Unleashing Upstream Data

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Imagine a world where the information and visuals you need to run your business are fully and freely available to you on demand. Any questions you may have can be freely explored. The information needed is there for you, regardless of the type of data. It may be geological or geophysical. It may be structured or unstructured. It may represent production volumes, measurement, well data, equipment information, simulations, maintenance, lab samples, real-time information, internal logs or external feeds, audio or video. All data has value, but it is not always easy to extract, combine, and exploit while managing persistent data integrity and availability issues.

Traditionally in the energy industry, performing an analysis or creating a view of information across applications or assets requires a focused data-compilation effort or a complex application landscape. Information is sourced, manipulated, evaluated, modeled, compiled, buffed, and polished into a nice bespoke tool or dashboard. Then data-feeding processes and interfaces are created to keep the information current. This can be cumbersome and expensive. Change is needed to enable the kind of digital revolution that energy businesses require to survive and thrive.

The case for letting your ideas fly

Traditional needs for decision support have underscored a case for borderless data platforms. A common quote echoes the imperative: *"Ideas cannot be limited to the confines of a silo. They need space to run around and occasionally bump into strangers."*[1] For example, an operator wishing to understand the lift efficiency they can achieve from implemented recovery techniques may want to analyze the situation in real-time to revise injection rates dynamically based on current performance. A disintegrated application landscape marked by data silos and disconnected workflows complicates this.

Companies now track bit performance in fields and focus on optimizing drilling in general. However, what if they wanted to track bit performance against production rates and compare that across geographies? Or perhaps they would want to evaluate this by formation type or completions type? Alternatively, what if a planner wanted to look across geographies to evaluate past well plans and drilling activity by depth to understand how drilling dysfunction can be avoided?

When crude or gas prices are healthy, producers may strive to maximize production. But how should production targets change when constraints are introduced? Examples include comparisons of market prices to lifting costs, the impact of infill drilling on a reservoir in a field, and constraints related to storage, pipeline capacity, or equipment downtime in a facility.

For years, the industry has aspired to achieve integrated operations in production fields with collaboration between those managing reservoirs, production, facilities, and others in the value chain. Some companies are connecting incentives across the lifecycle of a well. The ability to make shared, informed, and cross-field, cross-asset, or well-specific decisions has been challenged by application and data silos.

These types of upstream information needs are not new. But methods for delivering answers are changing. Data is being decoupled from applications and engineered into cloud-based platforms – schema-less or structured – to open the door for new access, search, analytics, and a range of previously unimagined possibilities. Truly unlocking upstream data means breaking silos, unifying data sources, and opening the door for connectivity with other sources and sectors.

This may serve as useful while energy companies' portfolios expand. For example, a company may start managing producing assets in a geography as a blended portfolio – oil and gas, fossil fuel power generation, renewables that produce power, and other energy sources. They may need to

understand and forecast production capabilities and unit costs and manage production priorities across these sources in a geography on a regular basis.

Wholesale power markets and market operators do so 24 x 7. Power markets involve a multi-faceted balance of physical demand (load), supply (generation), market price dynamics, and the need to keep the lights on. Complexities to these factors exist, however. For example, generating units tend to play different roles depending on their physical characteristics and geographic location. Transmission congestion is a complication. But in general terms, power system or market operators tend to apply a merit order, ranking generating units by cost, lowest to highest, with the lowest cost generators called to produce first. As market dynamics change in spot markets, day-ahead markets, and forward trading, the processes or algorithms

driving whether a unit will be called on to produce in a timeframe will govern the dispatch or the plan. In simple terms, market demand and supply impacts market prices, and market prices play a key role in determining which asset produces, and when. There are always exceptions, but a unit should produce only when it is in the money. Imagine trying to analyze asset capabilities, costs, and market dynamics across business lines to apply production dispatch concepts to a blended energy portfolio.

Traditional upstream data needs are reasons enough for busting data silos. A changing energy world where companies diversify their portfolios and carbon capture and related reporting requirements are adopted makes the case for borderless data platforms even more compelling. Energy businesses need it. Emerging technologies are making it possible. This is the time to let those ideas fly.

