Master big data to optimize the oil and gas lifecycle

Information management and analytics (IM&A) helps move decisions from reactive to predictive
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The ongoing challenge is to find the best ways to make data, technology, people, and processes more cost-efficient.
Getting a handle on big data

The evolution of technology, coupled with the need to explore and produce oil and gas more efficiently, continues to change the way the industry operates. The ongoing challenge is to find the best ways to make data, technology, people, and processes more cost-efficient. Unleashing the power of data with information management and analytics (IM&A) solutions is a critical means to enable oil and gas firms to use information strategically to reduce time to first oil, lower operating costs, and improve all areas of the oil and gas lifecycle.

The sheer volume of data in both oil and gas segments is being driven by control systems that generate thousands of transactions per minute as well as by devices and sensors that generate terabytes of data per hour. Upstream oil and gas is highly competitive in planning, exploration, delineation, and development of the fields. The immense amount of data originating from sensors and control systems helps companies to retain a competitive position. On the downstream side, sensor data levels are increasing exponentially. Leveraging this data to maximize production with regard to maintenance and forecasting is becoming increasingly critical due to volatility in the market.

Further, the variety, frequency, and complexity of oil and gas data are accelerating:

• **Greater variety** – driven by enterprise systems that provide open-form text data, audio and video files, blog posts, comments and paper files captured in the field, and data from Enterprise Resource Planning (ERP) system integration and filtering
• **Faster frequency** – driven by shorter batch processing cycles (day, hour, and minute), complex event processing, and real-time streaming
• **Higher complexity** – driven by precisely calculated values and measurements, analytics provided from audio and video, data integration across multiple vendors and systems, and the increasing need to get analytics from search systems

Leveraging information to make better decisions

Having effective information and managing data properly is vital to all business activities. IM&A enables the integration of common and disparate data sets to produce meaningful information for fact-based decision-making – in turn reducing financial, legal, technical, and operational risks. When acted on properly, data also has the potential to optimize all three phases of exploration, development, and production. Rather than just providing simple transactional support, IM&A solutions help transform decision-making from reactive to proactive.

IM&A enables better business outcomes by:

• Accelerating exploration and production (E&P) cycle times
• Increasing the productivity of assets across their lifecycles
• Applying advanced business intelligence and embedded analytics
• Ensuring the right information is available to the workforce at the right time
• Improving planning and forecasting results

Enterprise information management

A comprehensive IM&A solution for oil and gas companies provides both enterprise information management (EIM) as well as operational IM&A capabilities. EIM allows oil and gas companies to take a holistic, enterprise-wide view of their information management requirements and develop a strategy where IM&A facilitates distributed collaborative working practices and information-rich working environments for informed decision-making.

Comprehensive architecture

Key to the successful implementation of an EIM strategy is an architecture that encompasses the enterprise information framework. This includes the use of both a service-oriented
architecture (SOA) and enterprise service buses (ESBs) to enable source data aggregation and integration in the most usable form. An integrated operation architecture is becoming increasingly important to oil and gas companies as systems leverage the same data sets for multiple business purposes. Scalability is also becoming more critical as data volumes, granularity, and frequency all increase.

**Operational IM&A**

Operational IM&A supports operational efficiency, asset management, decision-making, and regulatory compliance initiatives. Such capabilities are significant as the upstream segment becomes even more competitive and the downstream segment manages ongoing changes in production based on market pricing.

By using the near real-time or real-time data and analytical tools, IM&A helps upstream clients obtain accurate information. Precise information reduces drilling activities and the time to oil and gas. It has the potential to increase or enhance existing production rates. Additionally, operators can become more proactive than reactive to field operations. For downstream operators, operational IM&A provides an ability to optimize production real-time and reduce unplanned downtime.

**Pattern recognition in unstructured data**

IM&A now extends beyond a traditional focus on structured business intelligence data to include unstructured data. This is being driven by:

- **Increased numbers of data capture points** – which has increased the volume of data that needs to be quickly analyzed
- **Real-time monitoring and control** – which demands more subtle pattern recognition and trending capabilities to detect operational anomalies
- **Heavy levels of data integration and analytics** – to forecast and balance supply and demand
- **More comprehensive and detailed incident management documentation** – to meet regulatory and compliance requirements related to information management data retention, security, and privacy
- **Condition-based maintenance** – which requires that structured real-time operating data be linked with unstructured drawings and engineering documents

Recognizing patterns in unstructured data is critical to the way IM&A can improve oil and gas operations. For example, IM&A can compare real-time sensor readings against mined patterns taken from the historical database through base analytics or enhanced visualization techniques. Companies are able to identify issues and root causes in massive volumes of information, then identify and implement appropriate actions that will treat the cause upon detecting the pattern, rather than waiting for a crisis to trigger action.

