The Time is Right for Optimum Reliability:

Capital-Intensive Industries and Asset Performance Management

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Asset Performance Management enables a level of reliability that unlocks the tremendous value and productivity lying uncaptured in assets.

Software technology and process automation have driven tremendous efficiency and bottom-line value in asset design and asset operations for the oil and gas, chemicals and engineering and construction industries over the last 35 years. However, there is still a key aspect of these businesses that presents an enormous opportunity for value creation — asset maintenance and its impact on asset reliability.

Optimizing all aspects of a plant lifecycle (design, operate, maintain) requires putting asset reliability on par with design and operational improvement efforts. Optimum reliability is defined as the ideal asset reliability threshold that will drive a higher return on capital employed and extend the life of existing assets.

The macroeconomic environment over the last several years and the expected future macroeconomic environment (such as lower for longer or lower forever scenarios related to the price of oil) will increase competitive pressures that require these industries to find new ways to improve upon existing operational excellence initiatives. Asset reliability has increasingly risen to the top of C-level agendas as the answer.

Fortunately, a new class of technology tools have arrived to bring predictive and prescriptive power to process manufacturing and beyond. These tools fall under the category of Asset Performance Management (APM), and deliver new insights into asset and process performance. This enables a level of reliability that unlocks the tremendous value and productivity lying uncaptured in assets.

Capital-Intensive Industries Are Under Performance Pressure

There are a variety of converging trends, both economic and technological, that make this the right time for complex, capital-intensive industries to approach asset performance in a new way. These industries have historically focused on design and operational excellence throughout boom-and-bust economic cycles because there was always a clear business case. In good times, organizations looked to improve asset designs and operations to drive increased profitability. This enabled them to outperform the competition and meet ever-increasing investor expectations, and as a result, fund M&A opportunities and business expansion strategies.

In lean times, the need to sustain profitability and meet cash flow generation targets has forced cost reduction measures to ensure that core operations are meeting these goals for the enterprise. For example, even during the recent downturn, the refining and chemical businesses of integrated oil companies stepped up their focus on operational excellence to generate the profitability and cash flow necessary to sustain the broader enterprise. This trend has held true in the process industries over the last 20 to 25 years.

Recently, the pressure on these companies has significantly increased. The current market realities, along with a new group of activist investors, are forcing the process industries to focus on optimum operations and new business strategies as means to sustain expected return levels. Pressure from Wall Street and investors is also driving industry mergers and acquisitions to boost efficiencies and profitability. The merging of companies heightens the need to quickly assimilate, standardize and optimize operations to capture the expected value creation promised.

The current cycle has also increased the focus on capital cost reductions. For example, in the upstream sector, oil companies have focused on reducing their CAPEX and operational costs to lower their break-even costs, thereby generating profitability and cash flow at lower oil prices to sustain their investment strategies. These economic drivers have cemented operational excellence initiatives as the core of C-level strategy.

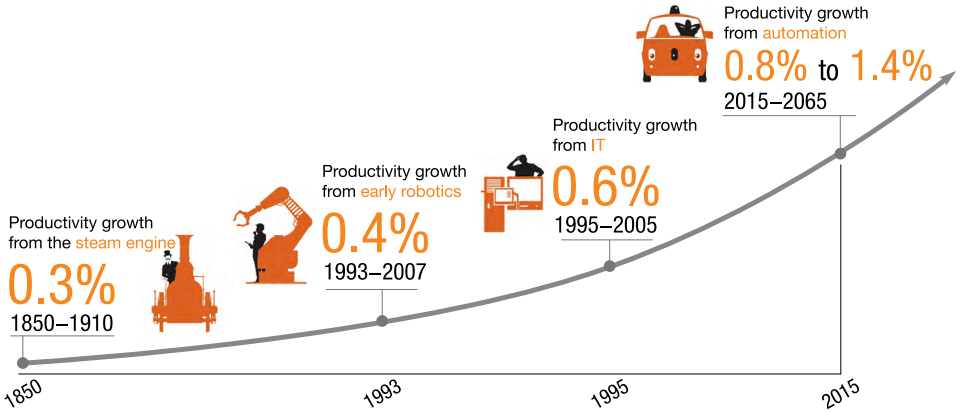
The Need to Address Asset Maintenance to Achieve Optimum Reliability