I have ideas. How can I harvest them?

Artificial intelligence can be used to enable the ingestion and consuming functions of a robust data platform.

## Artificial intelligence and machine learning

Artificial intelligence (AI) and machine learning make it possible for us to learn from the data we have liberated from applications by producing correlations between patterns and outcomes, coming up with predictions, and powering better-informed decision making. Ultimately, applying AI to a process is about creativity and the freedom to combine different data sets, structured and unstructured, to gain insights that would have been unthinkable before.

Companies are finding new ways to extract semantic meanings and relationships from structured and unstructured data sources to build knowledge graphs and enable completely new classes of intelligent applications powered by AI and curated knowledge.

This is powerful in a world where eighty percent of data is estimated to be unstructured. That is, not stored in databases or spreadsheets. Unstructured data is everywhere in emails, presentations, videos, reports, articles, images, sound recordings, and other media. Imagine capturing the aging workforce's knowledge, a

phenomenon continuing to affect the energy sector. AI can process images in presentations, chat messages exchanged by experts on a company's collaboration network, or videos sent by email. Combining and learning from this data can power applications on mobile devices and smart wearables to enable engineers and field workers to make better-informed decisions. Cognitive assistants familiar with the operations performed by a field worker that can answer questions, provide advice, and predict situations can facilitate diffusing a crisis.

Decisions today are increasingly made on mobile devices. AI is the engine we need to make them smart windows into data platforms. When dealing with production constraints, disruptions can come from situations like pinch points in the maritime trade. The water levels of major trade routes, such as the Panama and Suez canals, have been sinking, forcing cargo ships to shed part of their load . That is where creative AI
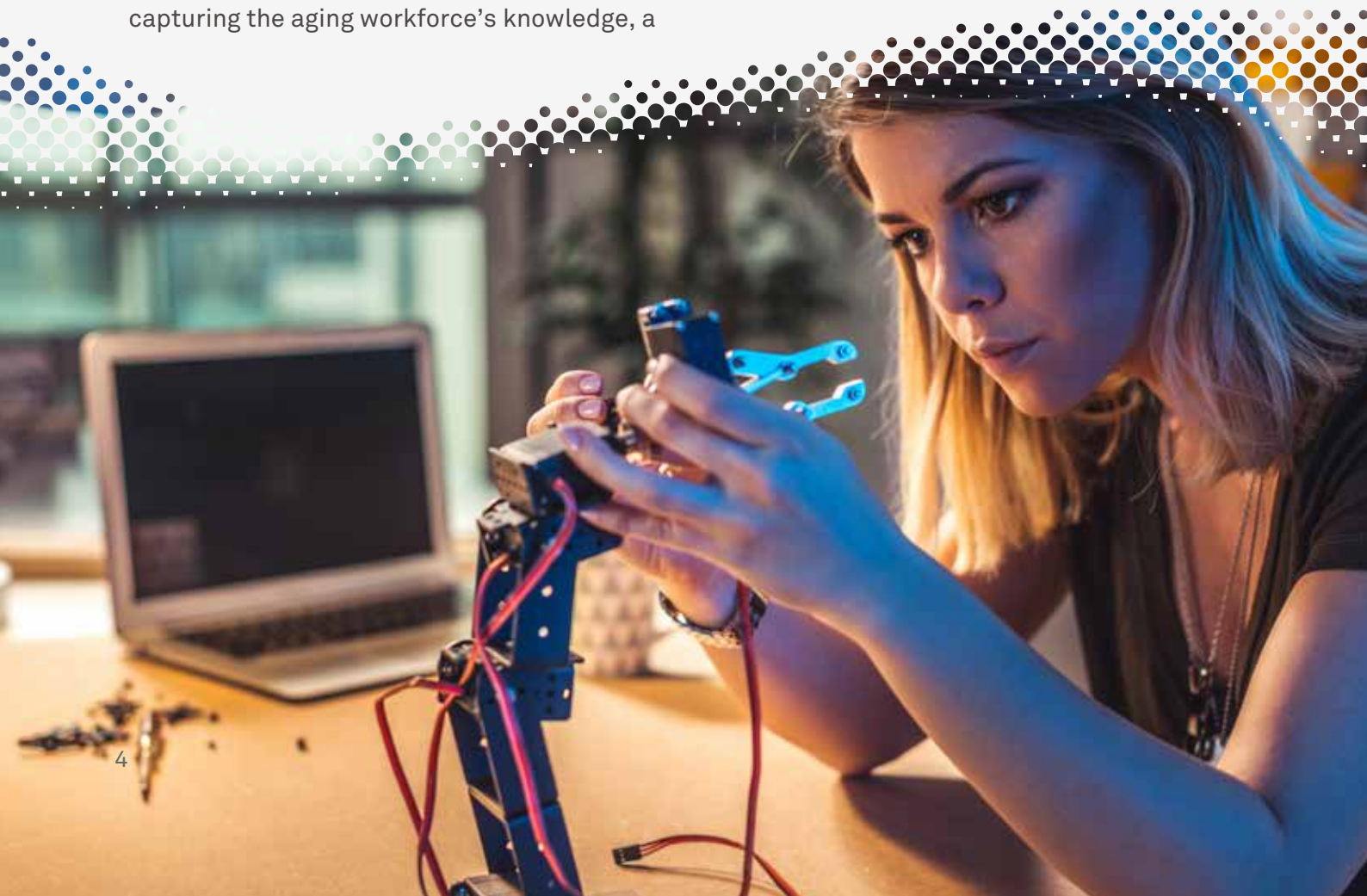
comes in. By combining data from producing assets with sources like weather information and forecasting models, and records of recent phenomena like super-storms or geopolitical developments, we can adjust production to an increasingly complex world and mitigate the risk of disruption. The more multi-faceted the energy industry's reality becomes, the more AI needs to deliver creative correlations to help us understand and plan.

