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SPECIAL ISSUE



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# Deriving value in integrated operations through data analytics



Despite the wave of Digital Oilfield initiatives over the two decades around the turn of the century, the oil and gas industry has lagged behind others such as aviation and automotive in their widespread adoption of data analytics to revolutionize their business and operating models, according to Mr. Samit Sengupta, Managing Director, Geologix Limited

A holistic approach will be required to derive value in Integrated Operations through Data Analytics. The application of data analytics to Intelligent Operations workflows has the potential to bring rapid results, though such initiatives must be fully aligned with business goals to deliver value. Data analytics use pattern matching techniques to predict problems and prescribe mitigating actions. Discovering the underlying cause of problems is the key to establishing the credibility of such methods. A multi-disciplinary team comprising engineers, geoscientists and data scientists who have seamless access to trusted data and contextual information pertaining to their project is a good start!

In January 2017, the World Economic Forum, in collaboration with Accenture, published a White Paper entitled “Digital Transformation Initiative – Oil and Gas Industry”. The report states that the “Digitalization in the Oil and Gas sector could be worth between \$1.6 to \$2.5 trillion for the industry, its customers and wider society over the next decade”. Despite the wave of Digital Oilfield

initiatives over the two decades around the turn of the century, the oil and gas industry has lagged behind others such as aviation and automotive in their widespread adoption of data analytics to revolutionize their business and operating models.

One of the challenges in embracing data analytics to provide operation insight is to avoid the common pitfall of thinking

correlation is causation. The entire discipline of data analytics is dedicated to discovering correlation between apparently unrelated parameters. For instance, you may find that monthly sales correlate with rainfall but unless you sell umbrellas, it may be difficult to prove cause and effect. To understand such correlation, one would need to talk to consumers when it is raining to

There is an opportunity to leverage data analytics to help address strategic challenges.

The wider trends of the Industrial Internet of Things (IIoT), big data and analytics provide significant opportunity and challenge in terms of adoption for operators

investigate what prompted their decision to buy.

So how can we apply data analytics techniques to Integrated Operations? One approach may be to look at areas of operation which need transformation due to shortage of skills and expertise. Although machine learning cannot yet replace human intuition, it can potentially give us consistent insight and foresight to support timely and effective decisions.

**BRIEF OVERVIEW OF DATA ANALYTICS**

What is data analytics? It is the discovery, interpretation and communication of meaningful patterns in data. In the Cambridge Dictionary it is defined as a process by which a computer examines information using mathematical methods to find useful patterns.

The discovery of patterns



requires the data to be available digitally. The more the types and volume of digital data, the higher the chances of discovering reliable patterns. These patterns can then be used to predict performance and even prescribe future actions.

For example, one of the digital readouts in my car predicts the “distance to empty” abbreviated DTE; i.e. the miles I can drive with the amount of fuel left in the tank. Although the math for this is quite simple, many factors need to be considered for this prediction to be accurate. As a car enthusiast, I am more inclined to test the performance of the car when I drive compared to my wife who habitually covers longer distances on a full tank of fuel. The application of data analytics algorithms ensures up to date and reliable prediction of this parameter irrespective of who is driving the car by monitoring the car’s acceleration, braking and coasting data.

**TRENDS IN INTEGRATED OPERATIONS**

Integrated Operations (IO) refers to work processes and ways of performing oil and gas exploration and production, which has been facilitated by new information and communication technology. Exploration and production companies are increasingly instrumenting their fields with the objective of running better and

safer operations. The goal is to aggregate sensor data in real-time to enable right-time analyses and facilitate proactive decision making.

The traditional practice has been to set up real-time operations centres (RTOCs) that provide sight of data through visualization dashboards for 24x7 surveillance by a multi-disciplinary team to provide decision-support to engineers and geoscientists at the coalface of operations. The expectation was that armed with the right information, the experts in the RTOC will be able to deliver the insight and foresight required to run a safe and trouble-free operation. For instance, when drilling complex wells, operators set up teams for remote monitoring of pore pressure and geomechanics parameters to mitigate risks associated with stuck pipe and well kicks.

Over the past 4 years, operators have had to adjust their business strategy to address a downturn in oil and gas prices. Restructuring, cost-cutting and a focus on operational efficiency have helped operators adjust to these new market conditions.

The long-term impact of the recent downturn and the industry response is not yet fully clear. However, going forward, the industry faces several issues which, increasingly, will present additional challenges for operators:

**Managing aging assets**

Over 50% of global oil and gas production comes from mature assets, for which maximising production efficiency and reliability is of critical importance. Achieving this in the face of widespread cost-cutting will be challenging.

**Retaining knowledge & expertise**

The human cost of restructuring

during the oil price downturn, coupled with the long-term demographic shift of the “big crew change” have the potential to significantly impact business and operational performance.

**Adopting new technology**

Technology is already considered a strategic priority by many operators. However, in mature operating environments, there are barriers to applying technology in a fit-for-purpose manner to improve performance.

