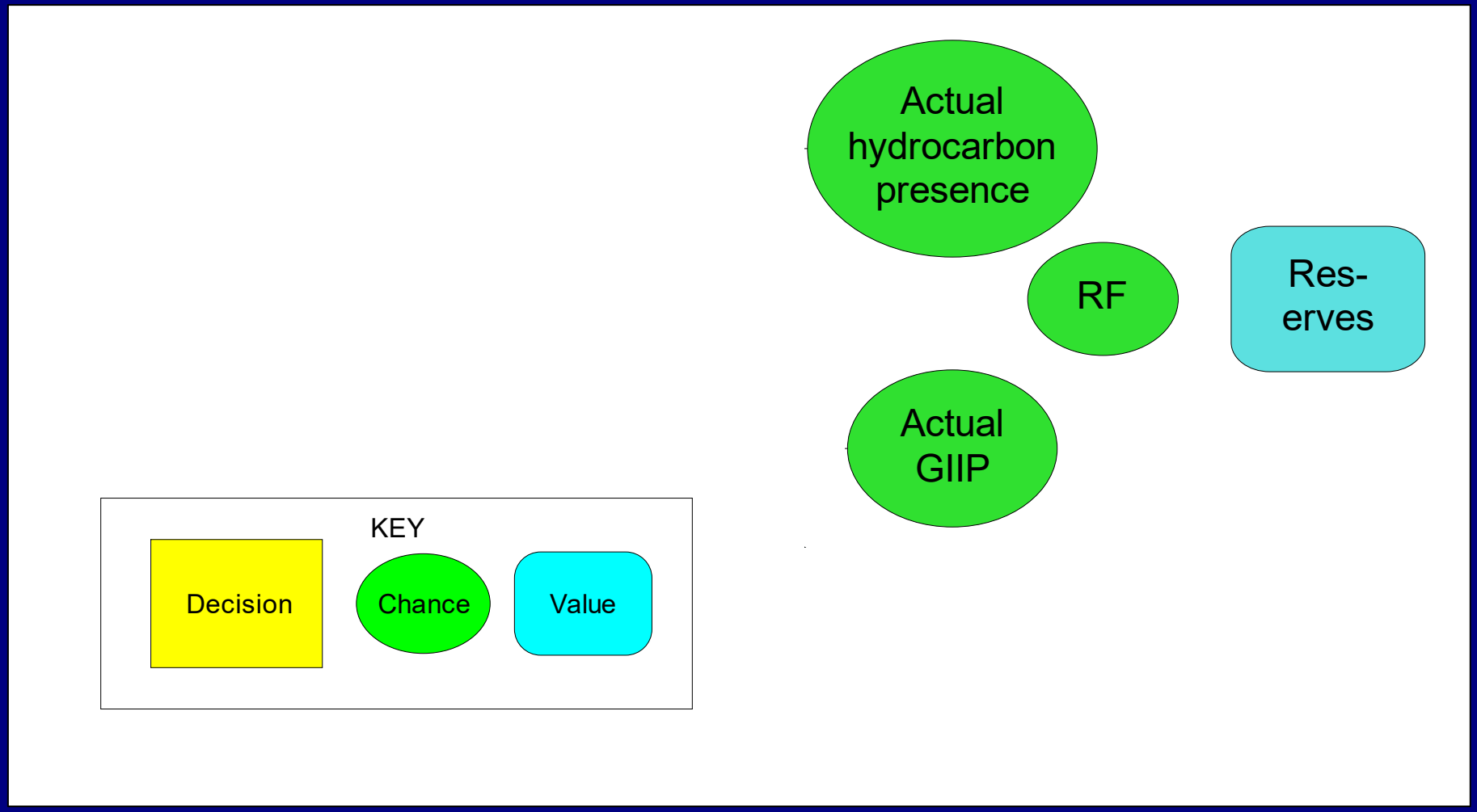
Key questions

- How much does the information cost?
  - Acquisition, analysis, delay to development
- How reliable is the information?
  - Will the measurement fail?
  - False results (imperfect information)?
- How useful is the information?
  - How significant is the parameter(s)?
  - What difference will the information make?

How do I undertake a VOI analysis?

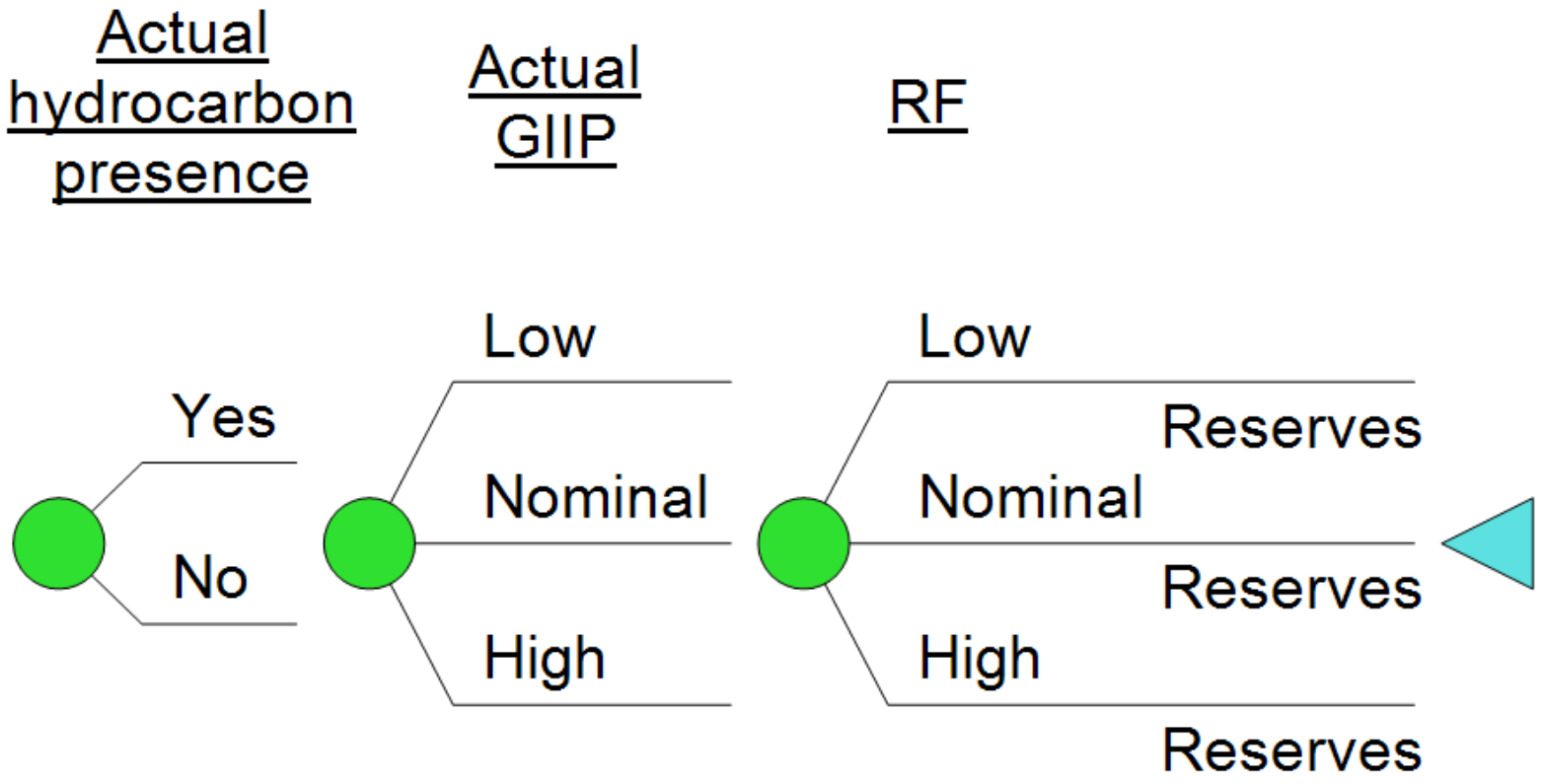
- Case example
  - Should an appraisal well be drilled in the North Extension?
  - Should the North Extension be developed?
- A new user took < two hours to learn the software & complete this analysis

