Digital Acceleration Opens a New Frontier of Value Creation

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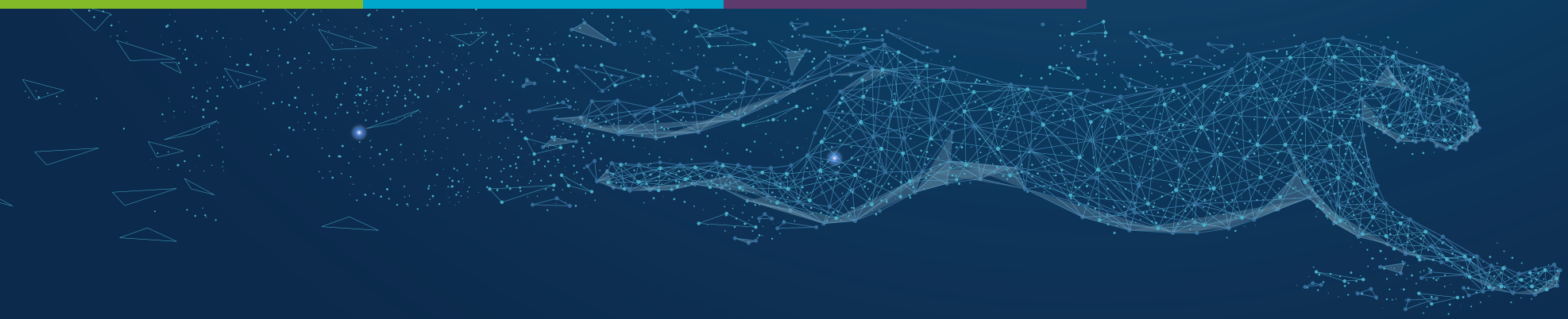

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Enabling Technologies Unlock Hidden Asset Value

In a way, the journey to big data and the industrial internet of things (IIoT) started in the process industries some four decades ago. The era of digitalization began when the first plants upgraded from analog and paper-based systems to digital instrumentation and distributed control systems, triggering the generation of vast amounts of data that supported the first wave of digital applications, such as real-time historians and advanced process control.

The next big opportunity has now arrived, as the advent of new enabling technologies such as high-performance computing, the cloud and data lakes, internet connectivity and mobility — among many others — have come together to generate deeper insights from the exploitation of this data. These advances are making it possible to derive insights not afforded before, to capture even greater value through improvements in operations and reliability, and ultimately to maximize margins through operational excellence programs.

The ability to leverage this massive collection of data to extend the life of assets and maximize the return on capital employed represents **one of the greatest sources of additional profit still available** — and it is made possible by technologies that fall under the "Industry 4.0" or "digitalization" banner. Early adopters of solutions that incorporate these advances will realize significantly higher profits and a competitive advantage.

The good news is, for companies in asset-intensive industries — and especially in the process industries — capturing this opportunity does not require the full-scale "digital transformation" that many organizations assume they must undertake. The advancement of critical enabling technologies such as automated agents, machine learning and data science, as well as the convergence between IT and OT systems, makes it possible to seamlessly integrate new capabilities within existing environments and applications.

The key now is to tap into the adaptability and scalability of these digital solutions — to apply this technology exactly where it makes the most sense for the business. Even taking just one step forward on the digital continuum can help solve important issues and pave the way for optimal system designs, stable operations and the elimination of unplanned downtime.

Increased profitability and reliability are truly just a few actions away. It's time to realize the value promised by digital acceleration.

Building on the Existing Technology Foundation

Companies in the process industries are in position to leverage many of their existing applications and technologies to realize the full potential of digitalization. As an example, there has been an increased interest in advanced process control (APC) in recent years — because companies realize that it is the "foundation" they need for successful digitalization. If you're going to go digital, you must have APC in place.

And indeed, according to the Accenture 2018 Intelligent Refinery Survey[1], APC is the technology that has the strongest foothold among refineries today, with 35 percent of respondents rating themselves as mature in terms of deployment and adoption. The report calls digitalization "a game-changer for improving process control through the use of artificial intelligence, machine learning and more robust data science modeling."

