WHITE PAPER

Intelligent Asset Inspection in O&G: The path to efficiency

Abstract

Profitability in the oil and gas (O&G) industry is closely linked with asset uptime. However, O&G assets including drilling rigs, production facilities, transportation networks, storage tanks and pumping stations are a part of a complex network of fixed and moving equipment. Faced with global uncertainties in supply and demand, the O&G industry needs to take a proactive and cost-effective approach to asset management. This requires leveraging digitalization and cognitive technologies to enable actionable intelligence and transition. In addition, the era of Business 4.0 demands data enabled decision-making for improved operational procedures, reduced costs, and increased revenues. This requires continuous data and model updates based on the latest changes in assets and decision support systems. In addition, as data is available in petabytes it needs to be verified, classified and organized in the right format for accurate decision-making.

This requires gathering large amounts of data through various acquisition methods including physical inspection, satellites, fixed wing aircrafts, drones, Internet of Things systems, SCADA, and integrating operational technology data and enterprise (IT) data for actionable decision-making. Asset inspection is key to gaining accurate insights into day-to-day operational processes and maintaining up to date status information for efficient and secure operations. High quality inspection data not only helps in planned asset upgrades but also helps improve maintenance for medium to long range planning.

This paper throws light on the intelligent asset management framework in O&G for acquiring, processing, updating, maintaining and reporting a complex set of data for effective integration and decision-making.

Building O&G digital enterprise on a connected ecosystem

As the oil and gas industry seeks to increase business performance through end to end digitization, they are increasingly leveraging a gamut of technologies from the Internet of Things (IoT), to cloud computing, edge connectivity, and advanced data analytics. For instance, IoT in O&G industry supports digital connectivity of physical devices for systematic support and integrating data and remote controls. Similarly, cloud computing helps store and manage data while reducing infrastructure cost, and edge computing elevates connectivity with intelligent devices for real-time, on-site, autonomous decision-making. However, for O&G organizations to deliver on the promise of a digital enterprise, data should be of high quality so that it can be easily verified and referenced. However, most companies lack quality data that can be easily organized and is traceable. Additionally, the growing interest in the ways new data is acquired from existing assets through more advanced inspection programs has created a pressing need for better guidelines and clear responsibilities for data ownership.

Digital O&G enterprises (see Figure 1) need to build on a strong ecosystem that enables information integration and creates actionable output. The ecosystem must allow for the availability of information and action to the right entity in the right context at the appropriate time for effective decision-making. Integration and distribution availability to all in the enterprise i.e. data democratization is the foundation of a digital enterprise.

