



Why APM Is Critical to Operational Excellence in the Oil & Gas Industries

Even as prices for oil continue to fluctuate around market lows, for much of the Oil & Gas industry the challenges being faced are far broader; skilled labor challenges in some regions, sustainability, corporate social responsibility and pressure to improve safety are among the major trends.



In this environment Operational Excellence emerges as a key initiative, and one of the most cost-effective programs a company can undertake to drive Operational Excellence is Asset Performance Management (APM). The axiom that “healthy assets are the foundation of a healthy business” is truer now in the Oil & Gas industry than ever before. However, many companies in the industry are struggling to gain the maximum return from their APM investments and asset health remains a challenge. To overcome the industry’s challenges Oil & Gas companies must:

- Understand how the digital technologies will transform the industry and what the advent of Smart Connected Assets means to an organization’s pursuit of Operational Excellence.
- Determine which new technologies have the most benefit in their particular position in the Oil & Gas value stream.
- Develop the business case to invest in appropriate technologies to enable the deployment of Smart Connected Assets.
- Put in place a strategy to deploy those technologies to quickly deliver value from Smart Connected Assets.
- Change organizational structure and culture to leverage Smart Connected Assets investments.

The Industrial Internet of Things (IIoT), Cloud, Mobility, and Big Data and Predictive Analytics can provide greater capabilities for improved APM and should be driving Oil & Gas companies to reconsider how they get the most from their assets. It is no longer sufficient to treat production assets as a cost center to be repaired with a break-fix approach. A more proactive and predictive maintenance (PdM) strategy is the minimum acceptable approach, and a Smart Connected Asset model is the enlightened path that can move the Oil & Gas industry in a better direction.

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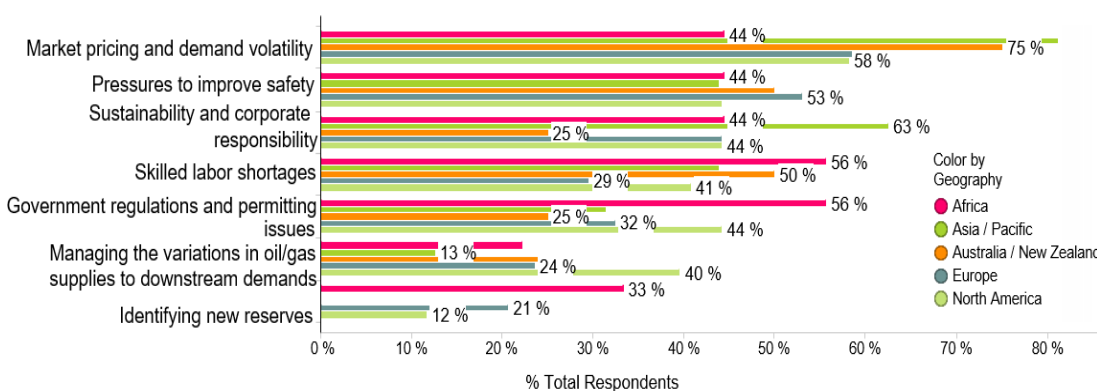
Research Spotlight

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Challenges Facing the Oil & Gas Industries

LNS Research has surveyed over 3,000 companies, of which approximately 275 are Oil & Gas respondents, and they indicated that the Oil & Gas industry faces challenges that are not drastically different than industry as a whole except that Operational Risk Management (ORM) is, not unexpectedly, more important in Oil & Gas as shown below.

Chart 1: What are the most important trends impacting Oil & Gas companies today?



Operational Risk Management, improving efficiency and customer service, and ensuring compliance are some of the top objectives of Oil & Gas companies today.

Of course, the challenges faced by upstream producers, midstream operations and refiners and petrochemical operations all vary significantly due to the different aspects of each segment. There are regional differences as well and differences between the Oil and Natural Gas sub-industries.

This report focuses on those segments where APM is having the greatest impact today. In particular, this report will use examples from Oil & Gas production (upstream), gas pipeline (midstream) operations and refining (downstream).

Top Operational Objectives of Oil & Gas Industries

This same group of respondents indicated their top objectives, given these challenges, were to improve efficiency, improve customer service, ensure compliance, deliver new products, and better manage operational risk, as shown on the following page.



