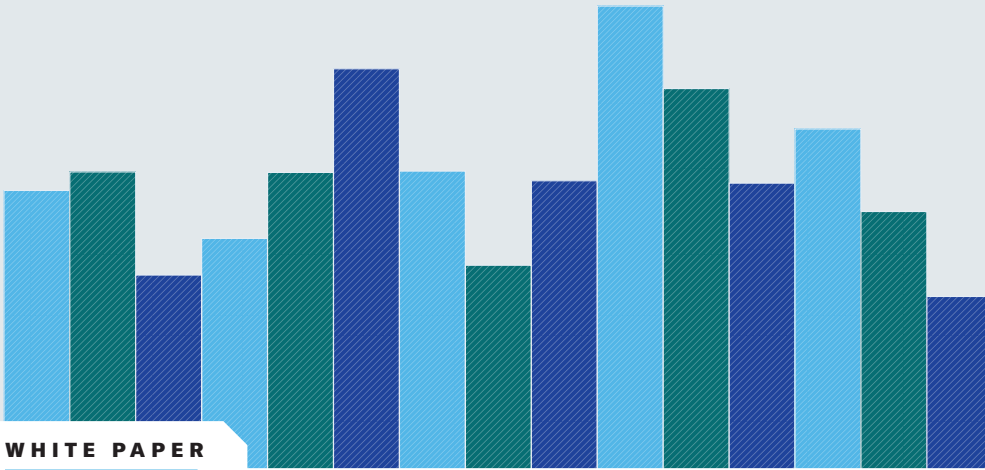




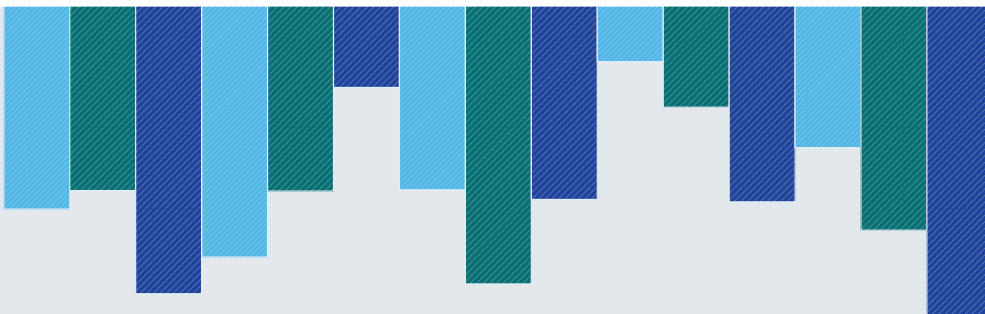
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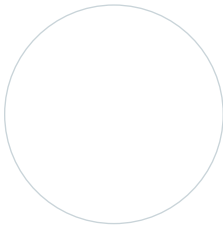
WHITE PAPER

# Gaining Performance Intelligence with Data-Driven Industrial Software



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Our world has transformed in the past two years. Businesses around the world had to move faster and more nimbly. Shared data networks became more important as we shifted operations and connected teams to serve our customers and optimize performance in new ways.

**Accurate, timely, accessible data—and the ability to organize and analyze it—will reshape how you can operate**

To convert data into decisions that deliver performance, it must be accurate, relevant, timely, complete—and accessible. We knew this before the pandemic, but the past two years have exposed the gaps in supply chains and the engineering to operations cycle, sharpening the business case for data-led operations.

According to Gartner, businesses that effectively share data throughout their ecosystem will achieve 50% higher growth than those who retain a siloed approach. This includes forecasts that sharing data could unlock up to \$100 million of revenue in the manufacturing sector alone. Indeed, the aggregated volume of industrial data is doubling every two years and is set to hit 174 zettabytes by 2026. The implications—and tangible opportunities—are just starting to emerge, for our industries and our planet.

**Industries are transforming**

It's no secret that data-led innovation is transforming how workers perform critical tasks. Where they once focused on tedious operational tasks, many workers are now tapping data to simulate and visualize opportunities, reinvent strategies with agility, and collaborate more effectively. Digital-first operating models are rapidly becoming standard operating benchmarks. Industries are finally beginning to realize the promises of digital transformation, as they unlock higher performance through collaboration between

connected businesses and individuals. In this connected industrial economy, a network of engaged workers is innovating to increase efficiency and enable industries to achieve more.

