Finding the Question is Often More Important than Finding the Answer*

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Abstract

Decision Based Modelling is a planning methodology that links field decisions to the integrated reservoir modelling process that helps teams analyze, validate, and evaluate options to make optimal decisions. The construction of idealized representations that capture important aspects of our subsurface assets is a vital part of our routine scientific and engineering analysis. The most that can be expected from any model is that it can supply a useful approximation to reality, e.g., “all models are wrong, some models are useful” (Box, 2005). While a model can never be “truth”, a model might be ranked from very useful, to useful, to somewhat useful to, finally, essentially useless (Burnham, 2002). As practitioners, we must not forget that the aim is to understand something about the real world, in order to predict, to forecast, to choose an action, make a decision, summarize evidence, and so on, but always on the real world. Modelling implies simplification and idealization. Our models are not the reality, but they must be applicable for the specific purpose which is to be investigated. Appropriate planning and decision framing is a key element of integrated modelling to ensure that key uncertainties and decisions are addressed without over-elaboration. Detailed questions are not as exciting as brilliant answers, but without them, even the most robust integrated models can be “essentially useless”.

Selected References

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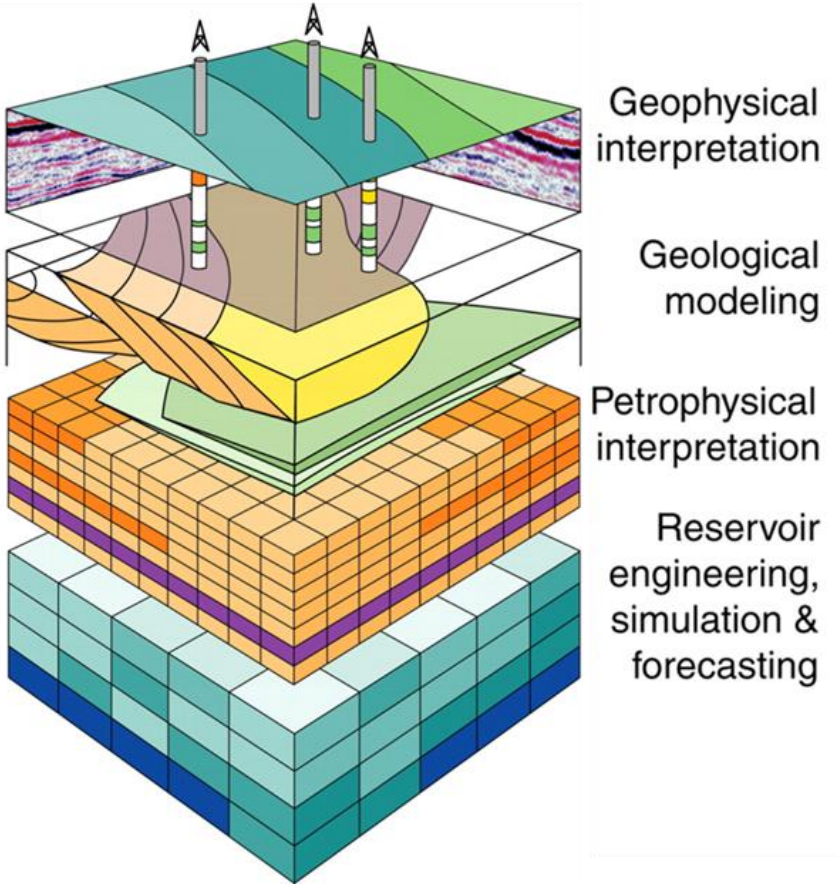
The construction of idealized realizations that capture important characteristics of the subsurface is a vital part of our routine petrotechnical analysis



