DIGITAL TRANSFORMATION IN UPSTREAM OIL AND GAS

Digital technology is transforming the oil and gas industry, improving efficiencies and boosting safety. By **Loren Sjoquist**, director digital transformation and strategic accounts, Emerson Automation Solutions, Asia Pacific.

FOR THE PAST several years, volatile market prices have been forcing oil and gas companies to rethink the way they do business — sidelining their traditional field development and drilling philosophies for productivity–focused, data–driven analysis.

In terms of achieving operational excellence, it is a complete reconsideration of how technologies, processes and personnel play a role in achieving sustainable business success.

This paradigm shift has incited a deeper need for the industry to digitally transform itself through widespread adoption and integration of equipment and systems that leverage the Industrial Internet of Things (IIoT) to

enhance operational performance and drive profitable results.

For upstream oil and gas operators, the need is more imperative due to the asset intensity of the industry, its remote operations and the hazardous environments in which its workers function.

Achieving operational excellence in this sector often requires the elimination of manual processes, siloed decision support tools and inefficient operational practices to maximise production, reduce costs and improve safety.

Of course, it also requires a reversal of the traditional industry–wide mindset of maintaining the status quo, which has fostered a skeptical approach to automation and digitalisation where

risk–averse companies sometimes eschew operational excellence practices and supporting technologies because they believe they are too difficult to adopt or are not practical for their day to day operations.

This leaves many oil and gas operations stuck in a devolutionary cycle of using outdated, unreliable, and completely inefficient systems to perform some of their most common and critical work — thereby costing millions in unrealised revenue and putting them further behind peers in terms of profit margin, operational efficiency and workplace safety.

However, the wave of digital transformation is steadily gaining momentum across the industry, and more companies are seeking
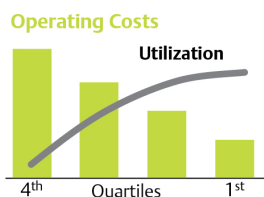
Safety

3X fewer recordables
and process incidents

Recordables

Process Incidents

4th   Quartiles   1st
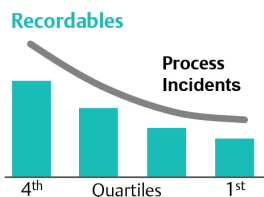
Production

30% lower
operating costs

Operating Costs
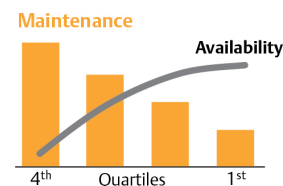
Utilization

4th   Quartiles   1st

Approximately ——
ONE TRILLION DOLLARS
in company value is lost every year to suboptimal operating performance ——
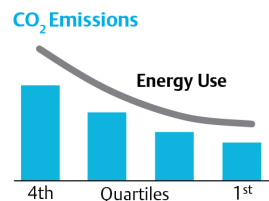
Reliability

4% higher
availability

Half the maintenance costs

Maintenance

Availability

4th   Quartiles   1st

Emissions

30% lower
emissions

15% less
energy use

CO_2 Emissions

Energy Use

4th   Quartiles   1st

digital enhancements to achieve more sustainable business success in parallel with those among the industry's Top Quartile performers— achieving performance within the top 25 percent of peer companies.

In the upstream oil and gas sector, these enhancements often include: wireless sensors and remote field intelligence; enhanced connectivity to communicate actionable and timely insight into the performance of fields and field assets; IIoT-based software to gather and manage data; optimised work processes and logistics; and perhaps most of all, guidance and consulting to shepherd them on their transformative journey.

Operational Enhancements To Maximise Production
Outdated and ineffective equipment, time-consuming manual processes and a lack of reliable and actionable data can hinder decision-making and negatively impact production for upstream oil and gas producers.

Where this is most relevant is in oil field production forecasting where upstream operations have typically struggled to rectify well dynamics and flow ratios with the limited geologic data available to them at the time.

With digital production modelling systems, such as Emerson's Paradigm Production Modelling solution, operators now have the ability to quickly and accurately model production in a way that better reflects the realities of the subsurface, without the computational cost

and complexity of a full physics fluid simulation.

It provides a dependable, high-definition production forecast that asset managers can use to make daily field optimisation decisions.

For operations that rely on various forms of artificial lift, there are digital solutions to help them optimise these processes and allocate energy to the most productive wells.

