FRONT END LOADING: MISUNDERSTOOD OR MISAPPLIED?
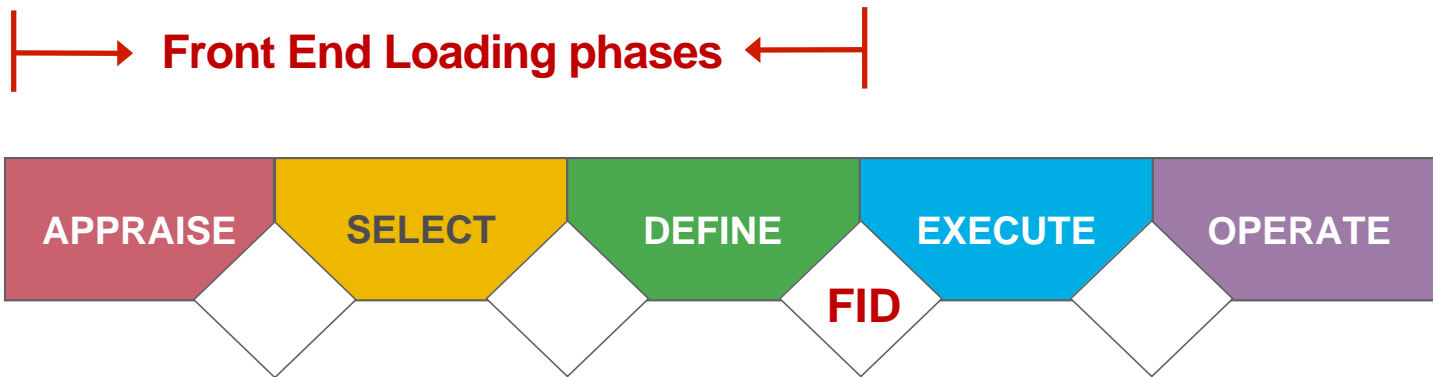
David Newman, Steve Begg & Matthew Welsh

Front End Loading

Front End Loading phases

| APPRAISE | SELECT | DEFINE | EXECUTE | OPERATE |

FID

Front-end loading (FEL) means investing significant effort in the phases that lead up to the final investment decision (FID)
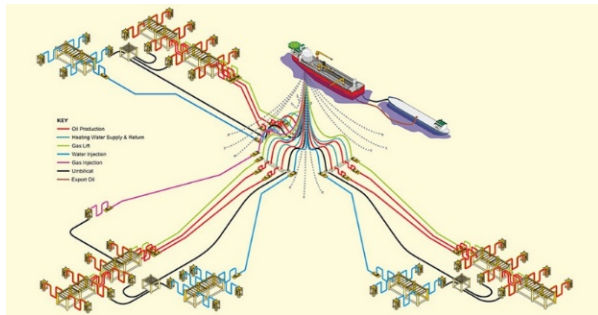
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Good Front End Loading

- **Development concept** is consistent with the realistic range of potential subsurface outcomes

  - **Well design** does not commence until there is sufficient subsurface definition to finalise well targets

- **Facilities design** does not commence until there is sufficient certainty on the predicted ranges of volumes, throughputs and fluid properties

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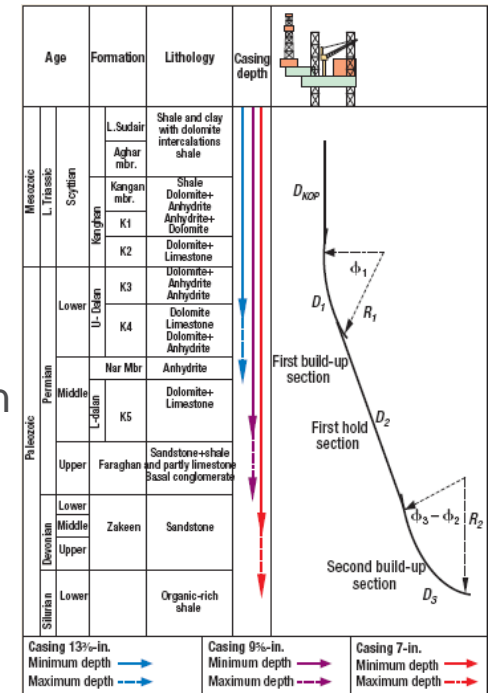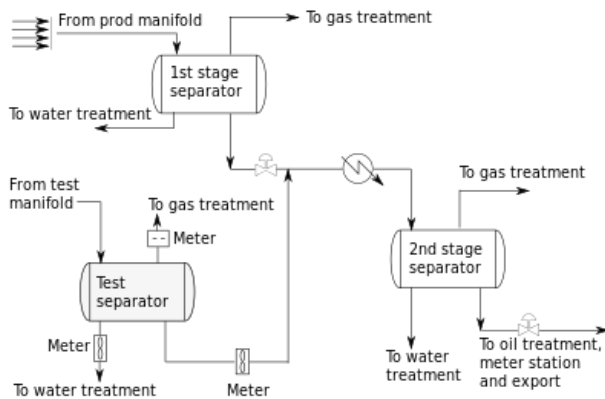
Poor Front End Loading