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Chart 2: What is the top operational objective for your company? (Oil & Gas)

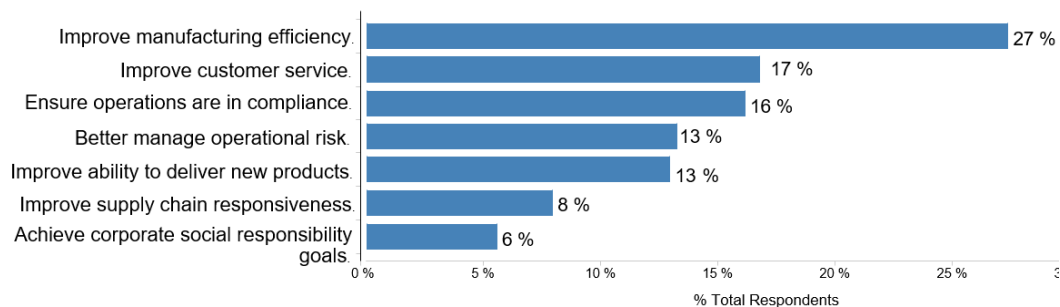
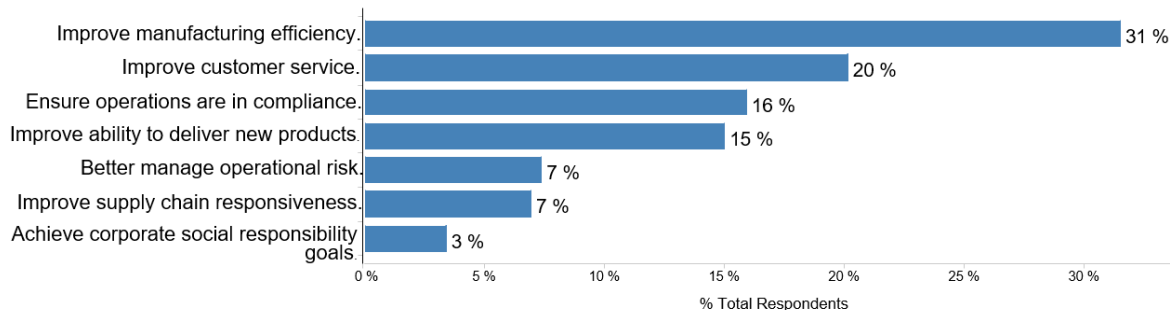


Chart 3: What is the top operational objective for your company? (All Industries)



The key to achieving these objectives is to pursue Operational Excellence.

What Is Operational Excellence?

Most businesses consider Operational Excellence as an environment that allows the achievement of optimal performance in all aspects of the business on an ongoing basis. It has its roots in different business process improvement methodologies employed over the last 30+ years including Six Sigma, Lean manufacturing, continuous improvement, business process management, and process excellence. For some companies these are all seen as synonymous while in others they are seen as part of the evolutionary path to Operational Excellence. The simple fact is that businesses have realized that they can no longer excel in a single dimension. This is particularly true in the Oil & Gas sector. Having a product in high demand but with an inability to produce it effectively is a path to failure.

In LNS Research's recent APM end-user survey respondents in the industry overwhelmingly chose improving operational performance as the number one strategic driver of their investment in APM, and 80+% named it as one of the top three drivers for investment, so it is clear that Oil & Gas businesses are focused on Operational Excellence.



The Importance of Balancing All the Pillars of Operational Excellence

Virtually every Oil & Gas company has at least five core pillars to its Operational Excellence platform which are:

- Asset Performance Management (APM)
- Energy Management
- Environmental, Health & Safety Management (EHS)
- Operations Management
- Quality Management

Figure 1 below illustrates LNS Research's view of Operational Excellence. It is constructed as a multi-dimensional platform on which an enterprise's people, processes, and technology rest.

Figure 1: The Pillars of Operational Excellence





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While the various pillars may vary in circumference, such as safety and environmental issues being critical in offshore oil production while energy efficiency being less of an issue, the fact remains that all elements of Operational Excellence must be managed to the same level of performance. If an oil or gas producer lets performance in any one leg suffer it risks the stability of its program. If it is weak in any two or more pillars the entire program risks becoming unstable and failing.

The Asset Performance Management Pillar

LNS Research's definition of APM is broad and inclusive. APM is understood as encompassing all of the processes and supporting technology that are used to ensure that the physical assets—both hardware and software—used to produce or deliver a company's goods and services operate at optimal levels.

This means those assets operate reliably, efficiently, and deliver the maximum value their capabilities allow. This includes tools like Enterprise Asset Management (EAM) or computerized maintenance management systems (CMMS), which are primarily used to schedule and manage the workforce and procure the materials required for maintenance activities, and then track and report those efforts to the real-time data acquisition used in condition-based maintenance (CBM), or even just usage based preventive maintenance (PM). All of the activities and processes between these are included, such as lubrication monitoring, vibration monitoring and analysis, thermography, and reliability centered maintenance activities (RCM), to name some common examples.