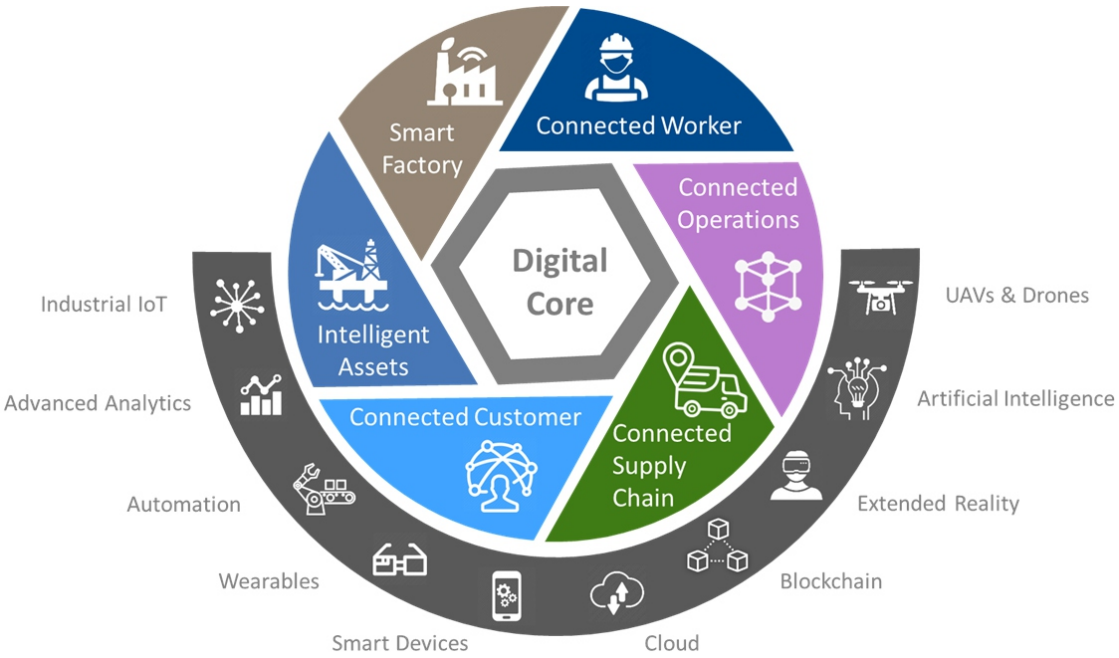

Figure 1: Digital core of a connected O&G ecosystem

A connected ecosystem built on a digital core that incorporates the latest advancements in data acquisition and business activities helps create a data asset that delivers value from digitization, automation and analytics. It is also the reason why good data is important to the process. A connected ecosystem coupled with comprehensive data management can help companies collect data through intelligent asset inspection, enable data storage and processing and conduct analytics for drawing business insights and integration. As data acquisition is a constant undertaking in the O&G industry from initial manual readings to IoT solutions, leveraging an asset inspection program helps distinguish data based on the asset and the reason for monitoring as well as the frequency.

In addition, producing an asset requires a number of sub assets that necessitate continuous intervention for enhanced operational efficiency. Typically, prioritizing what part of the asset to address is based on parameters such as first in – first out and highest throughput. As this is time consuming and non-profitable, integrating reliable, relevant and timely operational asset related data with enterprise data based on cost of operations and depreciation helps change prioritization based on profit contribution. For example, in prioritizing an oil field with a few 100 wells, there will always be a number of wells that are not producing due to maintenance, equipment failure or other reasons. The field maintenance organization has limited resource and needs to prioritize which of these wells to get back on line first. Today, this decision is often based on which well produces the most hydrocarbon and not on the profitability of the various wells due to lack of easily accessible or timely information. In a digital Business 4.0 world, this becomes a huge limitation.

Another example might be from the auto racing world such as Formula One. Here, the asset (the car) is operated by one person relying on information provided by the asset. A team of engineers and data analysts get real time data from the asset, compare it with historical data for both the asset and the operator in order to gain fractions of seconds of improvements in lap times and relay this back to the operator. The team management makes the decisions that have instant impact based on the data and platform that delivers accurate, accessible, relevant, timely information on a continuous basis.

The data acquired upstream is often not transactional in nature but has measurements that contain critical information. For example, a seismic trace recorded digitally might contain frequency information, which is a reflection of the earth layers passed through signals. The strength of those signals is also

measured in amplitude of the response. Clear data storage and processing helps trace the origin and preserve the acquisition parameter for reprocessing the data with newer algorithms or new technology. Data automation, analytics and business insights for predictive or preventive actions eliminates the need to verify the data.

Capturing the next frontier of value: Intelligent asset inspection in Oil & Gas

Intelligent asset inspection helps understand the operational status of a modern asset in the O&G industry. For this, organizations require inputs from multiple sources of data such as aerial surveillance, sub-surface surveillance, remote monitoring, remote sensing, SCADA, and manual or visual inspections. This data is then integrated with back office (IT) and smart data is stored for photogrammetry and thermal imaging. This helps companies generate machine learning algorithms and derive actionable insights for improved decision-making (see Figure 2).

For instance, companies can leverage intelligent asset inspection for successful adoption of digital models such as digital twins for planning and monitoring existing assets. An intelligent asset inspection program can help companies keep the digital twin of an asset current with every data change in the model. This makes it useful for real time monitoring and simulation scenarios. Organizations can also use inspections at appropriate frequency with appropriate sensors to keep the model up to date.

Similarly, a production facility or refinery can conduct asset mapping through satellites and drones, and build a digital representation of the asset. The data from the internal pipeline data acquisition system (pig) and other sources can then be stored in context aware storage to generate insights and feedback for anomaly detection. Such an intelligent asset inspection program can also use IT data for financials and supply chain information to drive improved operational performance across the organization.