One area that has escaped this efficiency and profit maximization trend to date is asset maintenance. The reason is simple: maintenance has historically been thought of as something preventive — and in many cases reactive, unpredictable and done out of pure necessity. Maintenance in this mindset is a cost center, and not something that creates measurable value. However, with increased focus on overall asset reliability and optimization, it's logical that these businesses — regardless of location or size — would look to proactively address asset maintenance.

This is especially true as downtime and unscheduled repairs can quickly undermine the hard-won value and efficiency in place from existing optimization programs. **According to a 2015 ARC Advisory Group report, *Proactive Asset Management with IIoT and Analytics*, despite the billions of dollars spent yearly on preventative scheduled maintenance, up to 82 percent of all failures cannot be avoided using traditional preventive and condition-based monitoring maintenance techniques.**

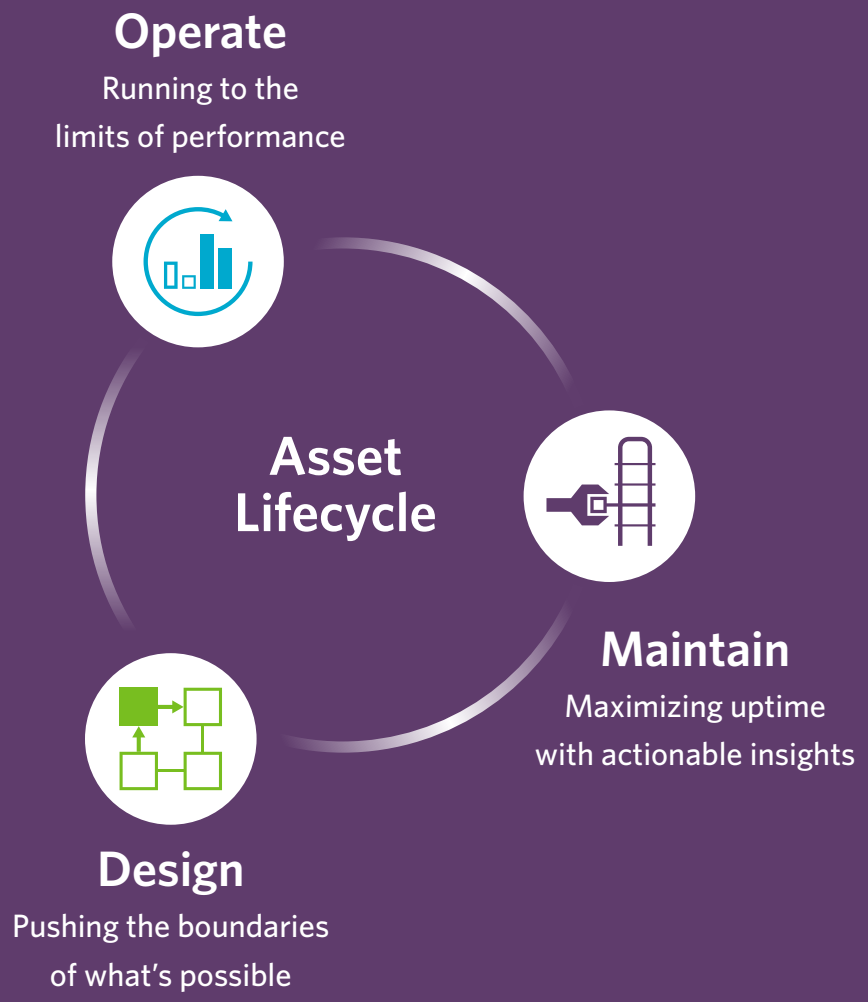
These failures don't follow a traditional time-based wear or usage failure pattern, resulting in "random" failures that cost the global process industry billions of dollars annually. In one example, a large, multi-site midstream oil and gas company experienced persistent oil well pump and pipeline compressor failures at a cost of close to $1 million USD per incident.