Geological Society London Special Publication 208, Ringrose et al, 2008

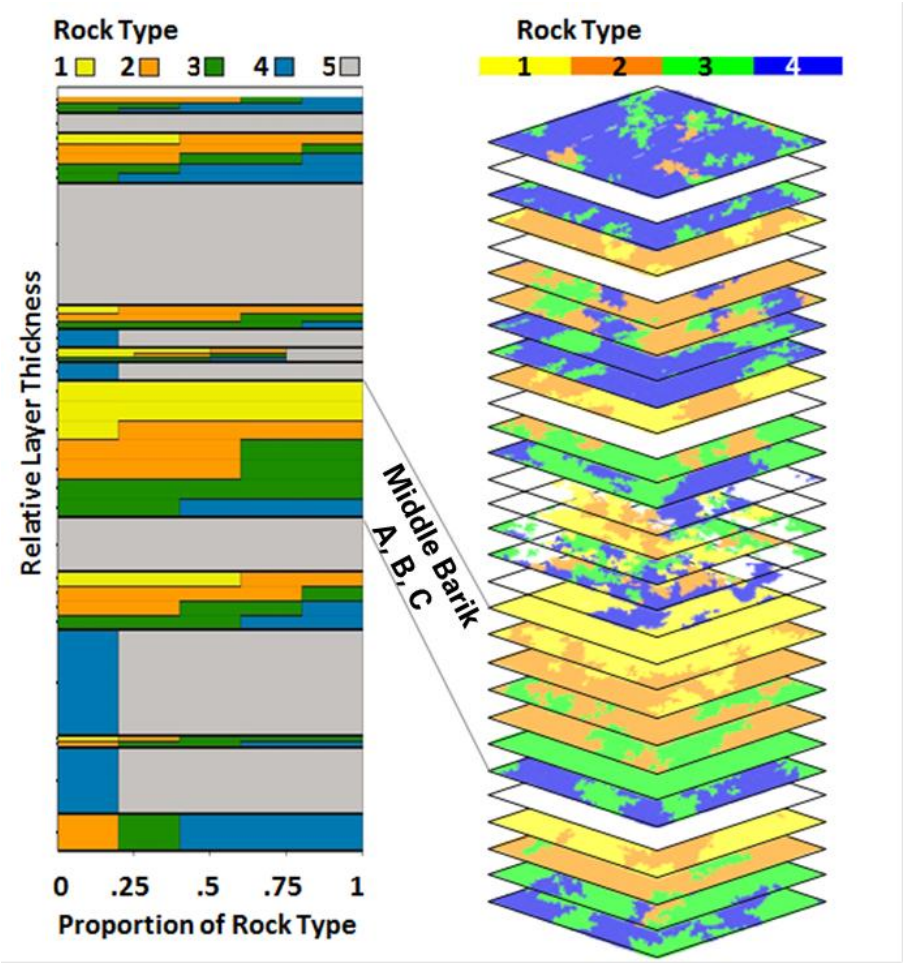
Decision Based Modelling is a planning methodology that links field **decisions** to the integrated reservoir modelling process that helps teams analyze, validate, and evaluate options to make optimal decisions.

-AAPG 2017 DBM Workshop

Muscat, Oman

Modelling implies simplification and idealization

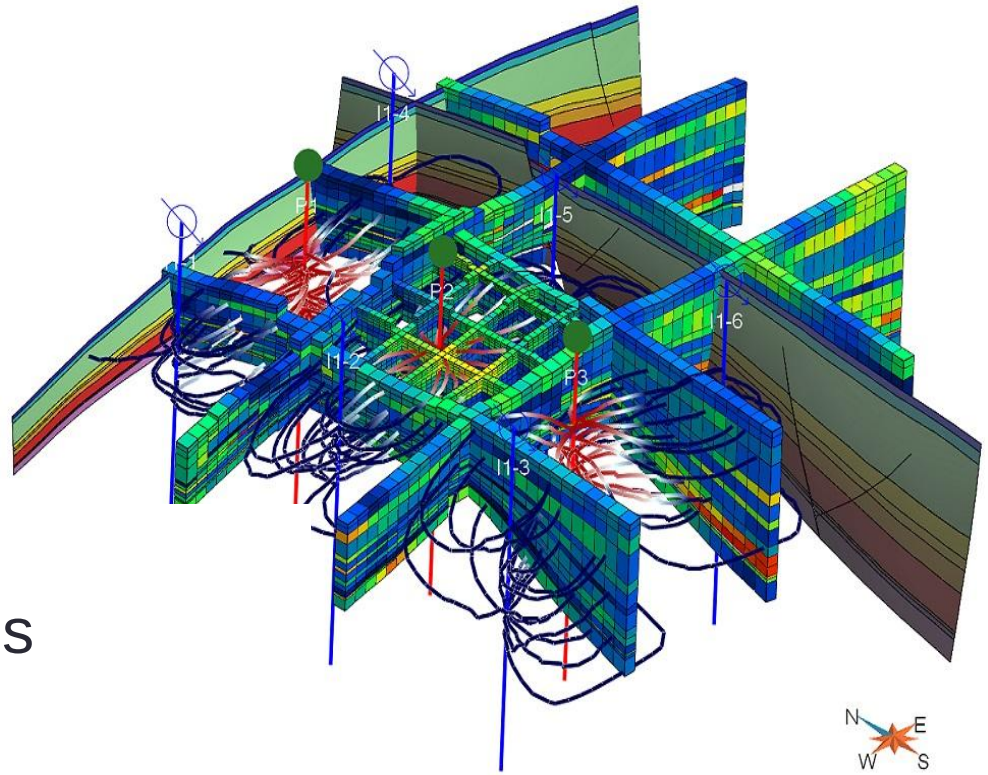
- Physical - 3D models that can be touched
- Graphical - maps, charts
- Mathematical – equations that represent systems or processes
- Conceptual – verbal or graphical
- Computer – simple or complex