Two main areas of lost value:

1. Doing the wrong project (including doing it well).
2. The level of rework required

- Longer schedule
- Higher costs
- Less production

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Front End Loading Benchmark Scores

Based on an assessment of:

- Reservoir complexity

- Level of subsurface appraisal and analysis

- Complexity of the wells and facilities

- Understanding of requirements and work completed for the wells

- The level of planning and preparation for the facilities

- How well the team is integrated

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Statistical Predictions versus Expert Judgment

- Research by Paul Meehl in 1954, and around 200 subsequent studies, shows that statistically based models are generally better at predicting outcomes than expert judgment.

- Studies cover a wide range of subjects including: longevity of cancer patients, football game results, and future wine prices.

- About 60% of studies have shown significantly better accuracy for the algorithms compared with the experts. Others, generally score a draw.

- This research leads to a counterintuitive conclusion:
  - **To maximise the likelihood of achieving predicted outcomes, decisions should be based on formulae rather than by using expert judgment.**

Opposing views on expert judgment vs statistical prediction

- Daniel Kahneman & Amos Tversky
  - People are subjected to heuristics and biases (e.g. anchoring, optimism, inside view vs. outside view, planning fallacy),
  - This results in decisions being made that are not optimal and may not be in their best interests

- Gary Klein
  - Pioneered the field of naturalistic decision making, He rejected the focus on biases as driven by artificial experiments
  - Klein studied how decisions are made in the field under typical conditions, using experienced people such as firefighting commanders.
  - These decisions were generally made using intuition or expert judgment.

When to trust expert judgment (Klein & Kahneman)

- The familiarity test: Have we frequently experienced identical or similar situations?

- The feedback test: Did we get quick & reliable feedback on the outcomes of past decisions/judgments?

- The measured-emotions test: Is our thinking clouded by emotions we have experienced in similar or related situations? ("no"= pass)

- The independence test: Are we likely to be influenced by any inappropriate personal motivations or biased thinking ("no"= pass)

When to trust expert judgment (Klein & Kahneman)

- The familiarity test: Generally there will be unique features to each project

- The feedback test: Quick and reliable feedback is not generally received. It is often several years between RFSU and FID

- The measured-emotions test: This tends to be at a personal level, depending on experiences on previous projects

- The independence test: It is hard to be dispassionate when you have invested a lot of time and effort on a project.

Implications for FEL Benchmark Score

- Independent Project Analysis (IPA) have shown that their FEL benchmark score is a good indicator of the likelihood of a successful project outcome.

- Meehl's and subsequent research shows that even simple models are better at predicting outcomes than expert judgment

- The FEL benchmark score is more than a simple model, and has statistical validity, suggesting that its predictions are likely to be superior to those of experts.

Interviewees

- 34 senior oil & gas personnel were interviewed.

- Interviewees were from 6 companies
    - 2 global majors
    - 3 mid-sized companies
    - 1 smaller oil & gas company

- All were highly experienced personnel
    - Average 29 years of industry experience (σ = 8.8 years)
    - Average 24 years of project experience (σ = 7.5 years)

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Interviewee categories

- Interviewees came from a range of organisational levels, and were categorised into three groups:
    - Executives (Vice President or equivalent level)
    - Managers
    - Professionals (Experts in a technical field)

- Numbers in each category:
    - 11 Executives
    - 19 Managers
    - 4 Professionals

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Interview format

- Interview questions were in a semi-structured format

- Mainly open questions were used, e.g.:

  o What does FEL mean to you?

  o How useful and important do you think FEL is?

  o How are the FEL benchmarking scores used?

  o What has been your experience with FEL – positive, negative, any perceived problems?