As part of the unprecedented transformation toward the energy transition, the prosumer phenomenon has been blurring the lines between energy production and consumption. Consumers who produce energy, mostly through rooftop solar panels and electric vehicles, and feed it back into the distribution network, are a new source of production data that needs to be collected, understood, and exploited. We can apply AI to learn from sources, such as traffic patterns affecting electric vehicles, geolocation data on charging stations, weather events, and prosumers' behavior, to manage this new component of the portfolio.

Data is not an end in itself. AI is the ultimate engine that unleashes the insight and power of a borderless data platform. The amount of data that can grow in these platforms is too large for humans to process, and AI applications make it possible for us to exploit it. Unlike the systems of the past, AI is not programmed. Like humans, albeit much faster, AI learns from data – a lot of data. The more, the better. AI, data, and creativity are what we need to make our ideas fly in a changing energy world.

Natural language query

A powerful AI capability is natural-language processing. This is the technology behind Amazon's Alexa. Artificial intelligence capabilities that understand natural language can quickly search across vast amounts of data. A way to facilitate this with data platforms is to extract semantic meanings and relationships from structured and unstructured data to build knowledge graphs and event correlation, using common extraction techniques, including "topic modeling." Once extracted, data can be directly consumed or used in machine learning models to enhance their accuracy and performance. Companies create these to curate knowledge so that natural language requests can be translated and run against knowledge graphs and structured and unstructured data sources. The results are aggregated and sequenced according to their relevance.