Influence diagram



Lays out the components of the frame

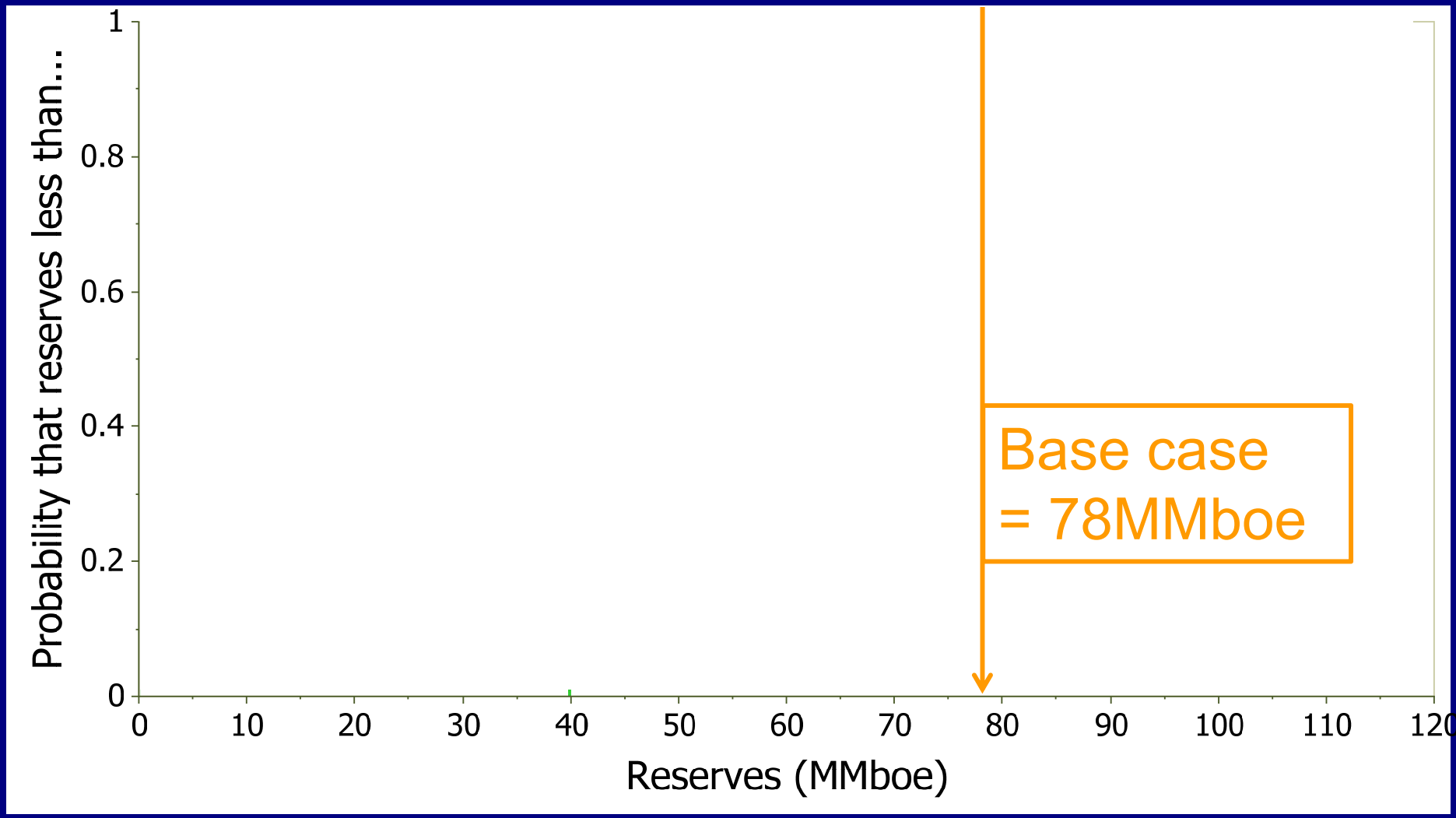
Decision tree



Reserves = Presence * GIIP * Recovery Factor

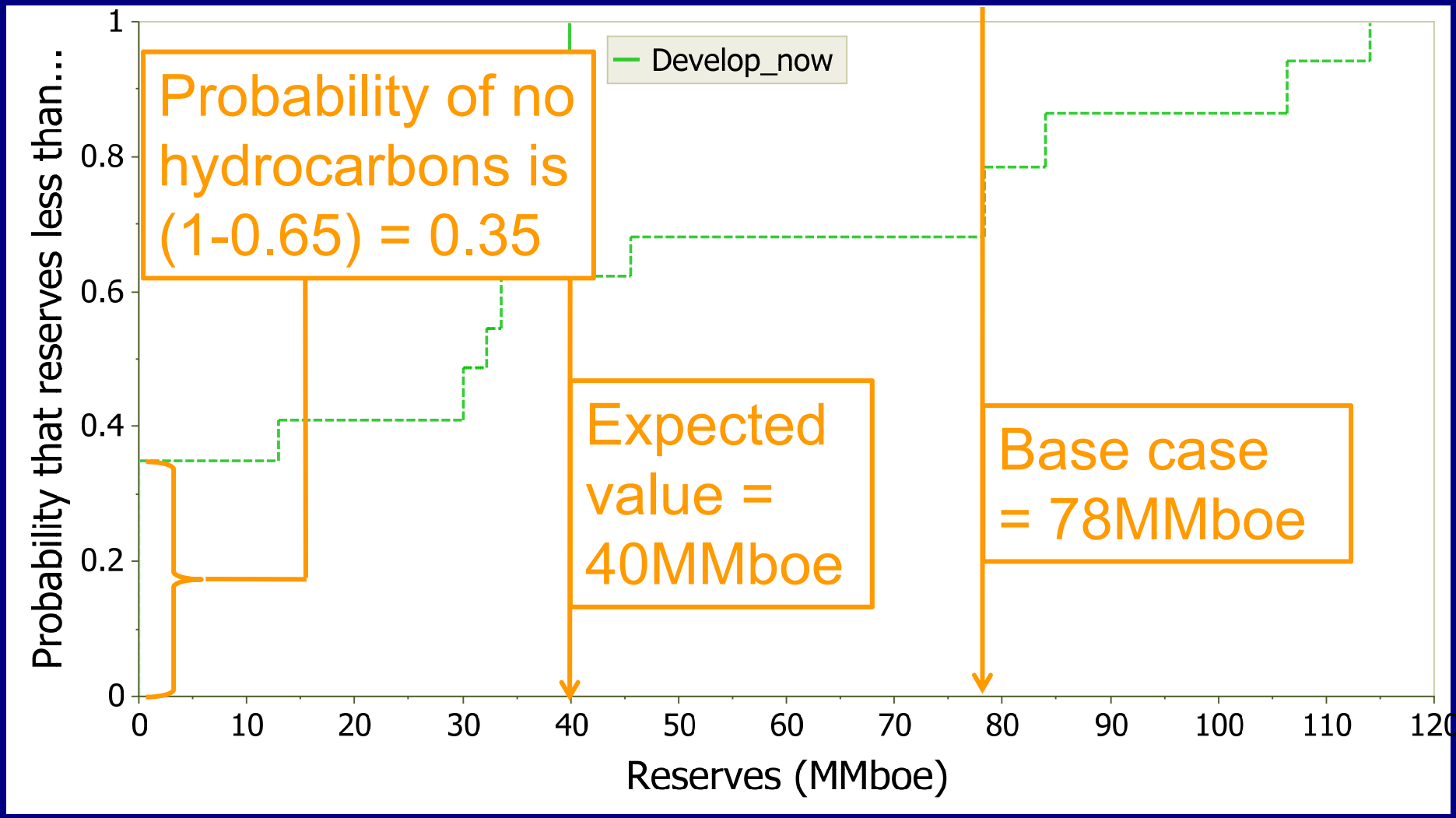
Base case: Yes + Nominal + Nominal

Base case: reserves for North Extension



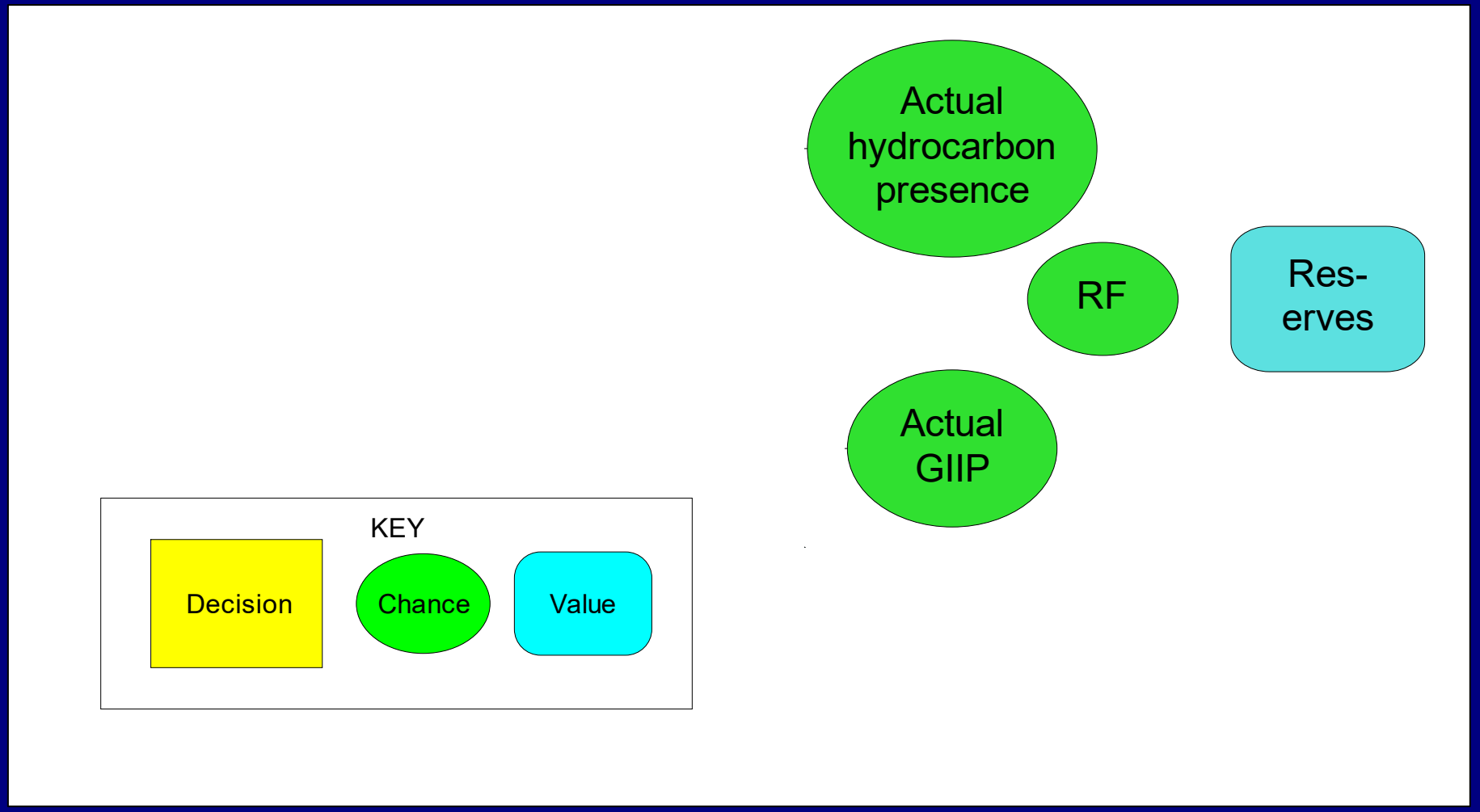
This should not be the basis of your business case