How useful and important is FEL?

Very

- FEL is critical
- Extremely important

Important

- It's a good check on how mature you are… FEL means you have your ducks in a row.

Balanced

- Getting the basics right is fundamental to project success and so is really important, but it can become a cottage industry.

Unimportant

How is the FEL score information used?

Hard criteria

Soft criteria

- We would seriously consider not going through a gate if we didn't reach an acceptable goal. (But) it's only one piece of information
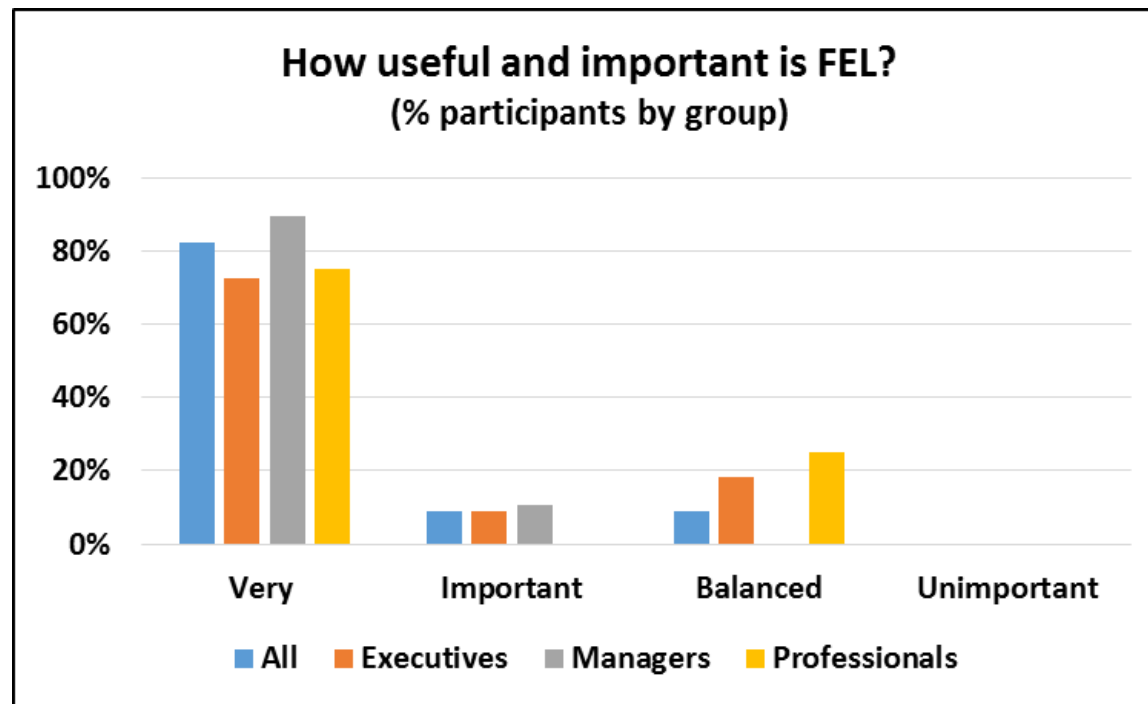
Contributing

- It's discussed, but is not a significant factor for the decision
- As a sense check … we make up our own mind. It's just another opinion

Not used

- The scoring information itself is not used, it is mainly the findings that are used.