Organizations are embracing the need for optimum asset reliability as an executive-level responsibility, since it directly affects how the company maximizes returns on capital employed. Improving reliability positively impacts a wide range of issues, from reducing excessive maintenance costs to planning for abnormal process conditions, avoiding emergency or unplanned shutdowns and successfully managing unpredictable feed and demands. Having a better approach to reliability also helps companies on the path to profitability. As we have seen throughout the years, the best performing companies — those that optimize asset performance — have the safest, cleanest and most profitable operations.



Source: "Harnessing automation for a future that works", McKinsey Global Institute January 2017

Optimizing asset performance makes the best companies even better



How the Science of Maintenance Can Drive Asset Reliability

There are three components to an asset optimization strategy: design, operations and maintenance. Design focuses on pushing the boundaries of what's possible with equipment. Operations look at running equipment to its performance limits. These areas have already seen heavy investment and digital transformation over the years.

It is the third area, maintenance, where a significant value creation opportunity lies since it focuses on maximizing uptime with actionable insights, better known as reliability.

As previously noted, maintenance has historically been approached from a less-than-scientific direction due to its reputation as a cost center. However, the ability to digitize and proactively monitor assets via sensors has steadily evolved over the past five years to where technology is now ready to revolutionize asset maintenance.

The technologies needed to underpin this trend (cloud, high-performance computing, mobile, big data analytics and the Industrial Internet of Things via sensors) have matured to where they can be trusted in both scalability and uptime. There is also a growing comfort with these technologies among engineers that are tasked with improving asset performance and reliability. Blending these technologies together with artificial intelligence, analytics and machine learning techniques creates the science of maintenance and paves a clear path to Asset Performance Management.

Models can now predict where and how an increase in system stress will cause a breakdown with months — not just days — of advance notice.

The science of maintenance leverages historical and real-time operational data fed to algorithms to model the precursors to failure across all assets and systems. This enables accurate, proactive identification of asset vulnerabilities in near real time. This intelligence also provides the ability to have a more refined set of recommendations. Those recommendations drive both what action is needed at a system and individual asset level, and when to take that action to maximize uptime and performance.

No longer will a plant lose a year's worth of value from optimization strategies in an unexpected shutdown over a span of two to three days. No longer will operation failures take place as market dynamics force operational changes. The models can predict where and how that system stress increase will cause a breakdown with months — not just days — of advance notice.

For the oil and gas company mentioned earlier, an initial deployment of failure anomaly detection software that modeled historical data showed how every previous failure could have been avoided. **A system-wide software rollout resulted in millions of dollars in savings through the prediction and avoidance of future major equipment failures.**

In another example, a refiner with capital-intensive compressors used machine learning software to cast a much wider net on its systems versus the expensive state-of-the-art vibration system and reliability centered maintenance (RCM) techniques previously used for decades. The refiner quickly identified the root causes of the undetected hidden equipment breakdown. Accurate alerts are now available seven weeks in advance of the vibration system, proactively preventing any potential compressor damage.

The coordination of these types of signals, with its deeper understanding of how the operation of a plant or asset impacts local and system-wide performance, is Asset Performance Management. It's through Asset Performance Management that the assets themselves can now be viewed through the same operational excellence lens as design and operations, delivering value via increased production and reduced costs.

"Despite all the optimization in our chemical assets, when something breaks down, all the optimization work and investment is compromised because production is impacted or stopped, quality is impacted and commitments are missed."