**Unlocking new capacity, forging new paradigms**


The data sharing revolution is important because it unlocks new ways of working. We call this performance intelligence: the capacity to harness data-led insights, enabling people to maximize sustainable value across assets, processes, locations and organizations. As we explore in this paper, industrial leaders from pharmaceuticals and manufacturing, to energy and infrastructure are using data-sharing models to create new operating paradigms. As Daniel Foster-Roman of Ontario Power Group puts it, "We are creating new networks of citizen data scientists across our organization. This democratization of data is happening not just in operational teams," he explains, "but across the business."

The benefits are radiating beyond operations and reshaping how the wider organization collaborates and innovates. This is performance intelligence in action, expanding the limits of what industries can do and achieve, and unlocking new ways to drive sustainable competitive advantage.

There's never been a more exciting time to be at the leading edge of industrial innovation. Read on and learn what this means for your business.

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# Gaining Performance Intelligence with Data-Driven Industrial Software



Organizations that want to position themselves for success in uncertain times need both the help of robust software and the ability to combine it with data analytics to better engineer processes, optimize operations, and maximize performance. The Covid-19 pandemic accelerated digital transformation at organizations as workers needed to perform their roles remotely and connectivity became even more important. But the pandemic also was a wake-up call when it comes to the need for data-driven, end-to-end industrial software that supports the entire value chain.

The pandemic exposed the gaps within supply chains. Industrial companies realized they needed real-time transparency or, better yet, predictive visibility that allows companies using artificial intelligence (AI) to anticipate and redistribute scarce maintenance resources. It brought home the fact that if data isn't timely, it also could be inaccurate, as many plant managers found that the schedules they received from their planning departments for factory shifts were unworkable because of labor shortages. Instead, they had to decide what could be produced based on the number of workers who came to work on a given day.


“Organizations have gone through massive digitalization journeys in the corporate systems and customer-facing and marketing platforms but neglected the core operations. Industrial software immediately has a role to play and provides an opportunity to close the gap [between operations and IT software] by leapfrogging from analog to a more digital process,” says Maikel van Verseveld, global manufacturing and operations technology lead at Accenture Industry X.

## HIGHLIGHTS

Digital maturity will allow industrial companies to achieve “performance intelligence,” which is **the capacity to harness data-led insights, enabling people to maximize sustainable value** across assets, processes, locations, and organizations.

Embracing a **software-led performance intelligence effort yields profitable and sustainable growth** because of the data-driven approach to optimizing engineering and operations.

Industrial companies that are implementing performance intelligence are **already seeing multiple benefits**, such as cost savings, improved yields and product quality, and sustainability gains.



Industrial software is especially important at a time when many organizations are still digitally immature because many are just now undergoing the first stages of digital transformation. An Accenture global survey of 600 industrial companies worldwide in 2020 revealed the digital maturity of manufacturers' end-to-end operations overall is only at 39% on a scale where 100% indicates all capabilities are deployed and rolled out. Most companies surveyed by Accenture are past the proof-of-concept stage and are now in actual pilots with partial scaling up. There are key differences among the industries included in the study. **FIGURE 1**

Digital maturity will allow industrial companies to achieve “performance intelligence,” which is the capacity to harness data-led insights, enabling people to maximize sustainable

value across assets, processes, locations, and organizations. Performance intelligence is based on utilizing a state-of-the-art software portfolio that connects the power of AI, which is rooted in real-time and historical data, with human intelligence to set the groundwork for more precise and strategic decisions. Embracing a software-led performance intelligence effort yields profitable and sustainable growth because of the data-driven approach to optimizing engineering and operations.