Risk profile: reserves for North Extension

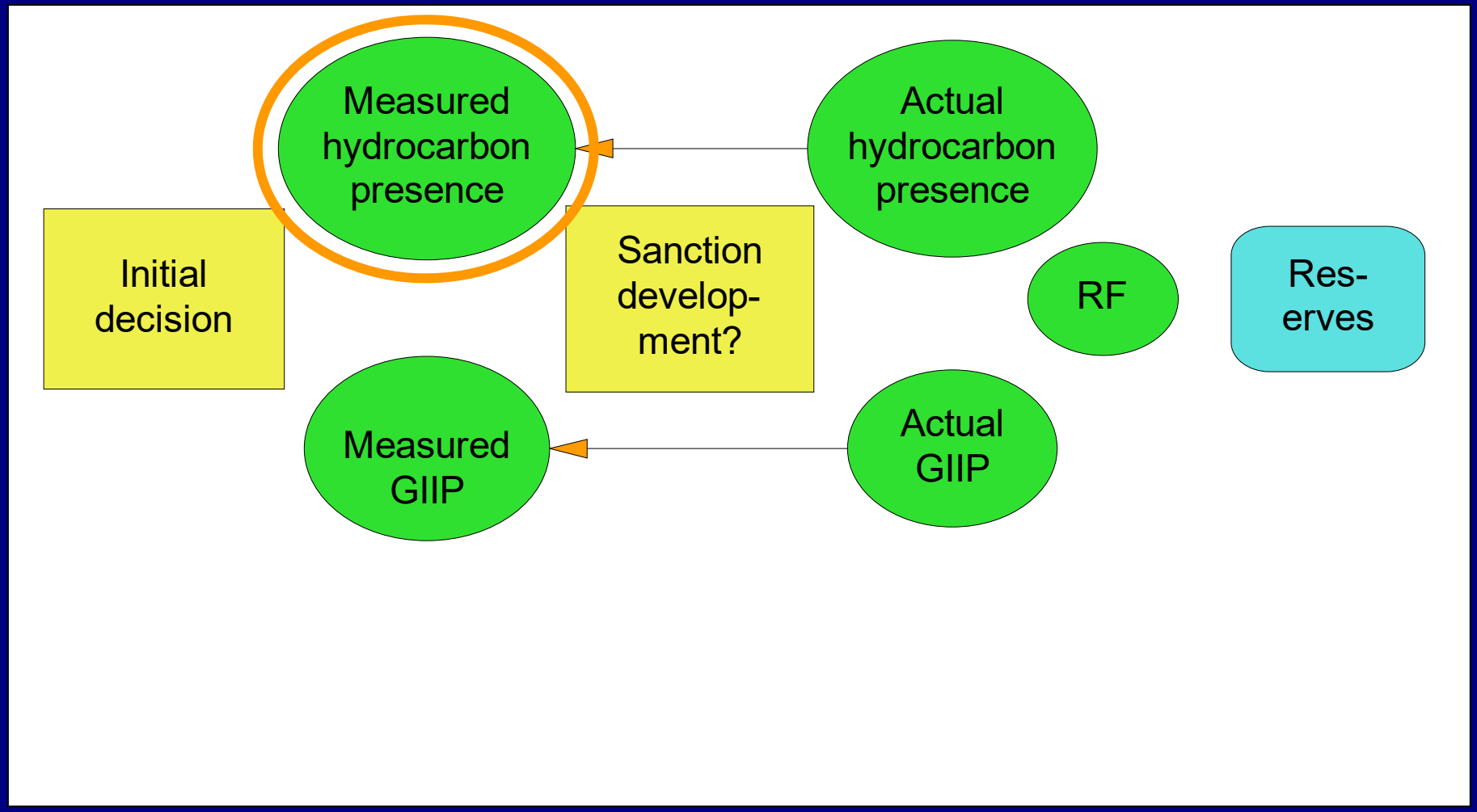


Illustrates the range of possible reserves

Influence diagram

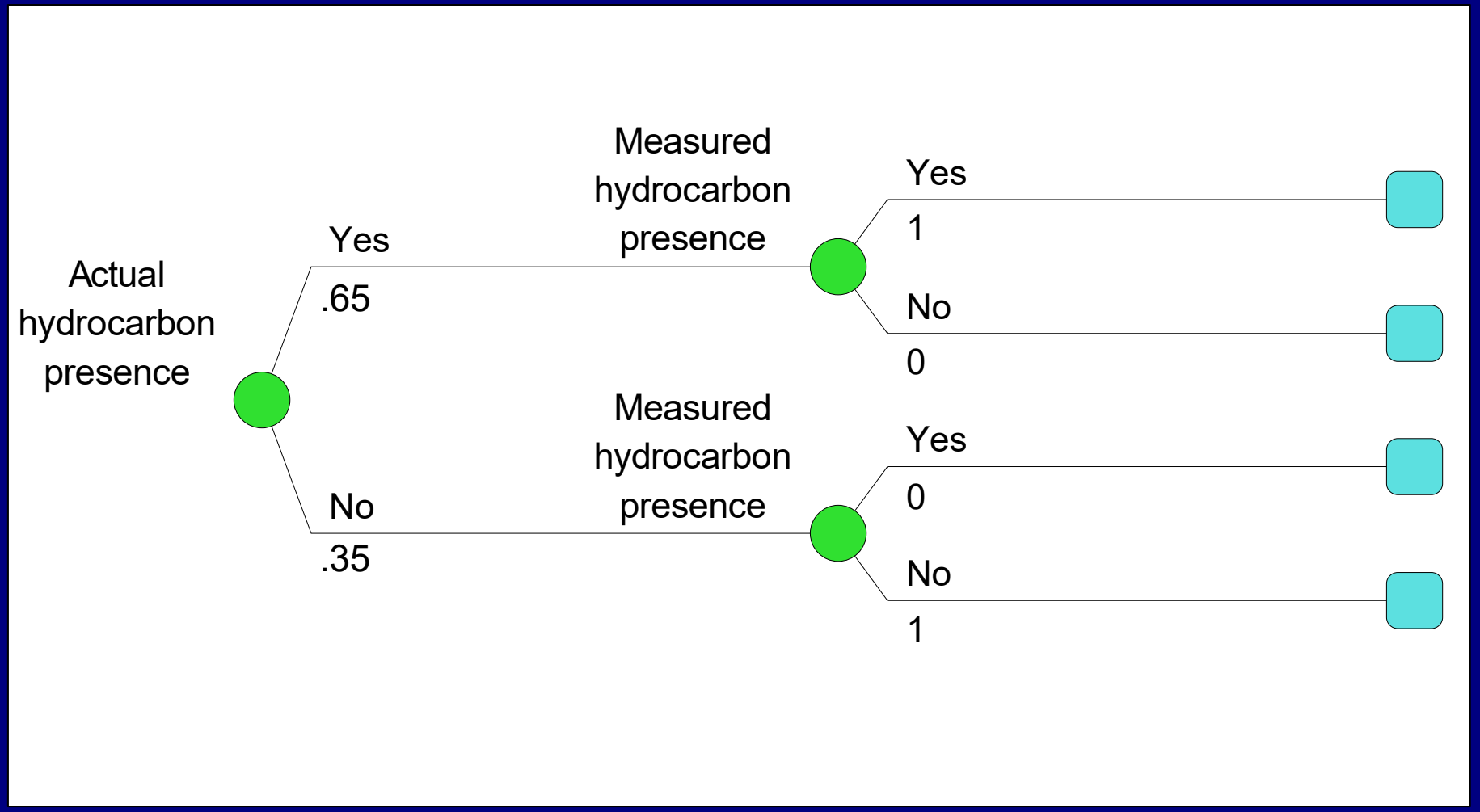


Influence diagram extended to include appraisal



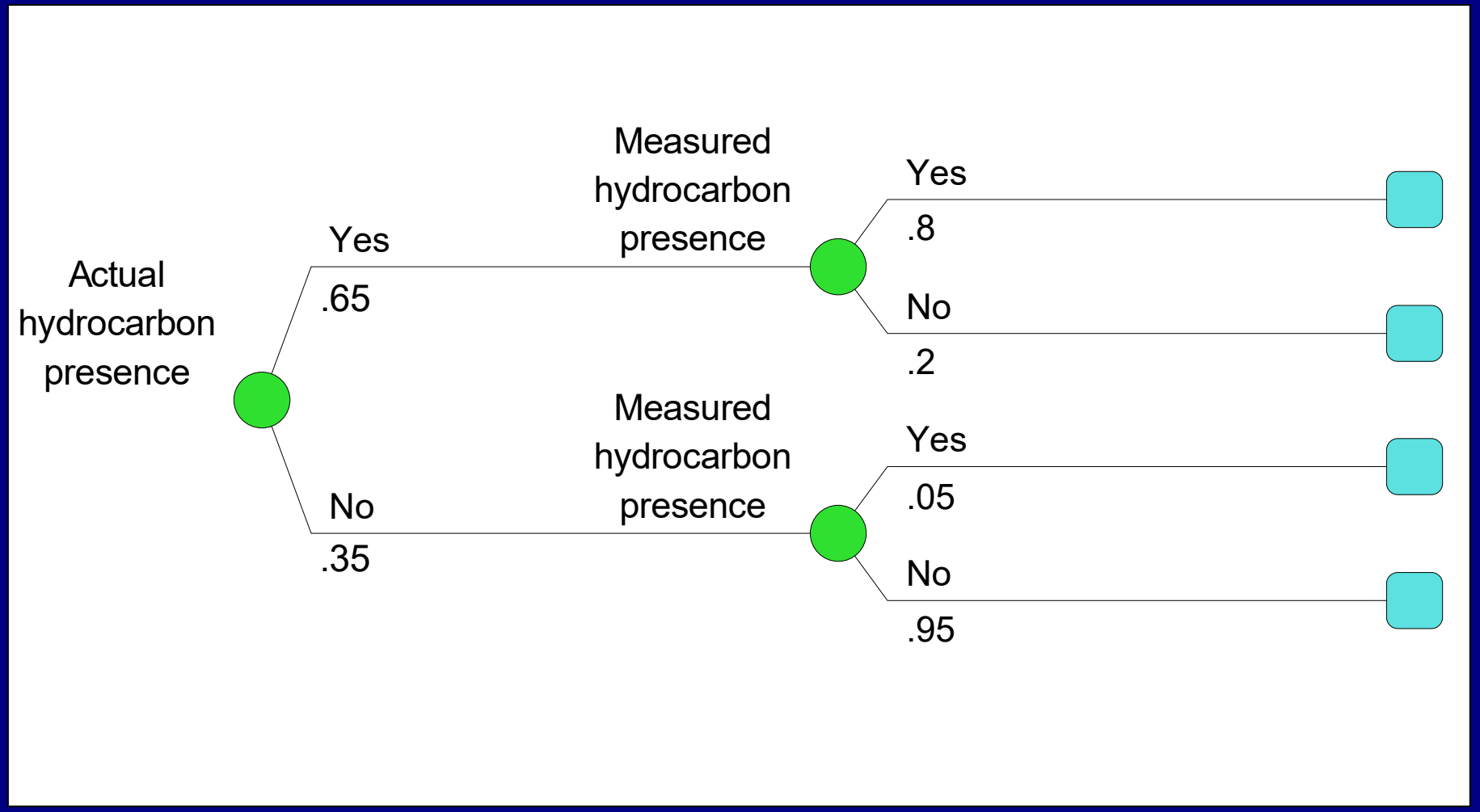
Measured HCP depends on actual state of nature