Spain, 2016 SPE 183468

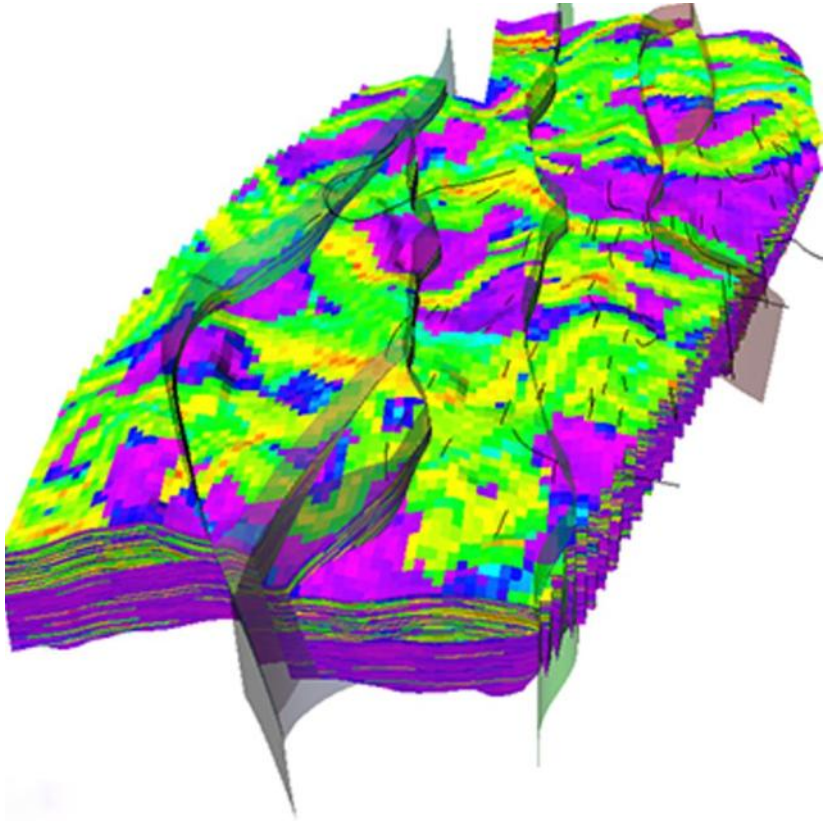
We are trained to be problem solvers and solution-finders.

- In school, we are given questions and graded on the quality of our solutions.
- Management examines the solutions that we propose, not the questions that we have asked.

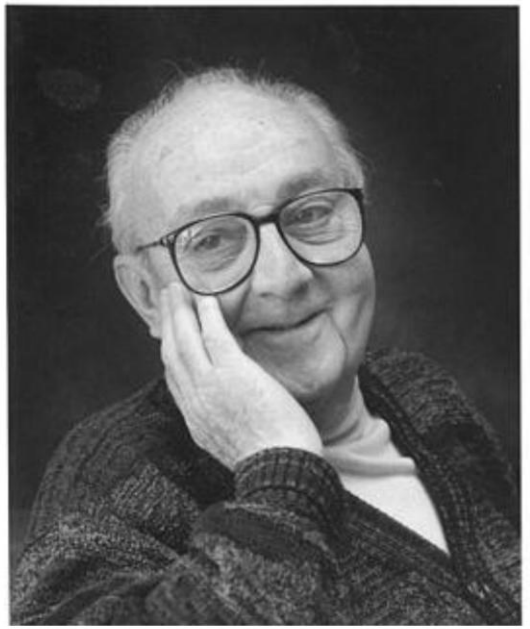


We are efficient at solving problems, even if they are the wrong ones to solve.