**Optimizing all phases**

IM&A helps optimize exploration, development, and production operations while providing better outcomes all along the lifecycle.

**Exploration**

The challenge in exploration is to provide quick, seamless, and automated access to structured and unstructured seismic data for geophysical interpretation. This linkage enables geotechnical professionals to understand the context in which seismic surveys were conducted, and it makes supplementary information available in real-time to support the decision-making process. Additional benefits are gained when well master data is integrated with unstructured information. Correlating seismic and well production data is critical to enable unified production and profitability analysis.

By integrating and potentially mobilizing this information, oil and gas firms can optimize processes by providing collaborative information and integrating seismic data management with unstructured information. This supports data preservation, data quality, data accessibility, and real-time process refresh.

For clients performing seismic studies, HP has gone a step further by supporting high fidelity seismic data capture by incorporating HP accelerometers. These wireless self-powered accelerometers provide greater density of information, which results in increased visibility and clarity to support geotechnical analysis.

In support of this, unstructured exploration data can be linked with structured data using an advanced IM&A solution, such as HP Autonomy. This process involves linking exploration data and producing analytics on unstructured metadata to improve metadata quality, leading to a higher success rate in finding economic reserves faster, performing indexing and metadata tagging on the fly, and ingesting the data in place. This can help the company make more informed business decisions regarding the economic viability of potential reservoirs, be they conventional or non-conventional.
Development

Development phase optimization includes overall asset development, product lifecycle management, and asset lifecycle management techniques – with a focus on reducing the duration of the development cycle. Optimizing the supply chain in support of development phase activities includes capturing and validating information for drilling, well development, facilities development, topsides development, geophysical data, and security efforts related to the access of control data. IM&A supports analysis of data by following or leveraging client or industry-based standards. Compliance with standards ensures information management capabilities are implemented and supportable over the long term.

While current IM&A offerings can deliver strong benefits, HP is working with clients to expand on the results and potential. HP is piloting the deployment of additional sensing capabilities during the drilling process, which would allow more detailed subsurface information to be gathered and correlated with information originating from control and historian systems. Enhanced benefits from the initial results include:

• Provisioning of additional data that supports flow rate analysis
• Capturing out-of-bounds activities during well phase completion
• Establishing a broader information base for use in pattern recognition of undesired events

HP leverages information gathered at the development site to enhance results obtained during the drilling process. Using complex algorithms that correlate multiple information sources, clients can identify signatures and patterns associated with undesirable results. Information is then fed back into automated or manual control processes to either capture potential events in real time or address needed process changes to avoid suboptimal results.

Production

IM&A solutions help clients focus on uptime and production optimization for both upstream and downstream operations. Oil and gas companies can identify appropriate signatures through the use of HP-developed algorithms to analyze information from multiple control systems and data histories. These algorithms are then implemented in appropriate real-time control systems to act automatically, or support manual processes for intervention or process change.

Around the world, oil and gas companies are working to optimize results (such as uptime) with condition-based maintenance techniques involving the linkage and analysis of real-time operating data with asset maintenance and inspection data. The increased use of mobility solutions, whether based on common mobile devices or sophisticated machine-to-machine systems, provides another set of potential data streams for either analysis or condition-based monitoring activities.

In support of this, the trend toward an integrated operations model – providing common, standardized data for improved processes and enhancing the ability to detect, analyze, and show trends in operational data aberrations – helps to significantly facilitate optimizing uptime. For example, by leveraging a predictive and preventative model, oil and gas companies can better determine if a piece of equipment is degrading or requires inspection or maintenance, or should have its primary duty changed based on fatigue or power cycles.

IM&A here focuses on uptime and production optimization for both upstream and downstream operations. Optimizing uptime relies on condition-based maintenance techniques involving linkage and analysis of real-time operating data with asset (maintenance and inspection) data on the structured side to reduce or eliminate suboptimal results.
outages and downtime. The increased use of mobile sensor solutions (e.g., machine-to-machine [M2M]) for condition-based sensing provides important new data streams for analysis.

**Compliance and incident response**

The increased web of local, state, and federal regulations that change and mature with increasing activity in nonconventional assets has increased compliance requirements across the oil and gas lifecycle. Documentation and the ability to show traceability across structured and unstructured information helps demonstrate what activity happened and when so it is clear when the energy firm has completed the steps necessary to avoid incidents, mitigate impacts, resolve problems, and prevent similar incidents in the future.

It should be noted that IM&A can go beyond the organization’s own operations and performance to include unstructured data feeds from social media and other public sources. Such capabilities help companies better manage an incident by capturing and analyzing public opinion as well as evaluating and responding to loud and influential groups.