Conditional probabilities: hydrocarbon presence with perfect information



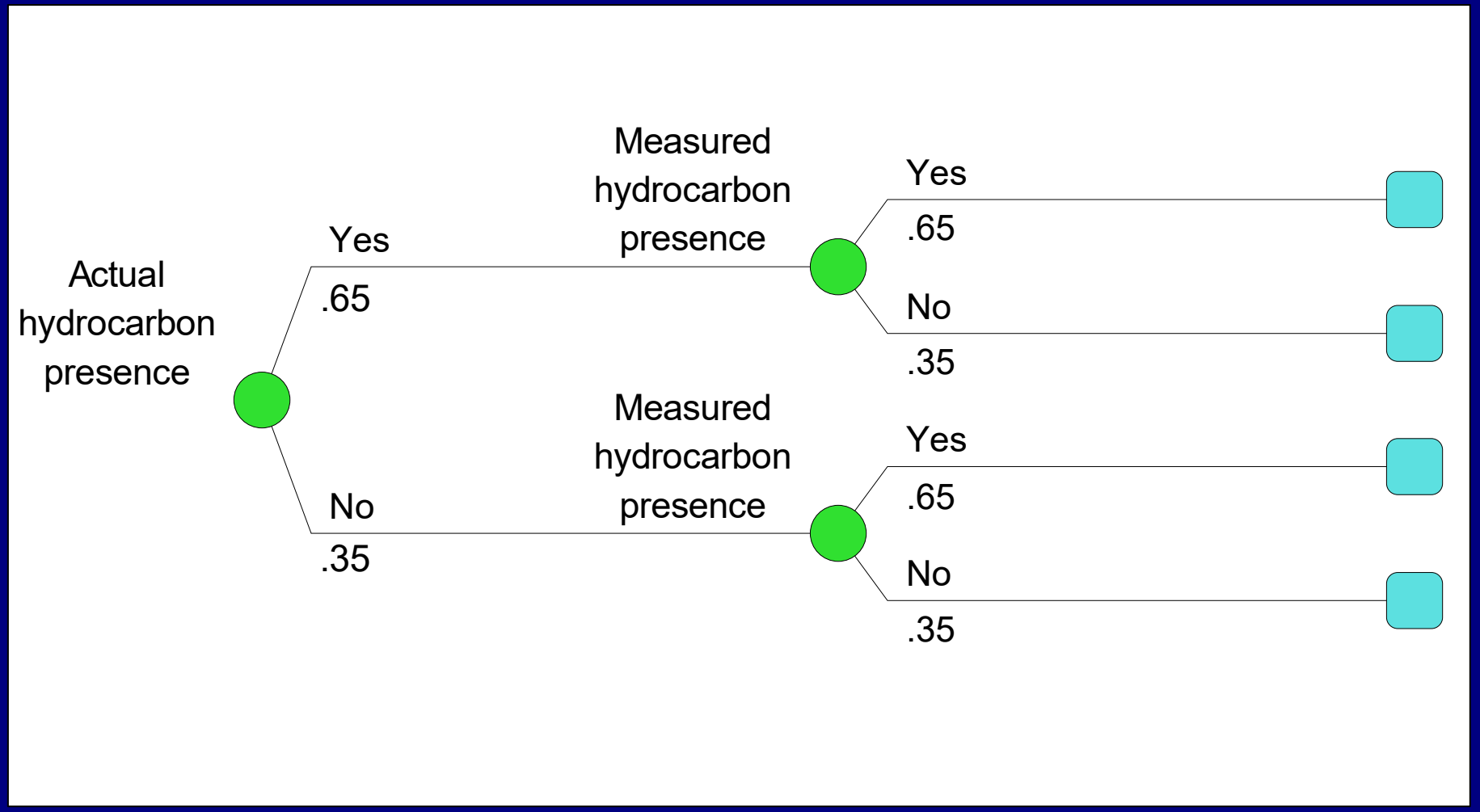
Captures the reliability of the measurement

Conditional probabilities: hydrocarbon presence with imperfect information



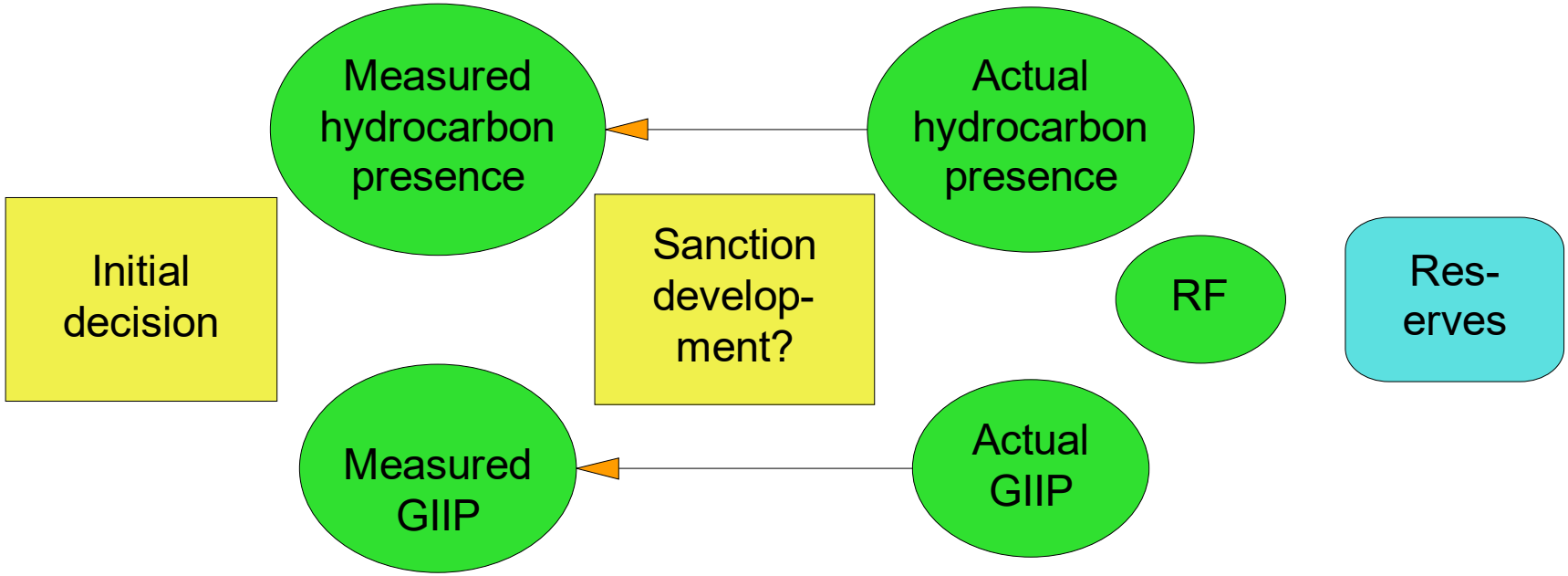
Captures the reliability of the measurement