— HEAD OF EUROPEAN CHEMICALS BUSINESS

Asset Optimization Through Asset Performance Management

Asset optimization is the comprehensive, holistic view of performance in a system-wide context for maximizing the reliability and life of each asset. It transcends all of the functional silos to drive the highest possible financial return over the entire asset lifecycle. Asset Performance Management, when deployed as an extension of operational excellence initiatives, drives asset optimization.

Asset optimization through Asset Performance Management can help every capital-intensive process industry improve reliability through four applications: analytics, risk management, root cause analysis and identification and system-wide readiness. Asset optimization strategies make the best companies even better by optimizing the asset lifecycle across design, operations and maintenance. Asset optimization helps address and remediate the cross-functional tradeoffs that previously reduced asset value.

Through asset optimization:

- Asset designs will not only balance capital costs with operating costs, but they will also encompass reliability, maintainability, operability and flexibility of assets. They will consider all of the factors that contribute to the true lifecycle return on capital.
- The collaboration of asset design with operational planning will enable profitable, agile operations across entire business cycles, not just in a particular market environment or for a single design case.
- The optimization of maintenance and operations together represents an enormous opportunity to truly understand the root causes and costs of both breakdowns and degradation, enabling superior reliability.
- Asset improvement goes from being an event-based, time-consuming endeavor with heavy third-party support to being a continuous work process that incorporates operations and maintenance with design.
- Process safety becomes a continuous, consistent thread throughout the entire asset lifecycle, tying together design, operations, maintenance and asset improvement.

This is why Asset Performance Management starts with a focus on maintenance. The science of maintenance drives the strategy to improve the overall reliability of an asset or system of assets.

Organizations Are Ready for Asset Performance Management

The good news for the process industries is the building blocks are already in place to embrace Asset Performance Management. It was approximately 35 years ago when these industries began the transition from analog to digital operations. Over that time, these industries have been generating huge amounts of detailed data that have been stored and leveraged for higher-level applications, but put to very little use regarding asset maintenance and its impact on the overall reliability of an asset.

Organizations can now take existing historical equipment design and performance data, overlay the maintenance log data and build predictive asset performance failure models. The predictions from these models can effectively prevent asset performance issues and breakdowns.

For example, a North American energy company was losing up to a million dollars in repairs and lost revenue when hundreds of electric submersible pumps continually broke down. A pilot analysis of 18 pumps was executed using machine learning software, detecting an early leak on one specific pump. The remaining pumps were modeled for the failure and proactively targeted for updates, preventing issue recurrence and keeping every pump online and operating at full capacity.

The advancements in technology across artificial intelligence, machine learning, software, data analytics and the cloud are driving these models. Specifically, three technology advances are at the center of Asset Performance Management: increased computational power, the cloud and flexible software platforms.

First, improvements in machine learning and artificial intelligence have dramatically increased the ability to process massive data sets toward actionable insights. Second, the cloud enables this data computation at scale, delivering insights much closer to real time versus what normally took days or weeks. This near real-time data is essential to making predictions much earlier to help avoid failures.

Lastly, a flexible software platform completes the chain by incorporating historical data with live conditions (for example, an unexpected production increase that will likely lead to an operational disruption or asset failure), creating an integrated technology process that eliminates risk and ensures continuous production. Organizations can now leverage the enormous amounts of data generated to derive insights about performance to ultimately achieve asset optimization.

Technology Advancements Driving Asset Performance Management

increased computational power

the cloud

flexible software platforms

Conclusion

For complex, capital-intensive industries such as oil and gas and chemicals, the time is now for Asset Performance Management to take its rightful place in driving business benefits alongside existing operational excellence initiatives. Through Asset Performance Management organizations can transform asset maintenance into optimum reliability, avoiding breakdowns and extending the life of assets, thereby maximizing the return on capital employed.

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AspenTech is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with big data machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets faster, safer, longer and greener.

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