Why APM Is a Cornerstone of Operational Excellence

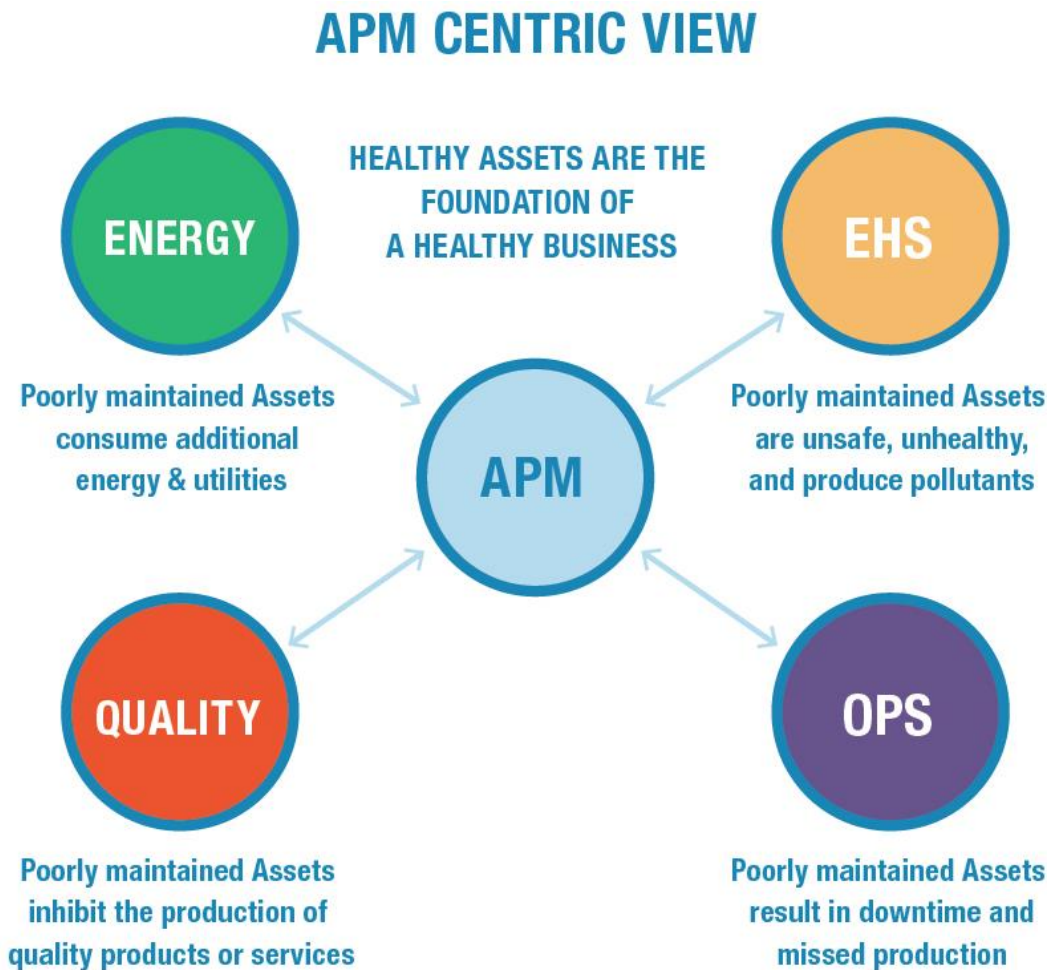
It should be obvious that machinery or equipment that is not operating properly and is prone to breakdowns is going to impact productivity. Equipment failures can also cause safety problems leading to near misses or even injury. Likewise, poorly operating equipment is often a leading contributor when exceeding emission limits and is one of the major causes of out-of-compliance performance in the area of environmental regulation in refining and other downstream operations.

Poorly maintained equipment can also be a major contributor to energy waste such as in midstream transportation areas. Also, with frequent shutdowns and startups there always exists the problem of achieving steady state, which is when both quality and safety are most easily maintained. Figure 2 on the following page summarizes the relationship APM has to the other key pillars of Operational Excellence.

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Figure 2: APM Centric View of Operational Excellence



What are Smart Connected Assets and How Do They Relate to APM in the Oil & Gas Industry?