Importantly, APC is all about value creation: increased profitability, increased revenue, increased efficiency and increased reliability. It starts with the target of safe, stable operations and meeting environmental regulations, and if you can do that, it translates to greater financial results and profitability.

Stable operations lead to greater reliability and better utilization of equipment, both of which drive value. That's the core of achieving operational excellence through asset optimization — maximizing your return on capital invested by optimizing performance over the full lifecycle and across the entire system.

Operational excellence can mean different things for different organizations, of course. It could focus on the company's crude purchasing decisions or how they run their plants or how they optimize their supply chain. But most companies do have an operational excellence initiative of some sort, and technology is at the heart of each one.

Asset optimization has always been about digital technologies. Now it is being accelerated through the introduction of new advances like AI, machine learning and multivariate analytics, enabled by advances such as high-performance computing, the cloud, IoT connectivity and robust cybersecurity. **These enabling technologies are why we can leverage data science algorithms that were derived long ago to capture new value today in asset-intensive industries.**

This step on the digital continuum is being driven primarily by new capabilities in the speed and power of computers. If you want to process 200 million data points (or more) on an almost real-time basis, you need a lot of computing power. In the past, that was prohibitive for almost everyone. Now, with the cloud and high-performance computing, you can readily access the server capacity to perform the necessary analysis.

We see today that companies are understandably excited to begin addressing some of the problems they've long been aware of but had never been able to solve. The hardest thing for them to understand is how to prioritize the multitude of digital initiatives without running the risk of lessening the chance of success. As a result, many are asking the question, where do we begin?

Start Small — You Don't Have to Do It All

When embarking on your digital evolution journey, it's important to be pragmatic. Start small; don't try to "boil the ocean" or solve everything at once. Industry is filled with examples of companies who tried to do too much too soon and ended up walking away from their investments.

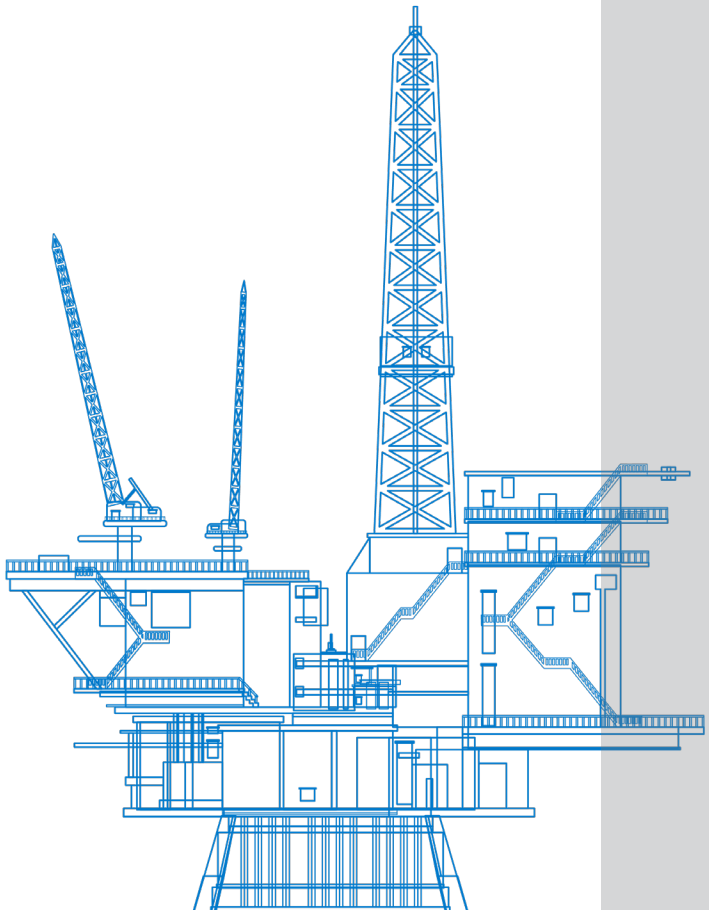
With today's enabling technologies, it's feasible to start by launching a machine learning program that focuses on a specific business problem, such as plant equipment failure — and then you can figure out exactly how these capabilities apply to your needs across the enterprise. This is what the polymers producer **Borealis** did when it was experiencing failures of the hyper compressor used in its low-density polyethylene (LDPE) process, which resulted in high maintenance costs and plant shutdowns.