**INTEGRATED OPERATIONS AND DATA ANALYTICS – MADE FOR EACH OTHER?**

There is an opportunity to leverage data analytics to help address these strategic challenges. The wider trends of the Industrial Internet of Things (IIoT), big data and analytics provide significant opportunity and challenge in terms of adoption for operators. Many operators are

currently investing in developing some internal capability in advanced analytics, looking for opportunities to glean insights from a wealth of available data.

However, for its potential to be fully realised, fit-for-purpose analytics must become part of the engineers’ toolkit within operator companies. Barriers facing widespread adoption of analytics in operators include:

**Finding where analytics can add value**

The integration of data analytics in the oil and gas industry presents a significant opportunity for operational improvement. However, deciding where to focus and then implement new approaches in such a diverse and complex industry may present a challenge for operators.

**Empowering engineers**

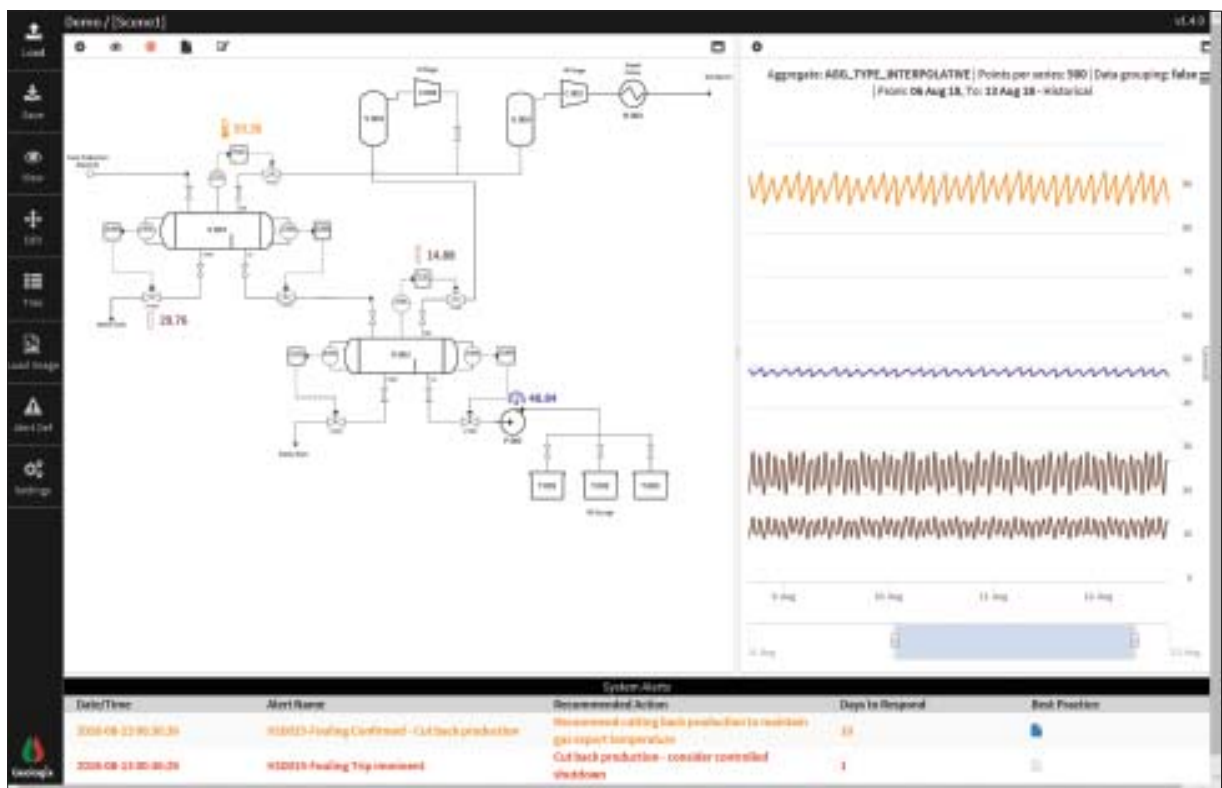
As well as employing dedicated data scientists, operators will require a much larger number of

analytics-literate engineers who feel empowered to combine analytics with their existing domain knowledge in daily work.

**A common platform for cross-functional workflows**

Although collaboration is recognised as critical for business success, workflows still largely occur within functional “digital silos”. This, combined with the expected impact of new analytics-based processes, necessitates the development of a shared analytics platform.

Operations Advisor is a solution designed to improve operational performance across the upstream and downstream value chains by integrating advanced analytics, knowledge management and decision support functionality. The vision is to provide a common digital platform for cross-functional workflows, whilst empowering engineers with a blend of predictive



analytics capability, data visualisation and automated activity prioritisation.