- Few kudos come from asking the right question.
- The right question is often the key to breakthrough business success.
- With a properly-framed question, finding an elegant answer becomes almost straightforward.



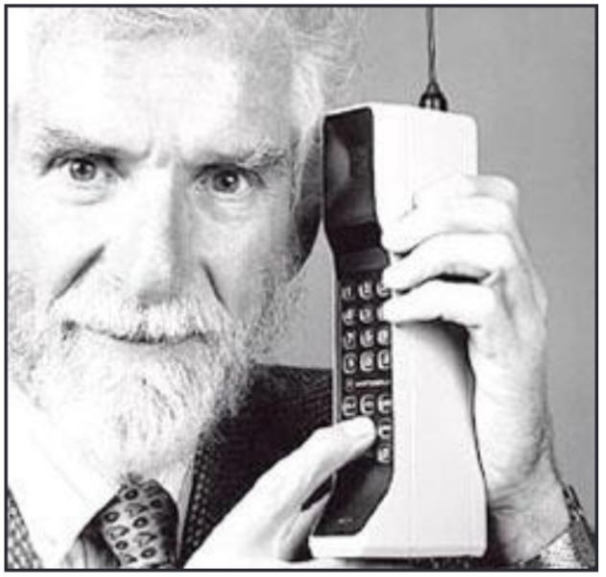
"The most that can be expected from any model is that it can supply a useful approximation to reality: All models are wrong; some models are useful."



George E. P. Box (1919-2013) – One of the great statistical minds of the 20th century

Presenter's notes: The only question of interest is "Is the model illuminating and useful?"

- How can you find the right questions to ask?
- Good questions are clear, even if they are broad.
- They need to be linked not only to an over-arching objective but also to:
  - challenges posed,
  - decision criteria, and
  - obstacles to adoption



Dr. Martin Cooper
Motorola DynaTAC 8000x

Presenter's notes: Dr. Martin Cooper, a young engineer at Motorola, was asked to lead a project on the next generation of a car radiotelephone. He stepped back and paused, which led him to ask himself a very insightful question. "Why is it that when we want to call and talk to a person, we have to call a place?" (*Presenter's notes continued on next slide*.)

(*Presenter's notes continued from previous slide*.)

Bank of America has had a massive win with its "Keep the Change" program that rounds up customers' debit card purchases to the next highest dollar, sweeping the difference to a personal savings account. The patented program is breathtakingly simple, for both the bank and the customer. The question might be something like "How can customers save money without thinking, planning, or clearly foregoing consumption?"

That nagging, insightful question changed the entire trajectory of his work, as he refocused his team's attention on untethering a person from a place (including a car). Dr. Martin Cooper made the first phone call over a cellular network in 1973, but it took an entire decade before the DynaTAC 8000x was sold as the first commercial handheld cellular phone in 1983. It weighed 1.75 lb., stood 13 in. high, stored 30 numbers, took 10 hours to recharge and cost $3,995.