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Over 80% of interviewees said FEL is very important …

How useful and important is FEL?
(% participants by group)

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..but nobody uses the FEL score as a hard criteria

How is the FEL score used?
(% participants by group)

Front End Loading: Misunderstood or Misapplied – Newman, Begg & Welsh

..but nobody uses the FEL score as a hard criteria

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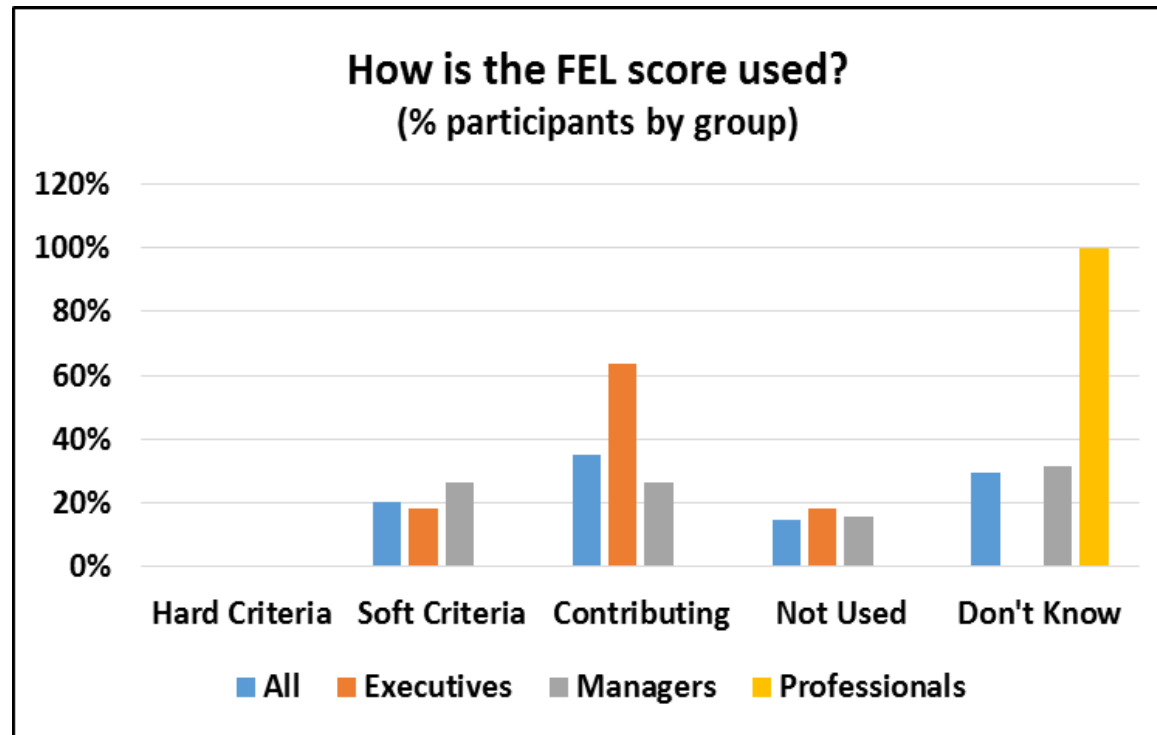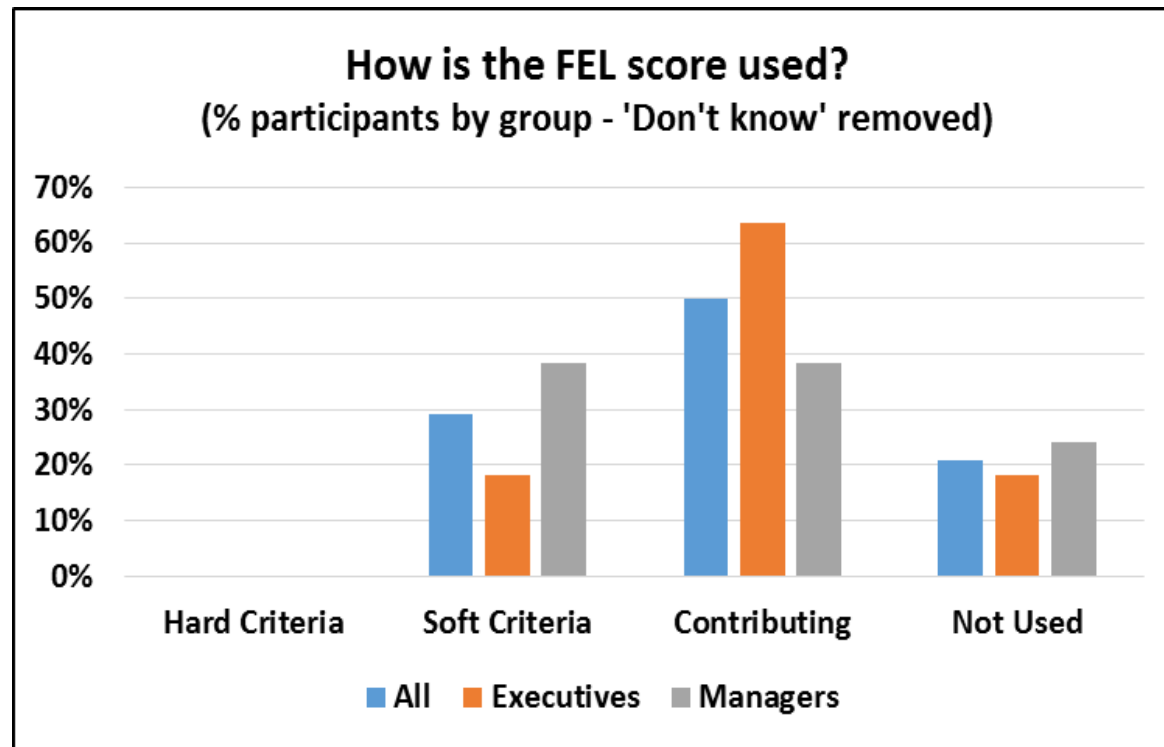
Assessment of knowledge of FEL - Template