The Industrial Internet of Things (IIoT), Cloud technology, Big Data and Predictive Analytics are combining to create an evolutionary change in manufacturing in general, and the Oil & Gas industry is no exception. LNS Research has categorized this evolution to a next-generation operational model as “Smart Connected Operations,” with the underlying production assets termed “Smart Connected Assets.” Figure 3 on the following page identifies some of the key attributes of Smart Connected Assets.

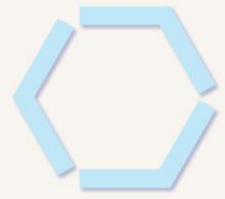


Figure 3: Smart Connected Assets Conceptual Model

SMART CONNECTED ASSETS

Converged Sensors, Instrumentation,
Controls, and Assets

REAL TIME → PREDICTIVE → AUTONOMOUS

AWARE OF AND CAN REACT TO:

- Design and Configuration
- Internal and External Operating Conditions
- Past Performance
- Predicted Future Failure
- MRO Inventory (Internal and External)
- Raw Material
- Supplier Performance
- Customer Requirements
- Environmental Impact



Smart Connected Assets in Upstream Operations

In most parts of the globe crude oil prices are so low that the focus is on keeping production costs to a minimum to maintain production viability. In regions where enhanced extraction methods are required, such as fracking or production from bitumen sands the situation is critical—many operations are now suspending or minimizing operations as costs outpace revenues. For these types of operations APM can become the tool to drive maintenance cost out of their operations by doing more with less. A CBM approach to maintenance, driven by Smart Connected Assets, allows for just-in-time (JIT) maintenance that will avoid over-maintaining equipment, avoid risk associated with EHS infractions and manage energy costs from failures while maintaining maximum productivity. It is simply a case where “an ounce of prevention is worth a pound of cure.” Smart Connected Assets enable CBM to be done cost effectively and with the lowest possible labor costs.

Smart Connected Assets in Midstream Operations

The transport step of the midstream has different drivers depending on whether companies are in the Oil or Gas sector, and whether they are transporting via carriers such as ship, rail or tanker or via pipelines. Since transportation via carrier is not unique to the Oil & Gas sector this report focuses on pipelines. As an



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example of how APM can be best leveraged in midstream operations this report employs a natural gas long distance pipeline as a case study.

Natural gas transmission by pipeline presents several challenges. Operating pressures and volumes are high and leaks associated with failures can have catastrophic results. The 2010 San Bruno California pipeline explosion continues to haunt PG&E, the pipeline owner, with ongoing fines, investigations, and criminal cases. Clearly the risks associated with a failure in a natural gas pipeline demand that pipeline operators start paying attention to the APM of these assets.

Vibration monitoring, corrosion monitoring, lubricant analysis, and performance sensing are all critical to ensure the complex pipeline system maintains proper pressures and volumes and that any abnormal conditions are flagged immediately to initiate proper maintenance actions. Safety and environmental issues are of paramount concern, but energy efficiency and proper productivity are almost as important. A coordinated management system that enables operators to have a single window into the health of the pipeline system throughout its entire length is critical, and Smart Connected Assets provide that real-time visibility critical to safe operation.

Smart Connected Assets in Downstream Operations

While energy prices are low and dramatically impacting the production aspects of the industry, downstream operations such as oil refining and natural gas processing into ammonia or other chemicals, are in some cases actually benefiting. This varies by region and by production capacity in each commodity class but in general, downstream operations are somewhat less concerned about cost minimization than most upstream operations. Like the midstream safety, environmental and energy considerations are driving the business, but quality also comes into play as the downstream plants often are the last steps in the manufacturing value chain, at least from a transformational perspective. Poorly performing assets that are prone to failure not only create issues with all of the previously mentioned areas like safety and environment, but are a major factor in failing to achieve production targets as well.

In particular, every time an oil refinery in the U.S. goes offline for unscheduled maintenance and creates a price spike for gasoline, the offending company is profiled on the evening news. Despite the revenue loss of not having production capacity the brand damage must be factored in as well. Clearly unplanned and disruptive breakdowns have multiple costs that need to be avoided. An intelligent APM strategy based on predictive maintenance, leveraging Smart Connected Assets—using CBM and RCM tools coupled with appropriate predictive analytics to assess different risk scenarios—can help refining and other downstream