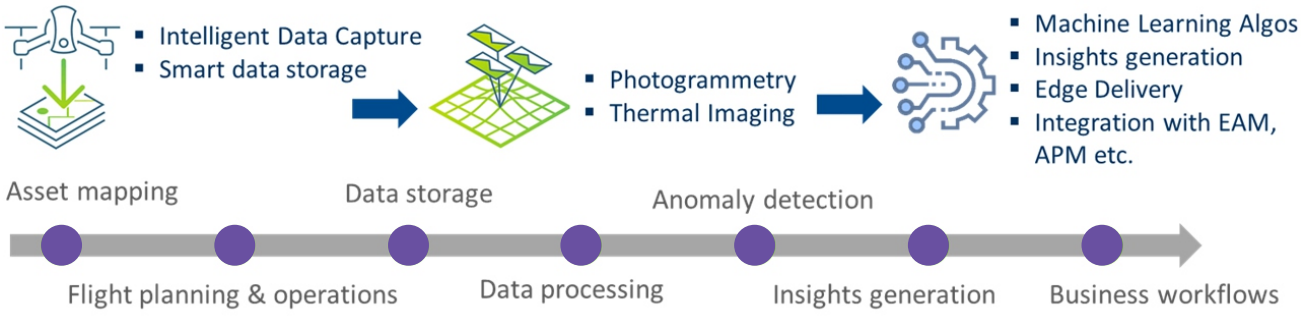

Figure 2: Intelligent asset inspection program

Another significant demand driver for more accurate and frequent update of asset status is the increasing age of the current infrastructure. Today, roughly 63% of oil field assets are past 50% of their expected lifetime. Clearly, the O&G workplace is hazardous, putting employees' lives at risk on a daily basis.

This when the governments and public alike have negligible tolerance for any accidents and regulatory requirements for asset reporting are getting more stringent.

Digital inspection of assets leveraging satellites, drones and other remote sensing devices can help reduce accident risks in high risk areas. For example, companies can conduct storage tank inspection through live data streaming and high resolution zoom-ins. This helps in accurate and precise visual inspection of structures to identify corrosion points and cracks as well as analyze deformation. Additionally, a central command and control hub can help workers update inspection strategy and send mobile alerts for superior visibility (see Figure 3).

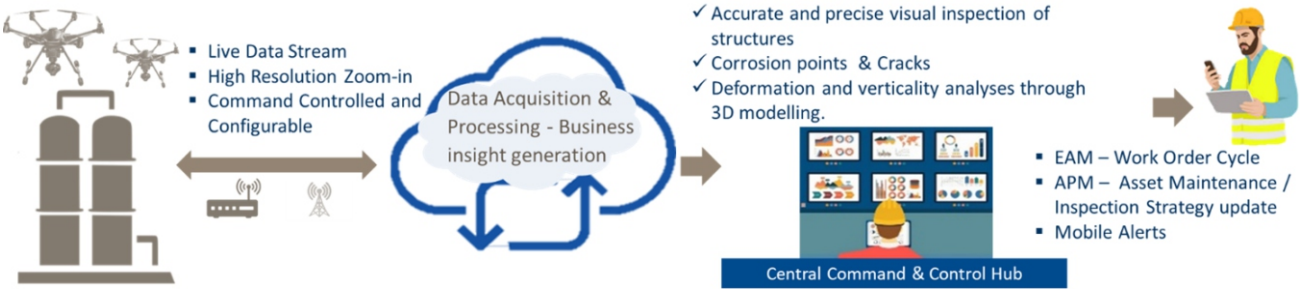

Figure 3: HSSE risk reduction in storage tank inspection

Establishing a digital foundation in O&G

A Business 4.0 enterprise is built on a digital foundation where data and information drive decisions. This requires establishing a digital foundation all the way from data ingestion through decision support systems and strategy to execution. A robust and agile intelligent asset inspection solution is the way forward to get in-depth understanding and knowledge of end-to-end enterprise assets. A digital model of assets allows simulation for potential changes and upgrades, and operational monitoring of existing assets. It will serve as a single platform to manage all asset types and provide up-to-date data for enabling risk-based inspection. Risk models that are built leveraging real-time asset data help create smart inspection schedules and allocate scarce resources in a more optimized manner while delivering maximum efficiency, efficacy, and safety. This, in turn, helps build an effective information ecosystem to catapult the digital O&G enterprise towards success.

About The Author

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Jan Erik Johansson is currently the Advisor, Upstream COE, at Tata Consultancy Services' Global Oil & Gas Practice. Formerly, he worked as Operations Manager, Senior Consultant and Practice Manager for the world largest Oilfield Service Company Schlumberger based in multiple countries across the world. He is an active member of the Society of Petroleum Engineers (SPE), American Association of Petroleum Geologists (AAPG) and American Association of Mechanical Engineering (AIMEE).

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