Conditional probabilities: hydrocarbon presence with no information

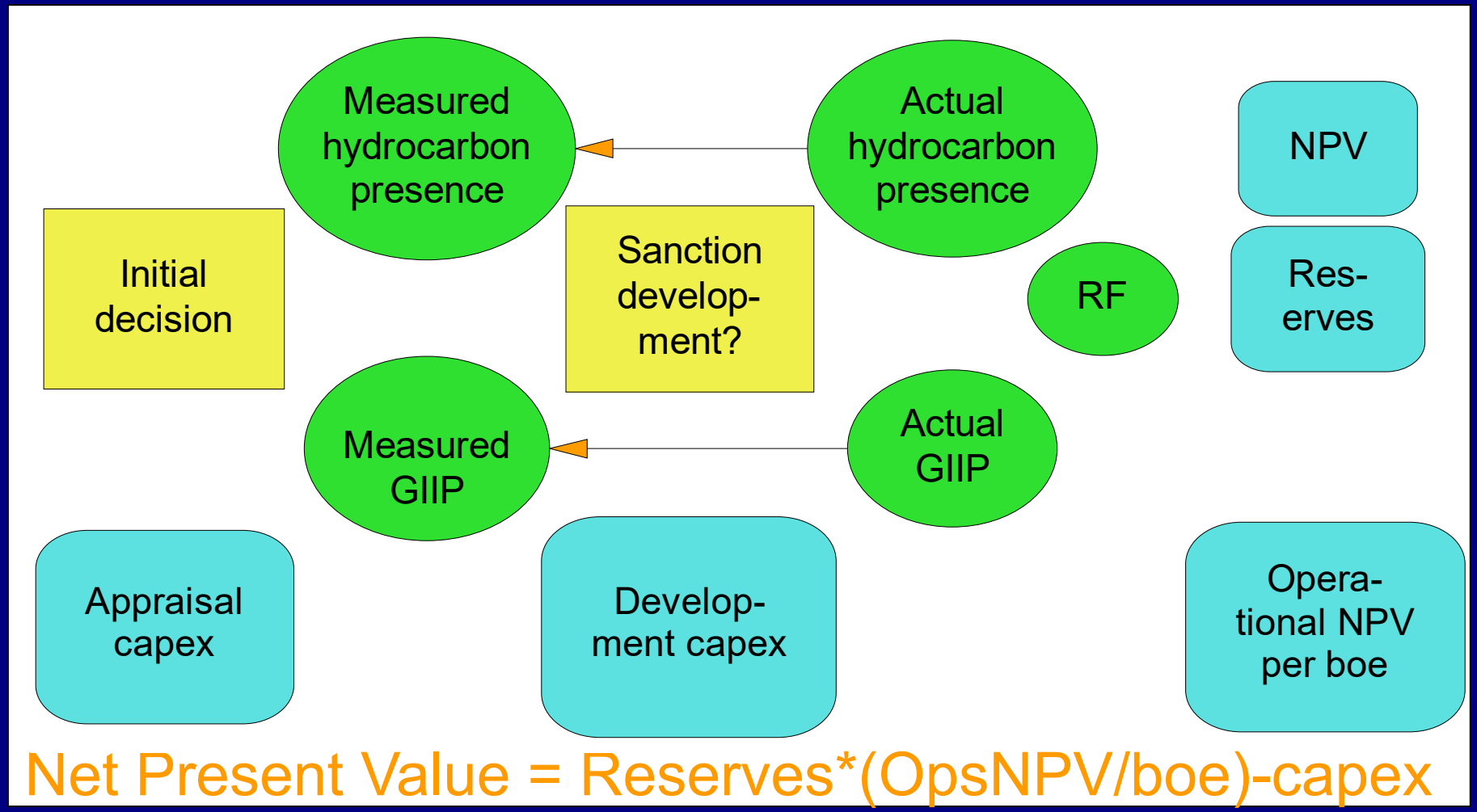


Captures the reliability of the measurement

Influence diagram



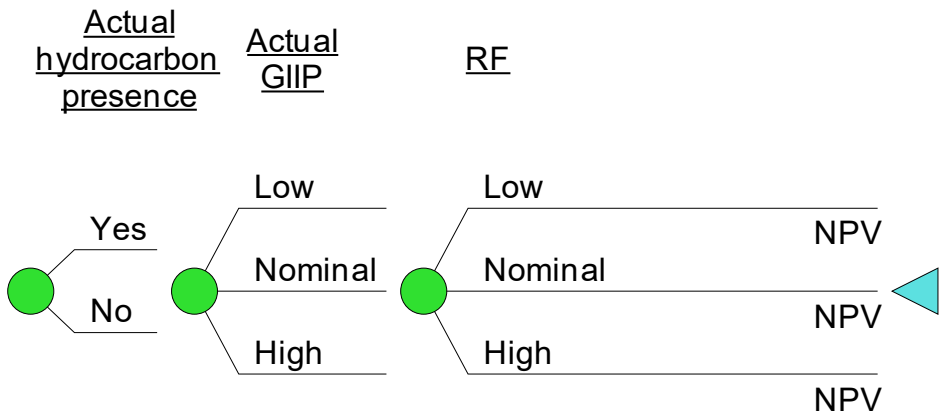
Influence diagram extended to include economics



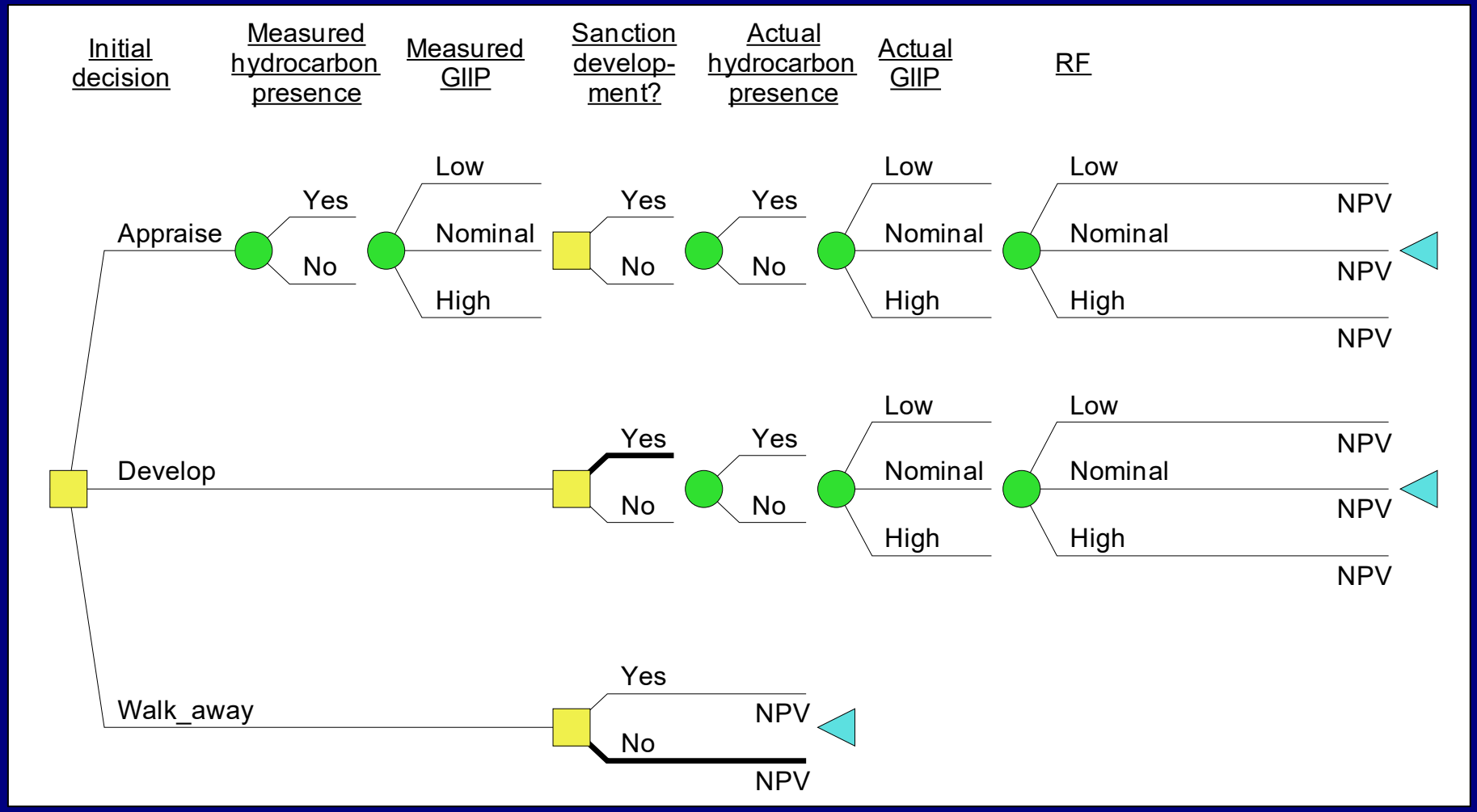
Net Present Value = Reserves*(OpsNPV/boe)-capex

Which decision options give the best NPV?