Borealis deployed machine learning, via prescriptive analytics software, and was able to get advance warning of the repeating failures about *four weeks* before they occurred. The technology also provides ongoing benefits in eliminating unplanned downtime, reducing asset damage (and therefore maintenance costs) and the ability to remediate downtime problems in a business-optimal way.[2] Being pragmatic does not mean going after small problems or profit opportunities; you can be pragmatic around a significant problem that represents major value.

Saras took this approach at its 300,000-barrel-per-day refinery in the Mediterranean, applying machine learning to four equipment areas: feed pumps, wash oil pumps, makeup H2 compressors and recycle compressors. They got their digital effort up and running in just a matter of weeks and were soon able to accurately identify the specific failure mode for each component — without any false positives.

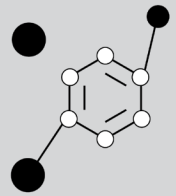
These capabilities enabled them to predict failures with lead times of 24-45 days, and Saras also expects to reduce unplanned shutdowns by up to 10 days, increase revenue by 1 to 3 percent and reduce refinery maintenance costs and operating expenses by 1 to 5 percent.[3]

In addition to focusing your efforts, it is important to assess the quality of the data that you will use. Even though the process industries have been collecting data for more than 40 years, when many organizations begin a digitalization project, they find that the data quality is not what they expected. An initial effort, therefore, must focus on determining the scope of data and examining the quality of the data. Data integrity will be the foundation of anything you want to achieve.



Beyond the Hype of Digitalization: **The Results are Real**

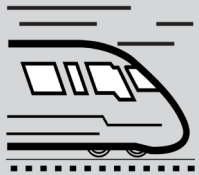
These are a few examples of what companies in different industries have achieved by applying advanced digital technologies to their specific operations and business goals.



Borealis
Gained 4 weeks' advance warning of hyper compressor failures

Saras
Predicted equipment failures with lead times of 24-45 days

Teck
Calculated remaining equipment runtime to save millions of dollars



CSX
Preemptively detected engine failures to save over $10 million

A World of Optimization Opportunities — in the Process Industries and Beyond

Even after many years of investments in advanced solutions, the process industries still have the opportunity to create significantly more value by leveraging data analytics capabilities. Prevention of failures in mechanical equipment, or prevention of process performance degradation, will eliminate accidents and the potential impact on health, safety and environment (HSE). Digital technologies will certainly play a critical role in driving sustainability and environmental responsibility, which will continue to be a top priority.

If we look beyond the process industries, there are assets and plants with less complexity and thinner margins that are not as digitalized. **Industries such as pulp and paper, mining, transportation and consumer packaged goods are now focusing on accelerating their digital transformation and achieving new levels of operational excellence.**

These industries will rely on edge sensorization to drive value by installing sensors in stranded assets and linking them to their enterprise systems or cloud-based systems. The sensorization of equipment enables the collection of real-time data from multiple stranded assets, so it can be pooled together to conduct the desired predictive analytics. In the future, edge computing will drive analytics to be performed closer to the equipment, thereby eliminating data latency and saving on cloud costs, all in a more secure manner.