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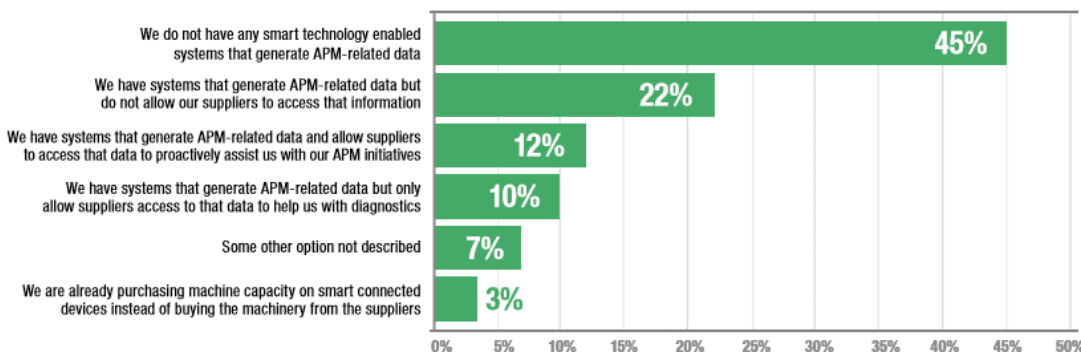
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operations maximize profit while complying with all environmental and safety related regulatory requirements.

Getting Started with the Smart Connected Asset Evolution

While the industry has been proceeding down the path of digitization for almost a decade now with the concept of the digital oil field, actual proliferation of Smart Connected Assets is progressing slowly, as shown in Chart 3 below. While this chart is for industry as a whole, the Oil & Gas sector does not vary significantly from the larger market.

Chart 3: Which statement best describes your attitude toward APM services provided by the vendors of the smart connected devices in your facility?



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The convergence of the IIoT, Mobility, Cloud and Big Data with associated Predictive Analytics is finally creating the environment where it is truly possible to have a single window into the process for both production control and asset health reasons. This single window can be extended across the entire asset train to provide an enterprise view compliments of the reality of Smart Connected Assets.

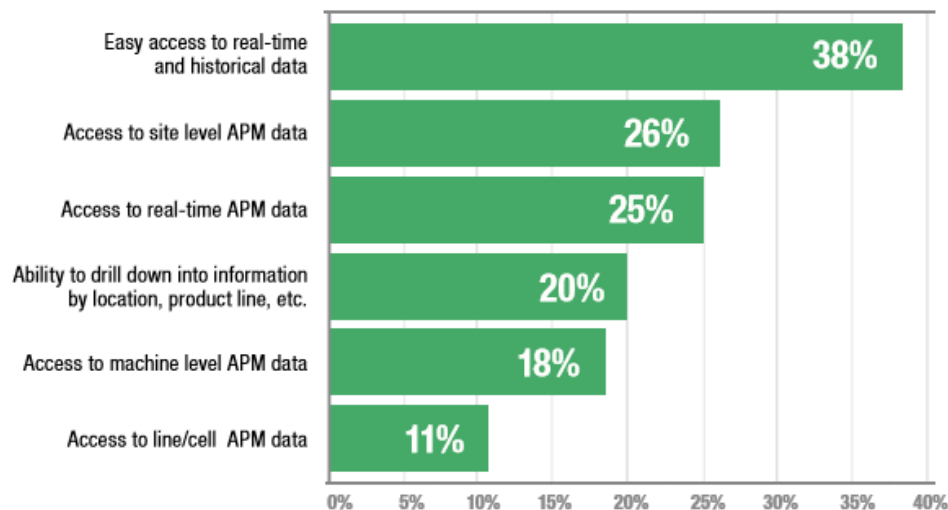
Producers that intend to survive the current turmoil in the industry understand they need to start the transition to the next generation of Oil & Gas technology or risk their eventual absorption by those providers that were savvy enough to make the leap. The data presenting the case for taking these steps exists today, as shown by over 250 respondents to the LNS Research APM survey, illustrated on the following page.



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Chart 4: How would you describe your organization's visibility into APM data in terms of granularity?



How to Leverage Smart Connected Assets in Oil & Gas

Oil & Gas companies today need to take advantage of their asset data. If the Oil & Gas industry is to continue to remain healthy and profitable in today's environment it needs to invest in Smart Connected Assets and deploy leading APM practices. To position themselves to best leverage Smart Connected Assets Oil & Gas companies need to:

- Inventory their existing asset base and understand which assets need augmentation, which have base capabilities, and which need outright replacement when it comes to the IIoT
- Design projects that leverage what exists today or can be augmented economically to achieve early successes
- Create an architecture that will allow for a rapid evolution to a Smart Connected Assets Model as technology deployment accelerates due to declining costs and greater availability
- Invest in new technology that supports the IIoT, Cloud, Mobility, and supports leveraging Big Data and Predictive Analytics, as well as identify suppliers that can help them deploy these technologies quickly and with the most cost effectiveness.

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