Good Questions Minimize Uncertainties

Single Well Models

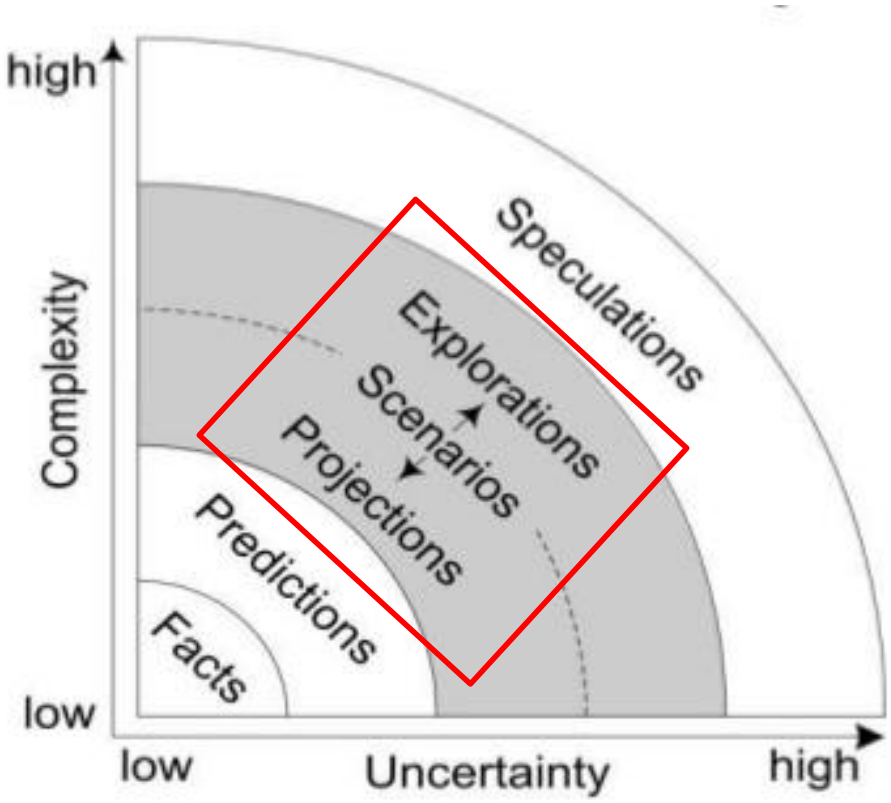
- Contribution of flow units
- Drainage area and shape
- Well and completions design

Sector Models

- Interwell interference patterns
- Well spacing optimization

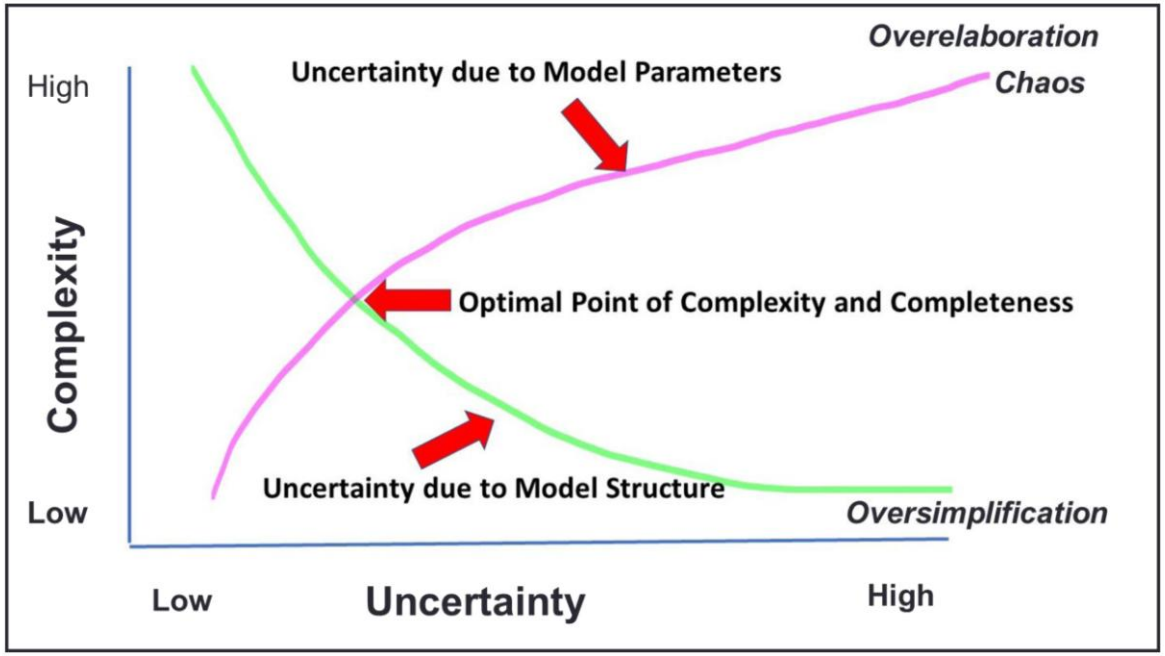
Full Field Models

- Field Optimization
- Coupled to surface facilities



Zurek and Henrichs, 2007

The Principle of Parsimony



"*Pluralitas non est ponenda sine necessitate*"

William of Ockham (1285-1347)

Presenter's notes: We can continue building more and more complex models for the interest of **completeness**. But remember that there is an **optimal model complexity** that we must recognize. Simpler is the model, more is the **model uncertainty** in prediction due to its frugal structure. But more is the model complexity, more are the parameters that come into play and hence predictions can become uncertain due **parameter uncertainty**. (*Presenter's notes continued on next slide*.)