Emerson provides a selection of well and lift optimisation solutions, like its SmartProcess Well Optimiser application, that provide needed insight into the lift methods themselves and allow asset managers to make optimised decisions based upon a real-time comparison of production rates versus targets.

For gas lift and Electric Submersible Pump (ESP) systems, the company offers a model-based Dynamic Lift Optimisation (DLO) solution that automatically allocates lift energy to the most profitable wells while also considering physical and economic constraints in the system.

Since production is also greatly affected by the conditions of the surface or equipment, producers can utilise digital technologies to gain real-time insight into equipment health.

Improved Asset Insight To Reduce Costs
Keeping upstream assets healthy and functioning properly is not only a function of increasing or optimising production but also of

minimising operational expenses, where maintenance costs have a significant impact.

Traditionally, producers relied on occasional manual inspections in often hazardous conditions to determine asset health and performance, and the lack of comprehensive insight typically resulted in a run-to-fail approach that cost exorbitant amounts of time and money to replace assets and restart the operation.

Today, producers can employ remote monitoring and diagnostics capabilities as a digital response to excessive maintenance expenses. Pervasive sensing devices provide the type of real-time insight companies have needed to adequately assess and address their assets' health and performance.

These capabilities are included in several asset management solutions, and are further realised with aggregated process analytics and predictive maintenance systems that can help asset managers adopt more proactive and less-costly approaches to increasing asset uptime.

Another function of reducing maintenance costs is having the ability to identify the most profitable wells and building a streamlined maintenance program that prioritises repairs based upon production and efficiency.

Emerson's Automated Production Surveillance solution includes a Marginal Well Identification Workflow application that captures all costs on a per-well basis, whether variable (water disposal, chemical injection,

artificial lift) or fixed (well operation, field overhead, administrative costs), and prioritises wells for maintenance activity or a potential shut–in (to shift costs to other wells).

To help customers capitalise on digital solutions for reducing asset downtime and maintenance costs, Emerson's Connected Services provide remote expertise to monitor assets, interpret results and provide actionable information so oil and gas producers can align their maintenance and operational responses with their business strategies.

Wireless And IIoT Technologies To Improve Safety

Perhaps the most significant benefit of digitally transforming upstream oil and gas operations is minimising Health, Safety and Environmental (HSE) risk. Manual reporting systems are rapidly being replaced by digital operator rounds that record data automatically and transmit it to a historian or operator software module.

Personnel no longer need to waste time and jeopardise their health and safety by working in remote and often hazardous locations to obtain measurement or performance data that they can now access remotely through wireless sensors and then upload it to an administrative cloud system through an IIoT–based platform.

The use of connected Wi–Fi and Bluetooth–enabled smart devices and integrated data management systems around work sites is becoming more prevalent, giving rise to digital

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mustering and personnel location systems and procedures for more effective workplace safety practices.

In short, the speed and efficiency of digital technologies and systems is facilitating a more effective collection, transmission and analysis of workplace data to foster a safer and more productive environment for today's oil and gas personnel.

But this digital transformation is also facilitating a safer environment through early detection of erosion, corrosion, cavitation and other factors that can lead to leaks, ruptures or explosions at well sites and points of transmission.

With wireless corrosion and erosion detection solutions, technicians can continuously monitor their assets intrusively or non–intrusively to identify early signs of metal loss and prevent equipment degradation.

Preparing The Digital Workforce

Aside from all the products and solutions that can impact the digitalisation of upstream oil and gas operations, a digital transformation also includes the integration and training of key personnel as well as enhancing processes and procedures

to facilitate these changes and ensure an efficient transition for the entire operational culture.

With the help of educational services, oil and gas producers can better equip their personnel by training them to use: automated workflows to eliminate repetitive tasks and streamline standard operations; decision support practices that leverage analytics and embedded expertise to reduce complexity and enable optimal decision–making; and mobile solutions that provide secure, on–demand access to information and expertise regardless of location.

One of the more effective models through which this training is accomplished is the use of a high–fidelity digital twin simulator as part of Emerson's Mimic Simulation Software solution.

The digital twin typically provides a virtual platform that allows companies to test proposed adjustments in a risk–free, real–time environment by creating an exact digital replica of the live operation.

As part of the Mimic solution, this dynamic simulation can be used in an advanced training module for new or inexperienced operators. By working in a digital, real–time environment, trainees can make decisions and perform advanced modelling and analytics without affecting production of the actual operation.

The digital twin model is also used in Virtual Reality (VR) field operators training for manual task learning, which also integrates with the Mimic process simulation. ⓘⓡ

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