**Key IM&A capabilities for oil and gas**

An effective IM&A solution for oil and gas should provide several important capabilities:

- **Management of high-frequency data streams** – This provides complex event processing, real-time orientation and streaming, data analysis, data visualization, and pattern recognition on the fly, as well as live business and production intelligence.

- **Contextual integration of structured and unstructured data** – The business challenge is to enable quick, seamless, and automated access to structured and unstructured exploration data to support geotechnical analysis activities.

- **Data visualization** – This provides the ability to exploit, view, analyze, interpret, and export available data. It involves determining if data is being displayed optimally. Workforce productivity means the right data at the right time in the right way and helps optimize the effectiveness of geotechnical resources. In addition, there is an increased use of multimedia, 3-D and 4-D imaging related to seismic processing, and videos and photos (using mobility) sent to experts who can then make recommendations based on that real-time shared data.

- **Data volume and variety** – Increased sensor deployment and integrated predictive analytics over multiple sources of data present an unprecedented opportunity. Control systems generate thousands of transactions per minute, and sensors generate terabytes of data per hour. Examples include enterprise systems that provide open-form text, audio, and video data files used for recording; videos, blogs, posts, comments, and paper files captured in field; and ERP system integration and filtering.

- **Integrated operations** – There is an increasing need to integrate data across multiple systems and to obtain complex analytics from search systems. Standardized data application availability and access across geographies enhance workforce productivity. Engineers, no matter where they are located, need to have access to the same applications and same data.

**Integrating operations**

IM&A provides a framework of processes, technologies, and applications to enable optimization and enhanced decision-making support for the oil and gas industry. Our years of experience include building IM&A solutions that integrate collaboration and visualization with information management and business intelligence. The HP approach includes:

- **Strategy management and planning** – bringing together technical and business aspects of the organization to conduct the detailed planning and prioritization needed for an effective integrated operations program

- **Workflows and processes** – implementation of configurable business processes

- **Data management** – the development and maintenance of processes and tools to ensure data is captured, stored, and made available consistently across an organization

- **Quality management** – creating the organizational structure, processes, and procedures, and technical architecture for identifying, monitoring, reporting, and improving the quality of information

- **Data integration** – a solid foundation for sharing data across the organization

**Building a comprehensive IM&A solution**

IM&A solutions can make an expansive and positive impact across all phases of oil and gas. To realize these impacts, both a robust operational database and an analytics platform designed to handle large volumes of streaming and historical data are required. The approach taken by HP in working with our oil and gas clients is to mine and collect historical data for patterns, analyze and correlate for root causes, and compare real-time sensor readings against mined patterns. To deliver this broad big data capability, HP combines process and capability with two key technologies: HP Vertica and HP Autonomy.
The IM&A portfolio extends from up-front enterprise information management consulting to implementation of IM&A solutions at the enterprise level. HP integrates its algorithmic analysis capabilities from HP Labs and Enterprise Services with the HP Vertica platform for real-time structured data analytics and HP Autonomy for optimizing unstructured data analytics.

**HP Vertica**

HP combines the Vertica analytics platform with our analytical technical capabilities and years of oil and gas industry experience. HP Vertica stores structured data that can be queried using standard languages such as SQL. It also functions as a real-time analytics platform and is used to answer business questions about data. In fact, the database can be queried while simultaneously streaming data in real time.

**HP Autonomy**

HP Autonomy excels at managing unstructured data. It enables oil and gas to process human data – social media, video, audio, email, text, documents, and images – from external and internal sources. This provides a single, common platform for meaning-based computing. It provides a conceptual and contextual understanding of structured and unstructured data regardless of format or language, instantly analyzing data from 1,000 different content formats (including text, HTML, voice, and video) and securely connecting to more than 400 different repositories. At the heart of HP Autonomy software is the Intelligent Data Operating Layer (IDOL), a highly scalable technology that supports the most demanding security requirements.

Working together, our IM&A processes and capabilities integrate with Vertica and Autonomy to provide advanced, cost-effective solutions that enable you to upgrade platforms, as well as connect and support the analysis of vast amounts of structured and unstructured operational and strategic data. These solutions are tailored to your needs with virtually no setup or manual tuning required.

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**Conclusion**

To become one of tomorrow’s market leaders, oil and gas firms must unlock the value within the huge amounts of data they have. HP can help these companies leverage the power of technology to capitalize on, not simply adapt to, challenges involving the management of this wealth of information. By implementing robust operational data stores for structured and unstructured information combined with powerful analytics platform capabilities designed to handle large volumes of streaming and historical data, firms can reduce time to oil and improve operational results.

To learn about solutions that can help you optimize your oil and gas value chain, visit [hp.com/go/oilgas](http://hp.com/go/oilgas).