There is currently a focus on how analytics can add value in oil companies. However, analytics alone does not deliver value. It is the decision-making and project-execution resulting from the analytics that delivers value. Therefore, Operations Advisor must be focused on decisions and actions.

The core capabilities of the Operations Advisor platform present opportunities for adoption across many areas in the upstream and downstream businesses, including in Operations, Subsurface, Maintenance and Drilling teams. For example, an area where Operations Advisor can add significant value is in Production Operations. The platform can increase performance by:

#### **Streamlining analysis of the production system**

- Structuring unstructured data
- Animation of existing diagrams or new sketches
- Quick to create views
- Flexible, intuitive visualisations (multivariate scatter plots, colour-coding)

#### **Identifying production**

##### **challenges before they occur**

- Create calculations and rules to identify recurring issues early
- Send alerts with early warning of impending production issues

##### **Improving decision-making through prioritisation of high value activities**

- Move from reactive to proactive – more effective activity planning
- Intelligent alerts to target high-value activities
- Function of time to event and severity of event

#### **Reducing the time from analysis to execution by capturing best-practices**

- Store notes on production events, procedures and best practices
- Linked to asset model (i.e. relevant to equipment type/system)
- Facilitate collaboration between functional areas i.e. wells / facilities

Central to the design of the Operations Advisor platform is the use of Data Analytics to predict reduction in production performance or critical equipment failure, and to prescribe and prioritise corrective actions based on correlation of data patterns with failure events of the past.

#### **CHALLENGES TO ADOPTION OF DATA ANALYTICS IN INTEGRATED OPERATIONS**

As with the application of any new method, stakeholder buy-in is crucial for its success. The application of predictive and prescriptive analytics is inevitable, not least because our industry now faces the challenge of being more efficient with less experienced people. However, a cautious approach is required as “getting it wrong” can potentially have unintended if not catastrophic consequences. Careful consideration needs to be given to three key areas:

##### **Skills Gap**

A fit-for-purpose application of Data Analytics requires not only the advanced knowledge of mathematics and computing but also a deep understanding of the domain. As well as employing dedicated data scientists, operators will require a much larger number of analytics-literate engineers who feel empowered to combine

analytics with their existing domain knowledge in daily work.

##### **Contextual Information Gap**

Data Analytics routines are useful for discovering and matching signature patterns from historical data sets. Consequently, richer and deeper data sets are likely to yield better insights. The main challenge is that a large proportion of contextual data is only available from information contained on paper or in image files. Manual extraction of data from such legacy documents can be cumbersome if not impossible. Operators will need to explore ways to automatically extract and shape the data into a standards-based data model designed to deliver rapid and reliable results.

##### **Data Quality Gap**

We all know that quality data is a mandatory pre-requisite for analytics and visualisation tools to provide us with dependable insights. However, the findings in a recent study indicate that:

- Data collation consumes about half the time in business activities – 52% in 10 workflows studied.
- Everyone who acquires data spends time rechecking it – 58 man-years/year to find and QC Well header, checkshot, deviation and basic logs.

In an environment where data and contextual information is aggregated from multiple sources, assuring the quality of data is non-trivial. Operators will need to set up a Quality Data Inventory to ensure that the quality of data used by Data Analytics algorithms is fit for the purpose of delivering the right results and helping to make better decisions.

##### **Standards Gap**

Data standards and ontology are essential components for the robust

and reliable data exchange mechanisms required to support a data analytics architecture. Although standards such as WITSML, ProdML, OPC and others provide a framework for the interchange of data between systems, their use cases are largely constrained to the transfer and consumption of measurements data. Creating an E&P ontology that defines a structured vocabulary will be needed to make contextual information more meaningful.

On a more fundamental level, standards that help define usage terminology and locations in databases ensure that the flow of data is consistent in retrievals, especially in key business workflows. These basic standards are needed not only in directly affected domains, but they also contribute towards an overarching structure that supports the E&P Enterprise.

### CONCLUSIONS

A holistic approach will be required to derive value in Integrated Operations through Data Analytics. The application of data analytics to Intelligent Operations workflows has the potential to bring rapid results, though such initiatives must be fully aligned with business goals to deliver value. Data analytics use pattern matching techniques to predict problems and prescribe mitigating actions. Discovering the underlying cause of problems is the key to establishing the credibility of such methods. A multi-disciplinary team comprising engineers, geoscientists and data scientists who have seamless access to trusted data and contextual information pertaining

to their project is a good start!

The author wishes to thank Dr Julian Pickering, CEO, Geologix Systems Integration and Philip

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### about the author

Samit Sengupta has over 35 years' experience in the upstream sector of oil and gas industry. After graduating from the Indian Institute of Technology, Bombay with a degree in Civil Engineering, Samit worked in the subsurface data acquisition and analysis industry in Australasia, US, Africa and Europe with Schlumberger, Gearhart and Halliburton, prior to creating Geologix, an international company providing software products, technical and advisory services to enhance Drilling Performance, Production Performance and Digital Transformations.

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