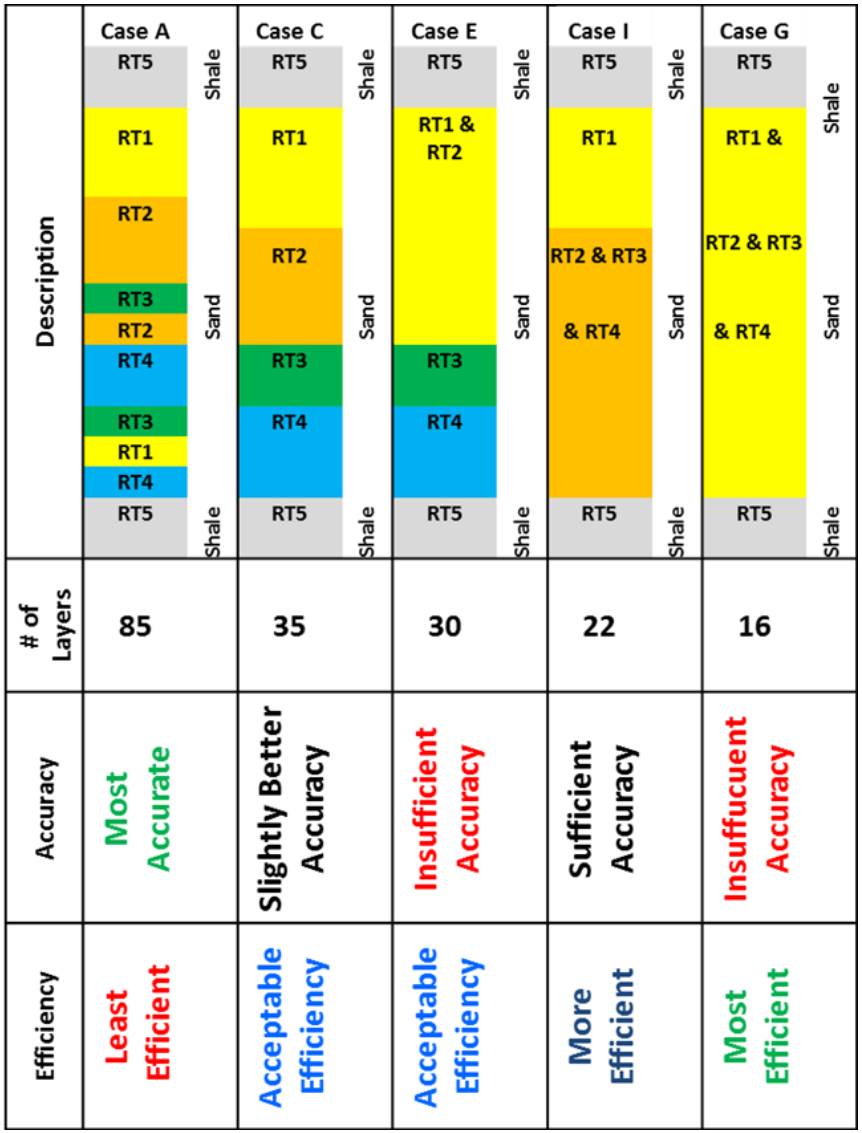
(*Presenter's notes continued from previous slide*.)

In overly complex models, our poor understanding of too many parameters can lead to a "chaos" or "noise". The parsimony principle is basic to all science and tells us to choose the simplest scientific explanation that fits the evidence i.e. involves fewest entities.

When scholar William Ockham wrote "Pluralitas non est ponenda sine necessitate" which later became known as the Law of Parsimony, "**plurality should not be posited without necessity**"). Which is simply to say that all things being equal, the simplest explanation may times tends to be the right one.

The term razor refers to distinguishing between two hypotheses either by "shaving away" unnecessary assumptions or cutting apart two similar conclusions.

- A further advantage of asking the right question is being able to rank the quality of answers with confidence.
- Too often, solutions framed without a question are judged by implicit decision criteria that never get verbalized or documented, so we miss the target



Spain, 2016, SPE-183468-MS

“An approximate answer to the right question is worth a great deal more than an exact answer to an approximate problem”

John W. Tukey (1915-2000) Mathematician – USA National Medal of Science 1973

Thank you!