This delivers data to end users without the need for advanced skills in data queries. As fast as you can speak or type, the system can create queries to return results with a high degree of accuracy and context. Think about being in your petrotechnical application and just verbally telling it to "import all well data below 8,000 feet for all wells within 1 mile of BigRun10-A" or "load core porosity and permeability data available in the Kutei Basin between 1000 meters and 2000 meters." This simplification of data search and retrieval is another valuable tool available to users to accelerate productivity and help unleash the insights hidden in most companies' vast amounts of information.
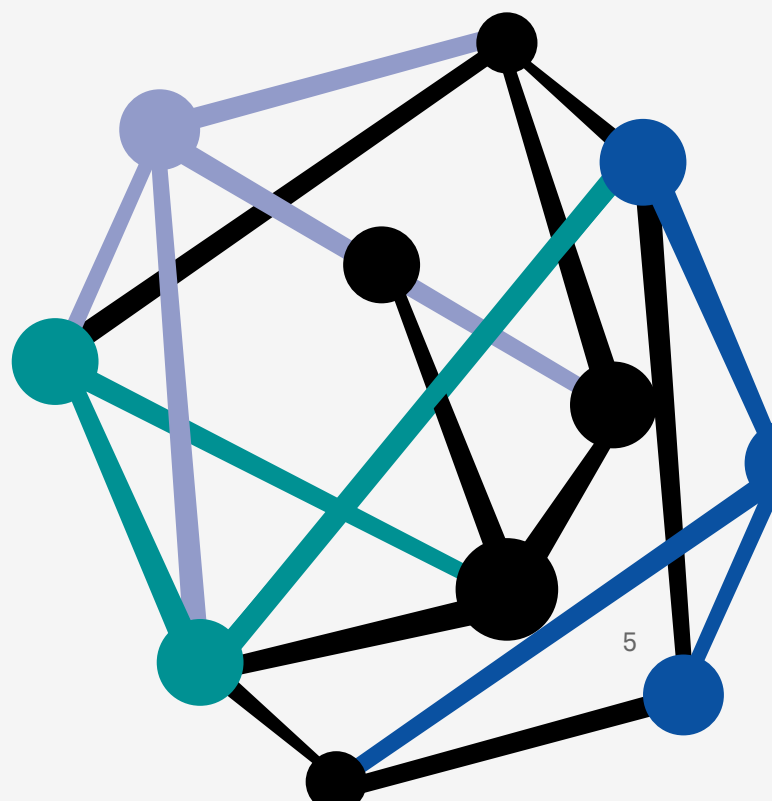
Solution self-service

Business applications, historically, are built by large internal IT teams or external vendors and are expensive to develop, license, and maintain. Enter data platforms and standard API access layers. These are the building blocks of the rising citizen developer – an end user who creates new business tools or workflows for consumption by themselves and others using data platforms and runtime environments endorsed by their IT organization. This contrasts to the in-house solutions they may have built in the past using spreadsheets and small databases, typically without the approval, awareness, and support of IT.

With today's self-service business intelligence and data visualization solutions, little to no coding experience for building applications is needed. This can be likened to the iPhone and Android app development platforms. Those platforms have eliminated barriers to application creation and now inventors can dream up and deliver tools to a global user base. Individuals are now empowered to create their own business solutions to address their daily problems rather than wait for IT to find a solution. Through citizen development, corporate IT can partner with the business to deliver the data and APIs without putting extra load on the IT organization while improving cost and enhancing end-user empowerment.

In summary, to tap the potential of a business, start by unleashing its data. Build the initial platform and choose your harvesting tools. Let it grow as your business grows. But, before you get started, take a moment and think of what would you ask your business if it could answer you?

This paper is the second in a series to help energy companies embrace business agility through cloud adoption. *Unleashing Upstream Data follows Cloud Nimble: Step 1 for Upstream Oil and Gas Business.*

About the authors

Jay Brown has more than 25 years' experience in oil and gas IT consulting on the operator and vendor sides. Most of his career has been associated with delivering and supporting enterprise data solutions of all types but primarily in the subsurface space with companies ranging from small independents to supermajors. He is a senior manager in the Exploration practice within Wipro's Energy, Natural Resources, Utilities, Engineering and Construction business unit.

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Silvia Cambie has more than 15 years' experience in emerging tech, cloud, AI, and machine learning. At Wipro, she leads digital transformation projects focusing on the energy sector. In her work with IBM Watson before joining Wipro, she learned the power of applying creativity to the way we train machines: the world's AI journey is in its early days, and keeping an open mind counts most. Silvia has also consulted for financial services and telco. Silvia speaks five languages and frequently keynotes international conferences. For the past thirteen years, she has been blogging on tech and its impact on the workplace.

References

[1]Quote attributed to author Steve Hardy

[2]https://www.jbs.cam.ac.uk/insight/2020/the-economist-a-grim-outlook/

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