	Low	Basic	Fair	Good	Expert
	Little or no knowledge and understanding in this area.	Basic knowledge and an understanding of simple techniques and concepts	Sound knowledge and understanding of the main areas of content. Have used for simple applications.	Thorough knowledge and understanding of most areas of content. Have used this for a range of applications.	Extensive knowledge and understanding. Use this all the time, and promotes its use
Front End Loading **YOU**					
DECISION MAKER*					

*DECISION MAKER = Your assessment of the level of knowledge and understanding of a typical decision maker in your organisation

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Assessment of knowledge of FEL - Results

	Low	Basic	Fair	Good	Expert
Executive YOU				✔	
DECISION MAKER*			✔		
Manager YOU				✔	
DECISION MAKER*			✔		
Professional YOU		✔			
DECISION MAKER*		✔			

*DECISION MAKER = Your assessment of the level of knowledge and understanding of a typical decision maker in your organisation

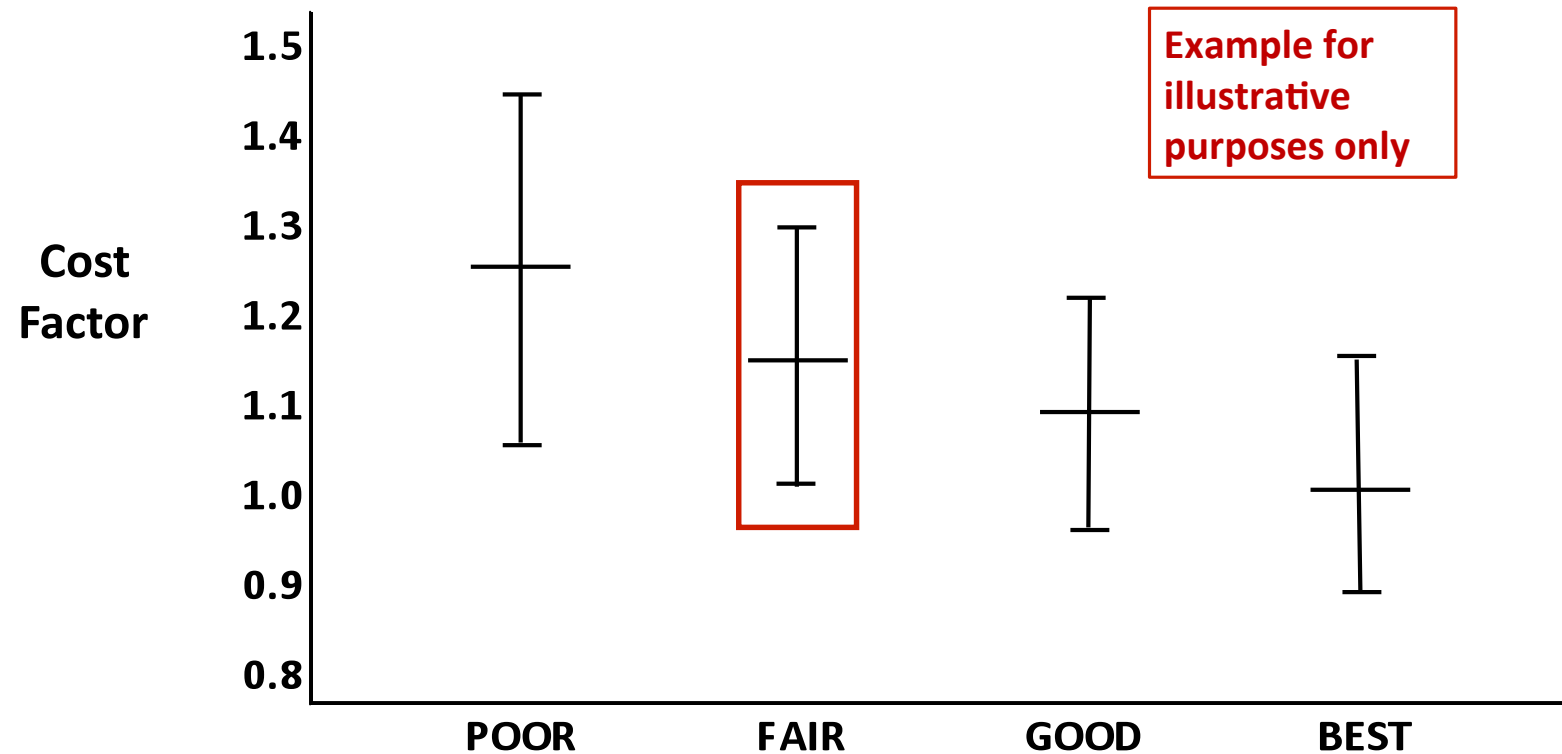Front End Loading: Misunderstood or Misapplied – Newman, Begg & Welsh

