

E&P competitive advantages from Cognitive decision support

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The E&P industry has always been “data driven”, willing to invest in new technology to improve data acquisition, interpretation, simulations and analysis. While still necessary, the historical approach to insight and decision-making is no longer sufficient. New technology may change the playing field.

Exploration success sometimes seem arbitrary, even lucky. Major discoveries in previously explored areas leaves us with questions like “why did not previous license holders succeed?” The simple answer may be – the data available, and the insight made possible – at the time of decision making. When we make different decisions today, to drill, drop - or decide a new location - we have the advantage of additional insight from new data – as well as the results from previous efforts. We have the potential to think outside the box - of previous assumptions and outcomes. This potential will depend on the organizations ability to explore and exploit new internal or external sources of information. This capability may be difference between failure, success and how we will perceive industry leadership.

Improving the basics is not enough

Most companies adopt the “basics”, like improved seismic acquisition, more sophisticated geoscience applications and

cross-functional collaborative work flows. They try to cope with the increasing amounts of “big” data, from wells, drilling, digitized facilities as well as studies, internal and external reports. All intended to improve exploration decision making, operational excellence and compliance. Doing an inventory of data in a typical E&P company today would show that about 75% of the data is unstructured, and growing exponentially. A paradox is that an increase in data does not necessarily result in an increase of insight and quality decisions. Multiplying data may even reduce insight, if “information overload” – leaves us without knowledge of what data we have, or means to locate and use the information. Improved exploration decisions requires more than just new or higher resolution data. It requires data to be available, timely, accurate, in your context – and “explorable”.

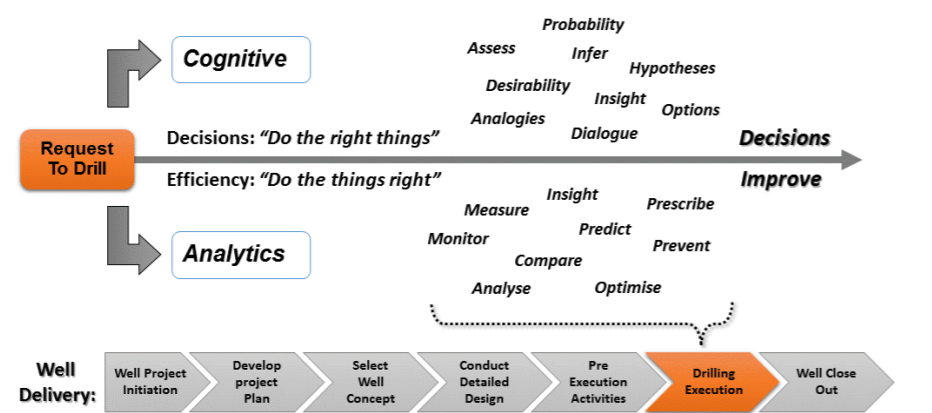
An example: Today we can analyze historical sensory and operational data to identify patterns or “analytical signatures” that pre-

cedes undesired events in areas such as drilling, artificial lift or facility operation. These signatures may be used to predict events and prescribe the next best actions to avoid them, or minimize their impact. Improved drilling efficiency by avoiding stuck pipe is an example of benefits from this approach. While this is a high impact improvement, it still is not enough. Improved drilling efficiency is a moot point if the well should not have been drilled in the first place, or in a different location.

The *illustrated below* (high level) Well Delivery process may highlight the different types of insight and decision making required when planning and executing a well delivery.

While there is a lot of effort invested in the execution part, where real-time analytics drives improvement, there is a lack of decision support in the preceding phases, where major and critical decisions are made.

Concept selection, locations, trajectories, rig selection etc. depends on our ability to understand



Analytics approaches as complementary support to drilling

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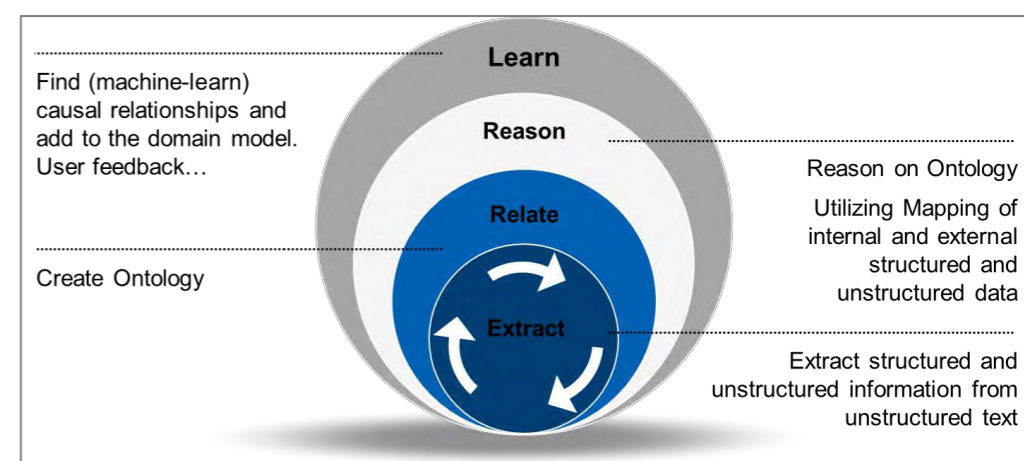
the request to drill, the objectives and best options. The decisions made will influence time, commercial terms, cost, HSE – and the probability of success. We categorize these decisions as “doing the right things” – and they can be improved by insight from a number of domains, such as previous projects, well reports, studies, newsfeeds, market analysis, external data providers and even open information sources. Most of these sources contain unstructured data, partial information, with little quality assurance – and requires a new approach to analysis.