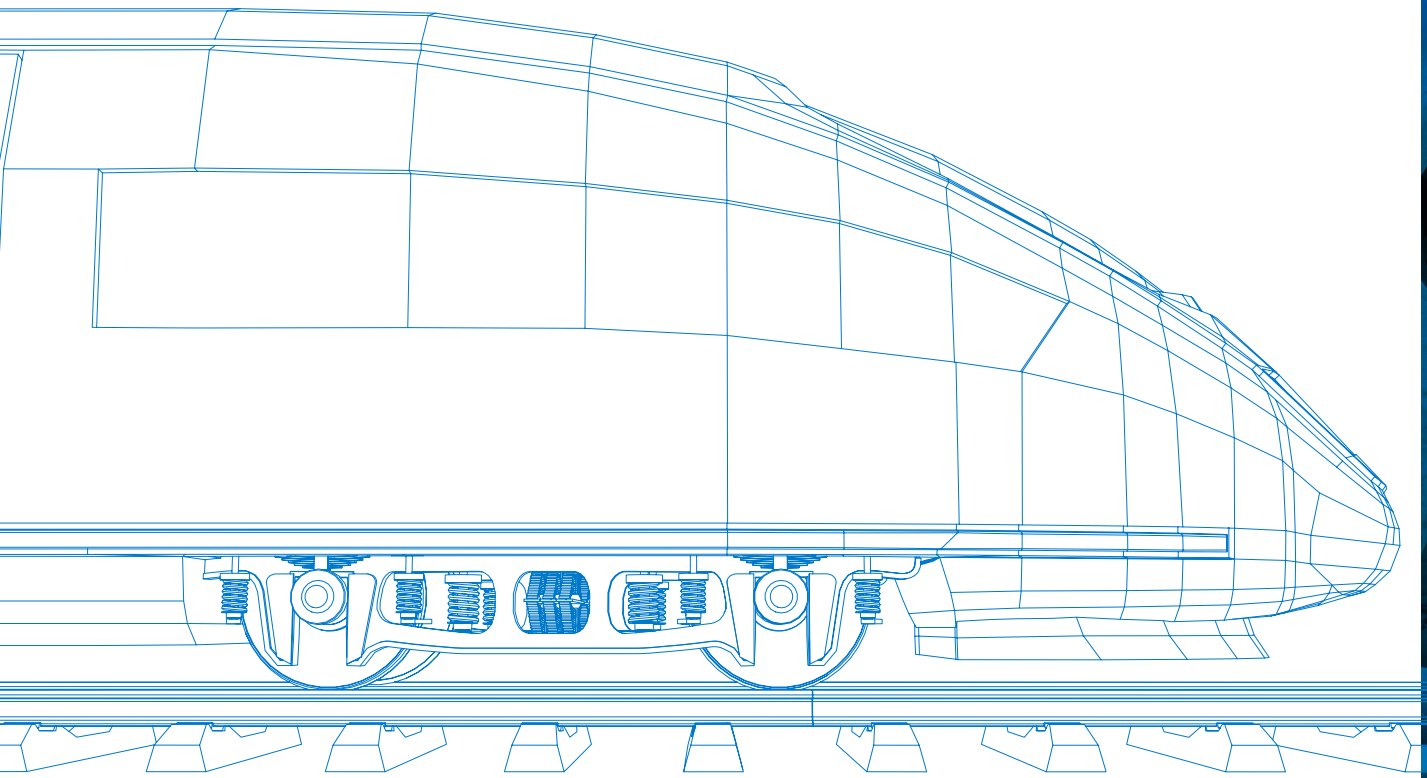
The rail transport company **CSX** tapped into the power of shared data when it launched a machine learning-driven program to prevent catastrophic engine failures by analyzing a variety of lube oil samples. Through machine learning analysis of archived samples, the software discovered both normal behavioral patterns and exact failure patterns, and then successfully transferred that data to autonomous agents monitoring some 600 locomotives.[4]

Within just four months, machine learning provided 10 “saves,” including prescribed corrective action, which amounted to over $10 million in saved costs. After CSX scaled the solution to more than 4,000 locomotives across its system, the company preemptively detected failures on another 96 engines, resulting in additional major savings.

With the incorporation of AI and machine learning, today's technology solutions can provide cognitive guidance to engineers, operators and maintenance personnel, and eventually they'll be able to solve problems that they would not even have attempted to solve in the past. This is where companies can make a true leap in optimization.

A refinery, for instance, might want to run 1,000 scenarios to identify the optimum crude oil slate for processing by taking advantage of the computing power available in the cloud. However, planning personnel can't possibly sift through those 1,000 scenarios in the time they need to decide and capture their position in the marketplace. Applying advanced analytics to those scenarios can help to quickly narrow the options down to the few that are optimal.

These technologies will enhance decision-making and serve as valuable support tools for the experts working in the plant. We will see much greater power, accuracy and speed in the decision-support tools coming in the future.