Why is the FEL Benchmark Score not used more?

- The scores are just an indicator

- Lack of in-depth knowledge of the project (benchmark consultants)

- Benchmark model not flexible enough

- Consultants can be influenced

- It works best for tried and tested approaches

- Not convinced that better FEL leads to earlier RFSU

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What can be done to help?

- Apply correction factors to predict likely outcomes based on FEL benchmarking

- Carry out a pre-mortem prior to finalising the decision

Cost factor based on FEL Benchmarking

Cost Factor (y-axis: 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5)

Example for illustrative purposes only

POOR FAIR GOOD BEST

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Benchmarked adjustments for project outcomes

	FEL	Adjustment Factors		
		Cost	Schedule	Production Attainment
E&P project	Best	**1** *(0.9 – 1.15)*	**1** (0.9 – 1.15)	**1** (0.9 - 1.1)
	Good	**1.1** *(0.95 – 1.2)*	**1.1** (0.95 – 1.25)	**0.95** (0.85 – 1.0)
	Fair	**1.15** (1.0 – 1.3)	**1.2** (1.05 – 1.4)	**0.9** (0.8 – 0.95)
	Poor	**1.25** (1.05 – 1.45)	**1.3** (1.1 – 1.5)	**0.8** (0.6 – 0.9)

Note: Concept only – Actual numbers to be developed based on benchmarking

Pre-mortem

- A pre-mortem is specialised form of risk assessment, which takes place just prior to key decisions being committed.

- It is assumed that it is now a year or two later, the project was implemented and it is a spectacular disaster.

- The team write down all the potential reasons for the failure
    - Especially things not normally mentioned for fear of being impolitic

- One of the benefits of the pre-mortem is that it legitimises doubt.
    - When a team comes to a decision, public doubts about the planned way ahead are gradually (even unconsciously) suppressed.
    - The premortem allows doubts to be raised, and to look for potential threats not considered before

Summary

- The concept of FEL is well understood…
  ..but FEL benchmark scores are not being applied very effectively

- FEL benchmark scores are likely to be a better predictor of project outcomes than expert judgment for oil & gas projects

- It is suggested that prior to the FID decision being committed:
  - benchmarked adjustments are used to provide an indication of the likely final cost, schedule & production.
  - A pre-mortem is carried out.