Decision tree

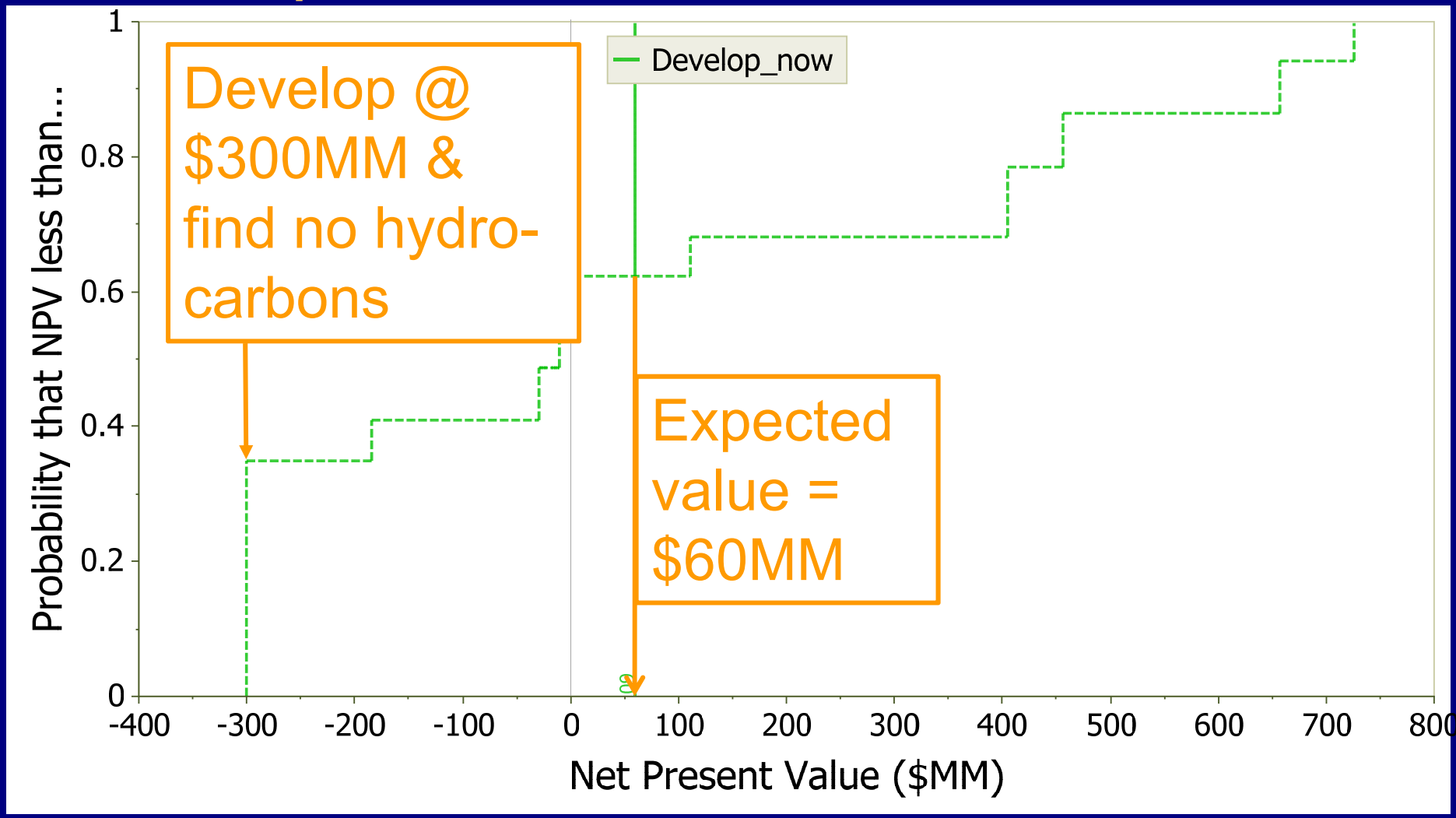


Decision tree extended to include appraisal



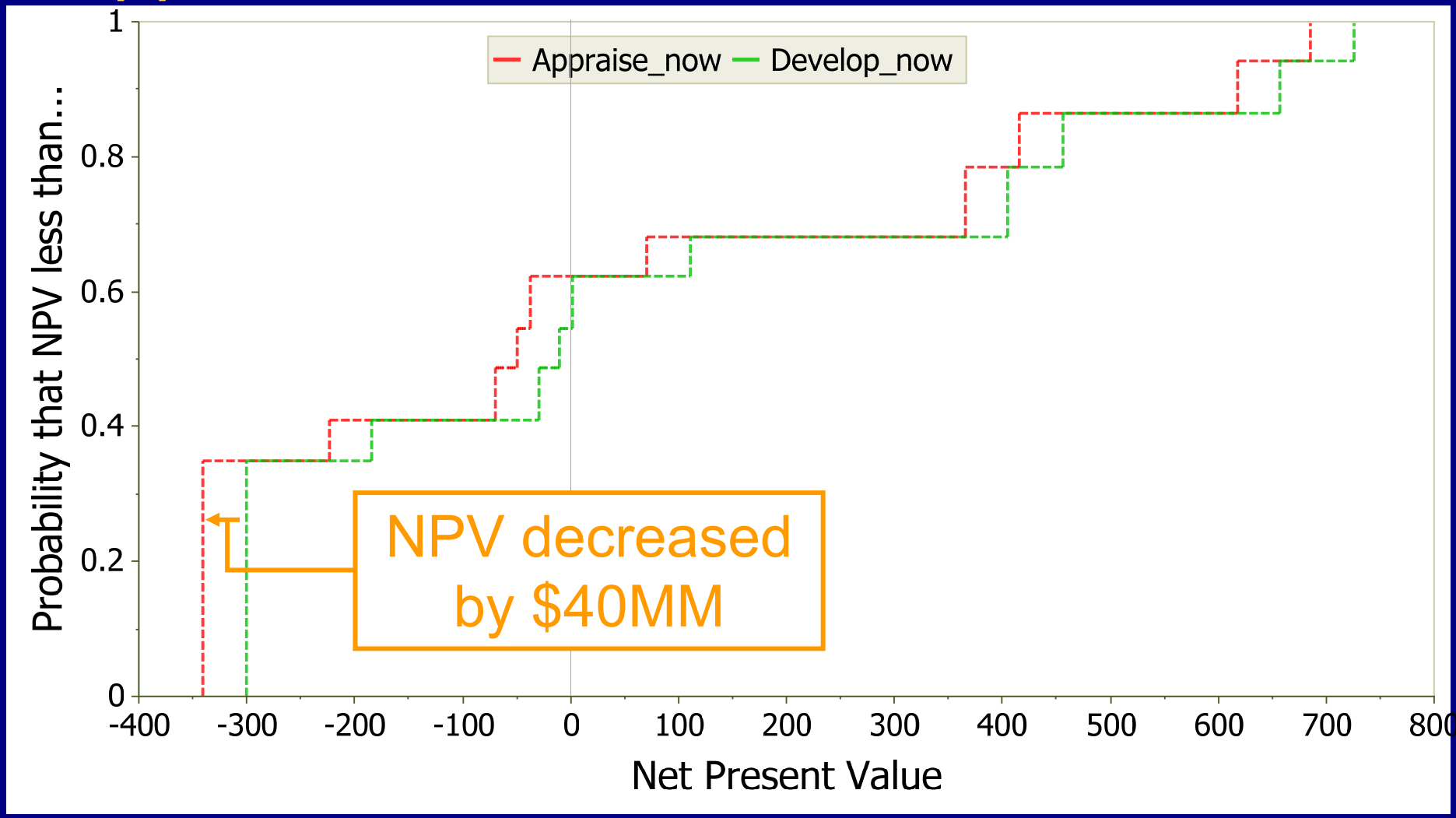
Captures the time order of events

NPV risk profile: develop now