The Keys to Success in Digital Acceleration

As the Accenture Intelligent Refinery Study notes, investments in digital are crucial to deal with a risky and increasingly complex industry landscape. Digital adoption is seen as a key driver of cost reduction and margin improvement, but there are three criteria that are necessary for success in leveraging advanced technologies.

First and foremost are **data management capabilities**, because this step on the continuum is all about collecting, aggregating, structuring, conditioning and then using this massive amount of data. Companies that don't have those skills will either need to develop them or access them through their provider of technology, or they will struggle in delivering on the promise of optimization.

As an example, the mining company **Teck Metals** sought to improve preventative maintenance by leveraging data from its system that monitors process signals. This forward-looking organization had already been using AI-powered software to monitor and predict equipment performance for several years.

Beyond just triggering a warning when failure conditions occur, the software employed by Teck was able to read process signals and calculate how much runtime a piece of equipment had left — and even automatically file a work order. This system has already saved the company millions of dollars in avoided costs, as well as improving safety and environmental performance, since potential risks are detected well before they become dangerous.[5]

The second key to success is **leveraging technology designed to streamline your workflows and address your business needs**. Companies that are looking to optimize through a digital program can partner with any number of technology providers to find a solution, but they also need to closely examine what they are getting in this arrangement. Is the provider simply leveraging long-published machine learning and analytics algorithms and exposing the data science to the user as part of the workflow? If so, that means more complexity for the user — and most likely the need to hire and keep a significant number of expert data scientists in your organization. That's not a successful model.

Today's best providers package the machine learning algorithms and the analytics within the workflows you're currently using, thereby hiding the data science to achieve ease-of-use.

This means engineers or other personnel in the plant can implement and scale the technology themselves. This should be a solution that works specifically for you; don't settle for less.

And third, you need a technology partner that has **domain expertise** specific to what you want to achieve in your industry. Understanding the process or environment that the technologies will be applied in — and being able to interpret what the data says — results in the most accurate context and most effective decision-making support.

The tools, services and solutions needed to overcome complexity and achieve new levels of reliability and profitability are now available, enabled by breakthroughs that make them accessible to any organization. By asking the right questions about your business and targeting these digital technologies to your needs, you can apply them where they will create the most impact. This will set you on the path toward a more holistic approach to achieving the highest possible financial return over the entire asset lifecycle.

The process industries have been on this digitalization journey for the last 40 years, continuously striving to improve operational performance. But it is only now that enabling technologies and sophisticated machine learning and analytics algorithms have converged to tackle process degradation and equipment failure in real time. This level of analysis opens a whole new area of value creation and reliability improvement for owner operators.

The value possible from asset optimization has increased exponentially from what we initially believed, primarily because of the opportunities available to achieve unforeseen levels of asset reliability. Ultimately, a significant increase in reliability through predictive and prescriptive analytics has an impact beyond just value creation. It also improves the health, safety and environment of employees and the communities where these assets reside, as well as the brand and reputation of the organizations that we all represent.

Notes:

1 The Intelligent Refinery: 2018 Digital Refining Survey, Accenture, June 2018 www.accenture.com/us-en/insights/industry-x-0/2018-digital-refining-survey | 2 "Borealis Selects Aspen Mtell® Prescriptive Maintenance Software to Improve Reliability at Polyethylene Production Site in Sweden," April 2018 www.aspentech.com/en/resources/press-releases/borealis-selects-aspen-mtell-prescriptive-maintenance-software-to-improve-reliability | 3 "Prescriptive Maintenance Software Helps Saras Improve Business Performance and Drive Operational Excellence," April 2018 www.aspentech.com/en/resources/case-studies/prescriptive-maintenance-software-helps-saras-improve-business-performance | 4 "The Next Wave of Technological Wonders," Progressive Railroading, September 2016 www.aspentech.com/en/resources/articles/progressive-railroading---the-next-wave-of-technological-wonders | 5 "Teck Takes on Tech," Teck Connect, Volume 19, 2017 www.teck.com/news/connect/issue/volume-19,-2017/table-of-contents/teck-takes-on-tech

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