Welcome your Cognitive advisor There is no lack of ambitions to organize, store, govern and make data available to users. Progress has however been slow and lagging. Current technology is helping us address some of the basic issues, but the main challenge is to enable users to interact with, and exploit, the growing volumes and types data in a more intuitive and supportive dialogue.

Superfast response to a web search may be impressive, resulting in millions of hits. The problem is that you are still left with a haystack where you searched for a needle. This is where new “Cognitive systems” seek to remedy the situation. The first cognitive pilot, named “Watson” managed to outperform the incumbent Jeopardy TV champions in 2011.

The technology that understood and managed to answer questions better than human experts has evolved into today’s “Cognitive systems”. They help experts by processing huge volumes of data to provide best insight and hypothesizes in areas such as patient diagnostic, competitive intelligence and research. Today’s system is capable of processing the equivalent of a million books per seconds, extracting relevant information – and present answers as hypotheses to questions asked in a natural human language. The Oil & Gas industry is conservative in some respects, and is late to follow the cognitive technology adoption already well underway in other industries. So, what would a true cognitive system offer the E&P industry? You should expect an “advisor” to:

1. *Understand your inquiries in*



Cognitive Analytics – Conceptual view

natural language, with a human style of communication. This includes understanding of industry “lingo” – the semantics and ontology. Searching for “wildcats in the North Sea” will narrow search to exploration drilling, and return – among other results - data from Johan Sverdrup, as the system would know that this field is part of the North Sea area, even if it was not stored or stated in one database or document.

2. *Generate and evaluate evidence-based hypothesis.* A cognitive system goes far beyond “search” – which may return scored hits. A Cognitive system responds to an inquiry with its best understanding of what the user is looking for. It will show its “confidence” to different responses or hypothesis. “Show me basins with similar characteristics as ...?” Or in medicine: “What could cause nausea...?”. Each hypothesis may be explored to see what data has been considered, analyzed and inferred from.

3. *Adapts and learns from training, interaction, and outcomes.* Building on the characteristics, the system will use feedback from users to improve understanding of relationships, semantics and credibility of source data.

See illustration above, of conceptual architecture.

Cognitive decision support in E&P

In an exploration context critical decisions are based on geoscientists understanding of basins and fields - and their assessment of

presence, type and volumes of hydrocarbons in a prospect. Developing good models of basins and petroleum systems requires not only access to quality data, but understanding of how to interpret the regions data. E.g. how to address ambiguities. The geoscientists experience is key, and usually supported by good practices of cross discipline collaboration and peer reviews. However – a relevant questions may be posed: Are the results influenced by individuals “bias” - or based on a too narrow experience or knowledge base? Would a different team produce different results, valuations and recommendations? This can be considered as a prospects intrinsic uncertainty, which cognitive systems may address.

Imagine a situation where you could expand your decision platform, where the basis of your geological understanding, value assessment and recommended way forward could be based on:

- Insight from *all existing internal data* (unstructured and structured) from all fields considered *relevant or analogous*, previously developed – with lessons learned.
- Relevant data and insight from *external data sources accessible* through open sources or subscriptions, like IHS, AAPG, Tellus, NPD, Elsevier, GSL etc.
- The *collective insight* – and *best hypothesis* – that can be derived from all above.
- A documented “*audit trail*” of what data was used in the hypothesis you based your decision on, for future use – and review – in case new data

would be made available. This is what IBM would categorize as a “*Cognitive Exploration Decision Advisor*”. Leading E&P companies are already exploring the potential of Cognitive Advisors, developing internal capabilities to get a competitive edge in situations where an “advantage of insight” may influence drill/drop, buy/decline – or the perception of “right price”. Most of these ongoing projects are confidential, while some – like Repsol – have announced their intent. The success in other – faster adopting – industries are impressive, and we believe the potential business impact within E&P is enormous. While these projects are comprehensive, the payback is immediate – when considering the business value of improved appraisal, better understanding of what to expect during drilling – or even a “drop” decision that saves the cost of a dry well.

While exploration is a hot area, other disciplines are also adopting cognitive technology to obtain new and better insight. Operations are following suit with a timely focus on production efficiency. Similarly, production – considering reserves growth opportunities from better understanding of concepts proven elsewhere, to enhance oil recovery. As crude prices threaten profitability, or even economic feasibility, of fields - the time is overdue to demonstrate some “exploration boldness” to make a step change in decision support. Challenges should be a motivator to move, not an excuse to stand still - or risk being left behind.