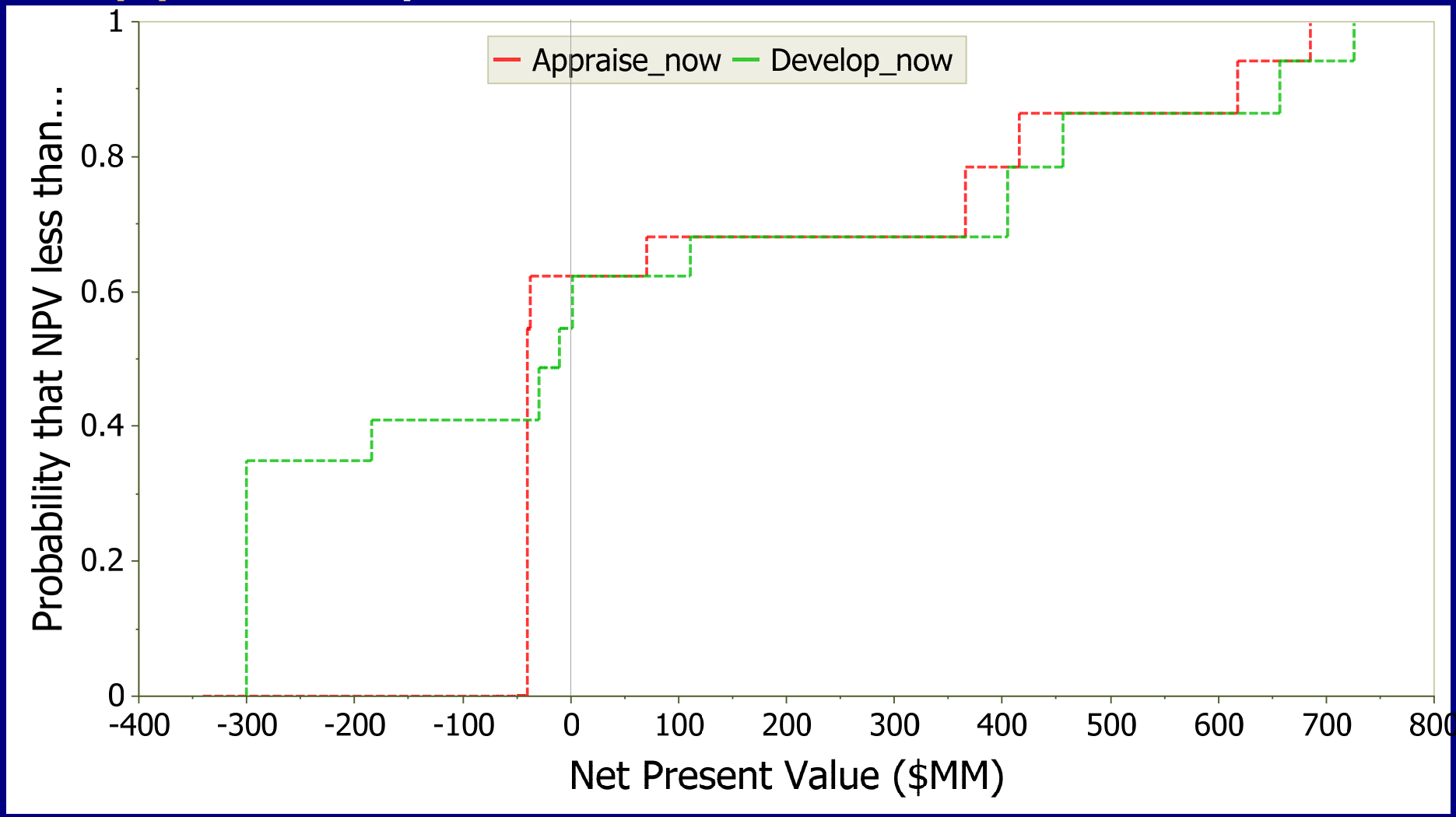
Illustrates the range of possible NPVs

NPV risk profile: appraise, no information



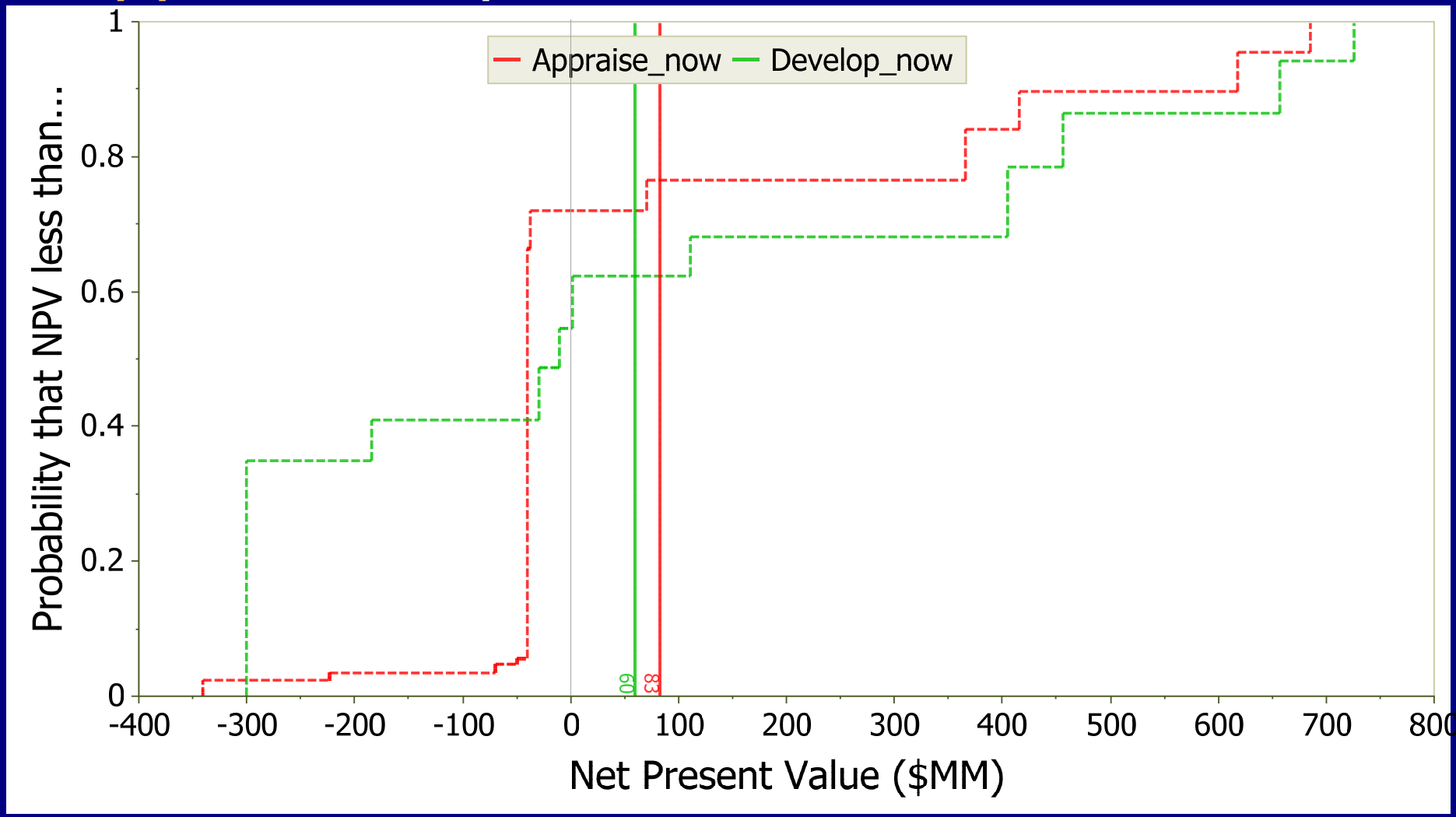
Spend $40MM on appraisal but get no information

NPV risk profile: appraise, perfect information

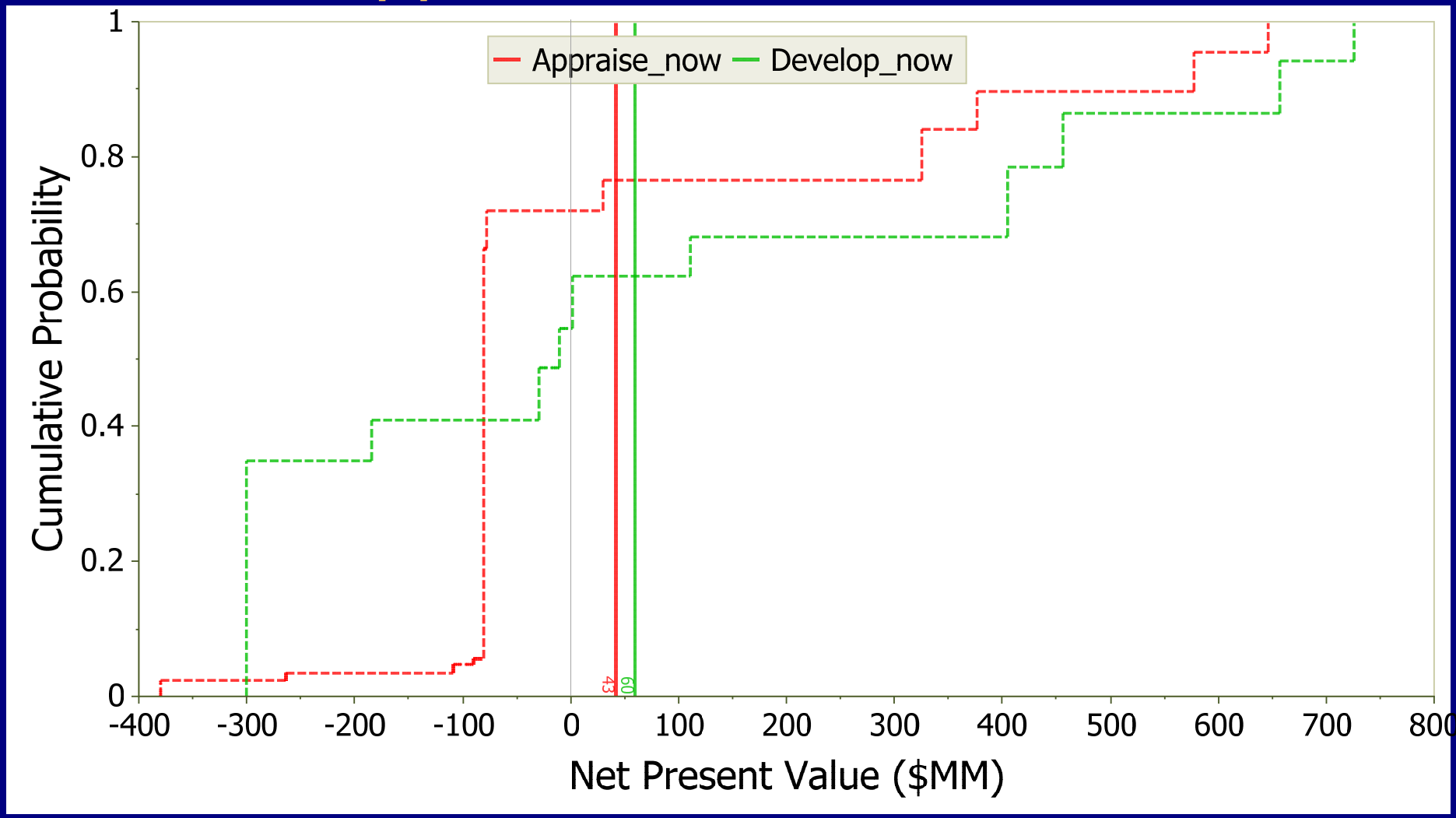


With perfect information only develop when net gain

NPV risk profile: appraise, imperfect information

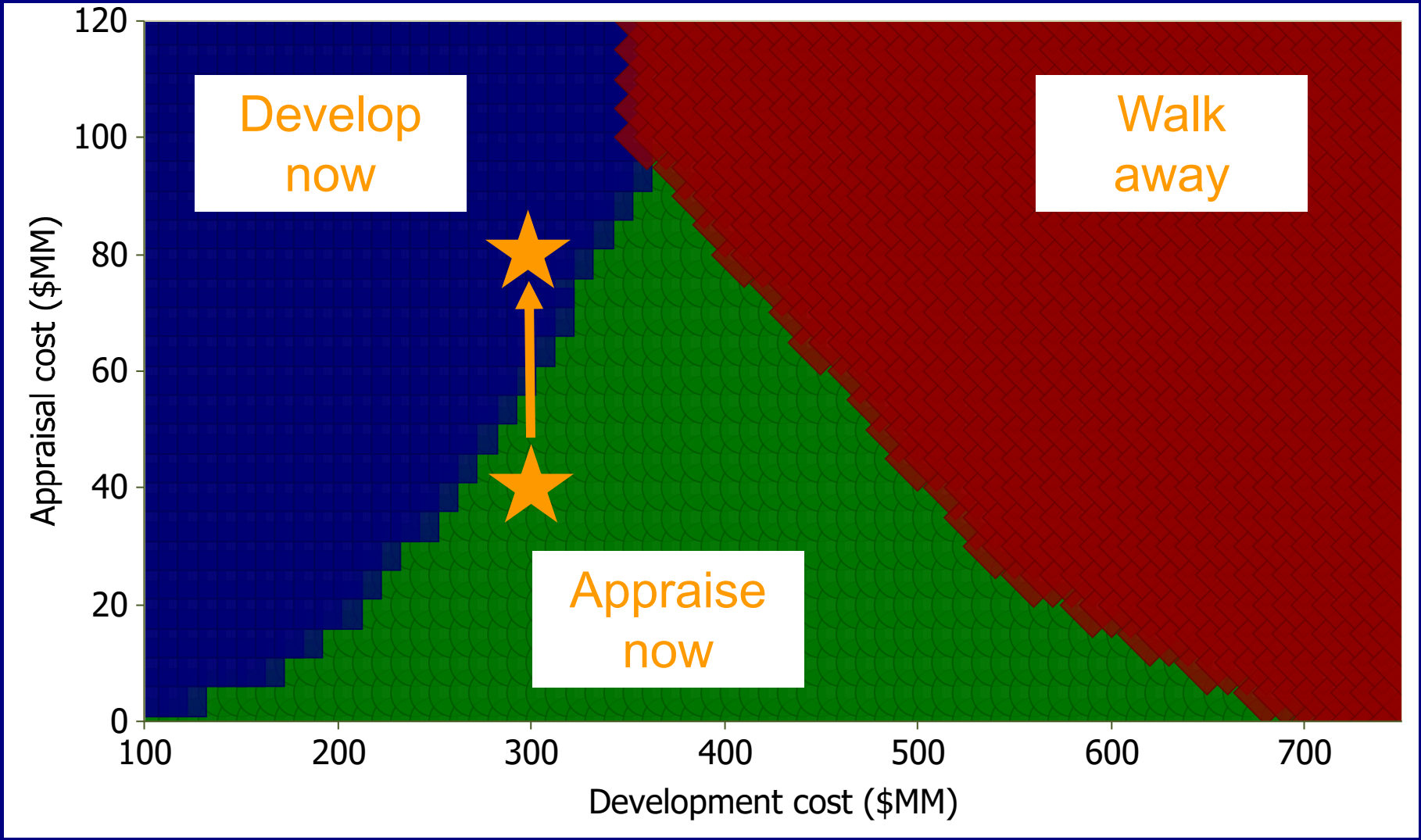


Risk appetite: which choice would you make if appraisal cost $80MM?



What NPV would you sacrifice to avoid downside?

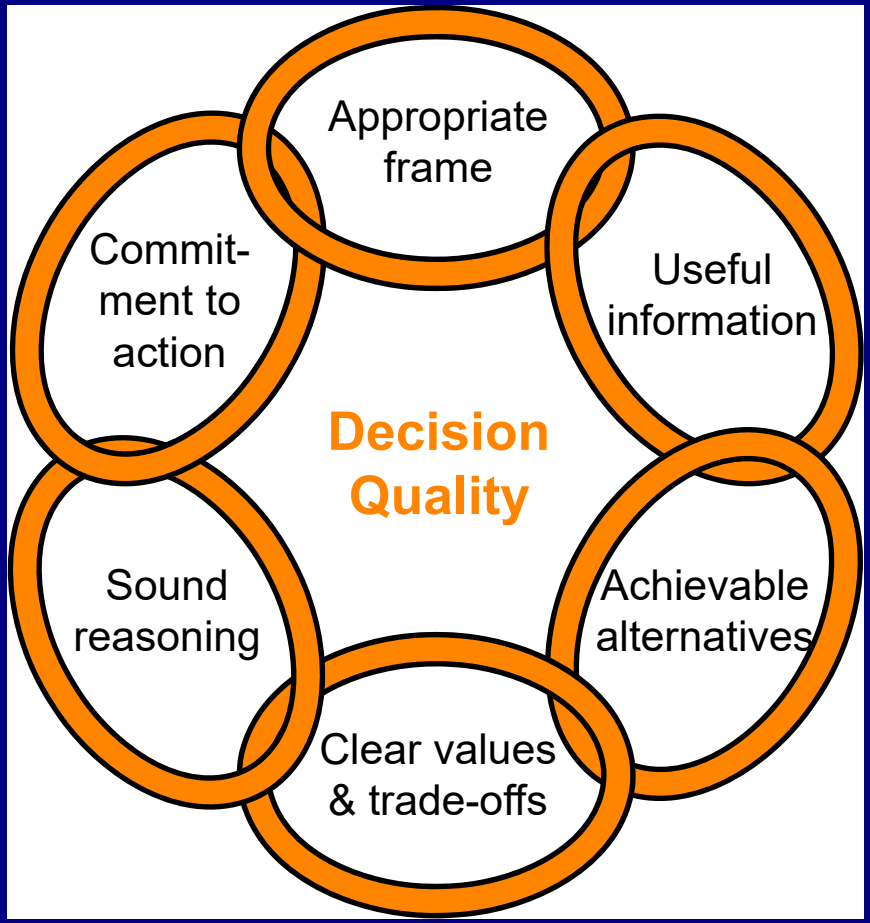
Two-way rainbow diagram



Green is where appraisal gives highest expected NPV

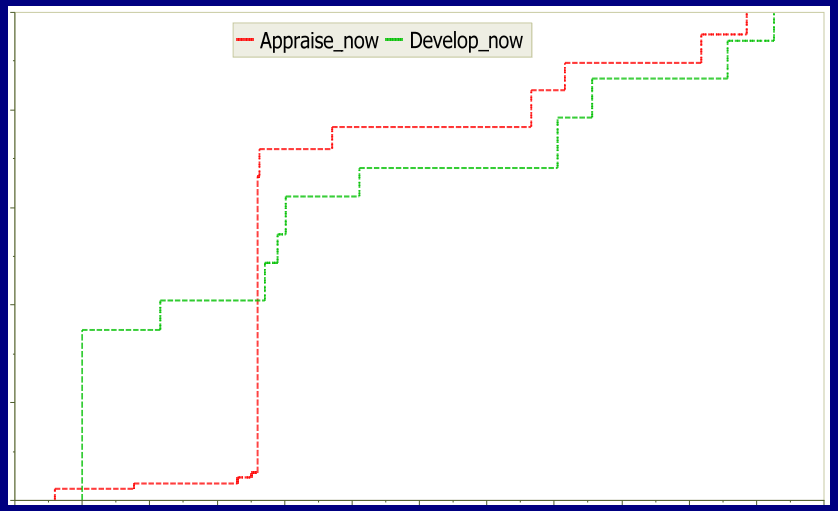
Summary: Decision Risk Analysis

- DRA can help you optimise not just satisfy
- Select an appropriate decision making approach
- Focus on delivering decision quality



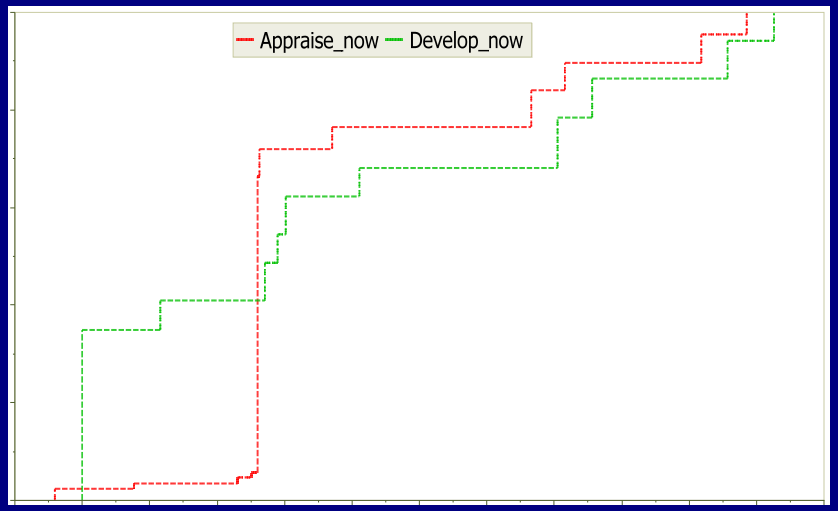
Summary: Value of Information (1)

- When?
  - Facing a number of decision options
  - Outcomes are uncertain
  - Opportunity to acquire additional information
  - Information costs money or time



Summary: Value of Information (2)

- Why?
  - Additional information might reduce future uncertainties
  - Best decision option might change with new information
- How?
  - Invest two hours and get a Decision Analyst to show you how



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