This Harvard Business Review Analytic Services report discusses how performance intelligence is helping industrial companies use data to reimagine how they have always approached production and allow them to set and accomplish new goals when it comes to efficiency, productivity,

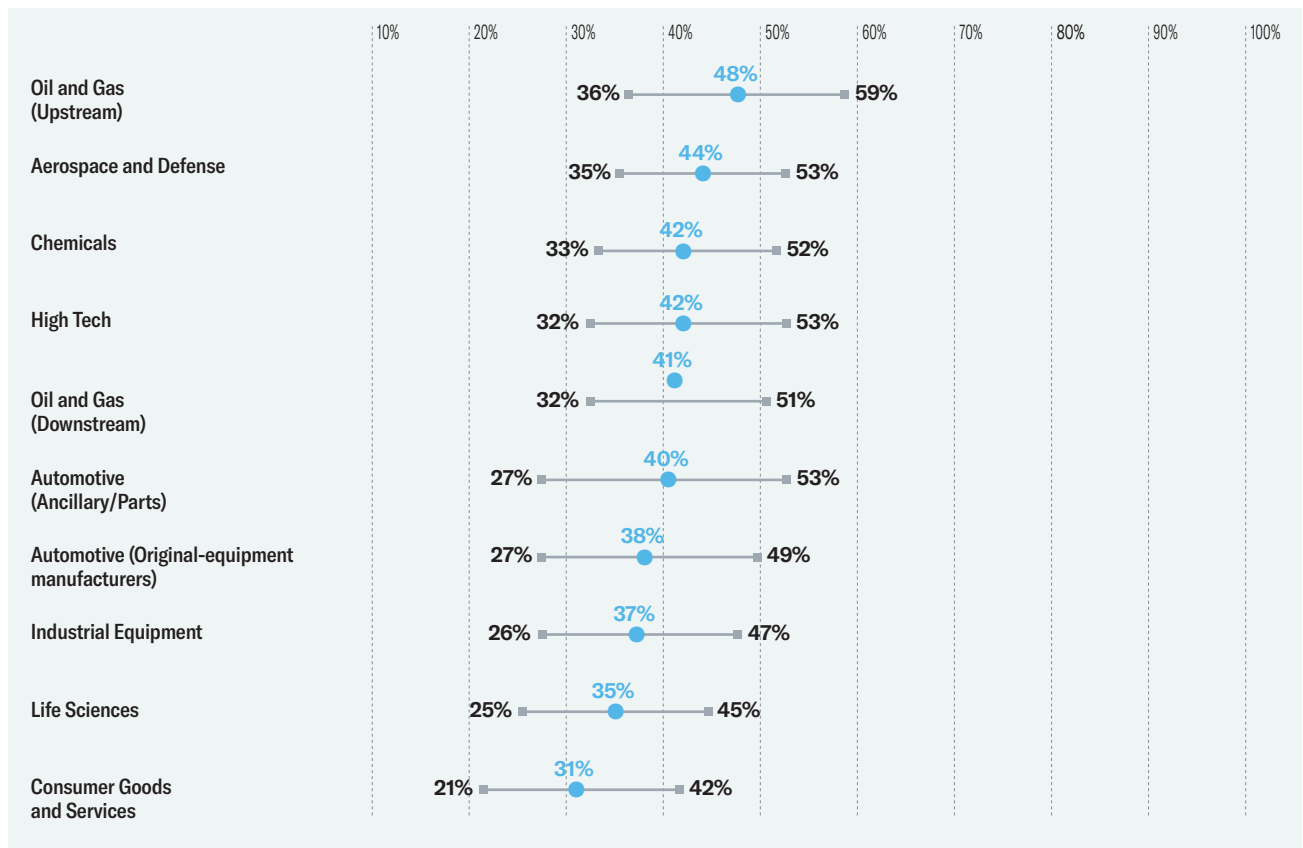
FIGURE 1

## Digital Leaders and Laggards

Digitization maturity varies widely by industry


100% INDICATES ALL CAPABILITIES ARE DEPLOYED AND ROLLED OUT

● AVERAGE



Note: Numbers are rounded to the nearest percent.

Source: Accenture, 2020



**Accenture's survey found a strong, inescapable correlation between the amount manufacturers invested in digital capabilities—both infrastructure and platforms—and the resulting impact on their operating income.**

sustainability, and employee well-being. It examines how some organizations are already utilizing data and analytics to maximize employee decision making. It shows how such companies are able to think and act boldly as they operate with confidence, knowing that advanced industrial software will allow them to predict and handle the next big disruption. Last, the paper highlights how behavioral change is key to successful digital transformation and how comprehensive data-driven software tools and the use of performance intelligence can help organizations accomplish it.

### **Industrial Software Investments Pay Off**

Companies that utilize state-of-the-art industrial software break the mold. It was digitized operations that allowed Cambridge, Mass.-based Moderna to develop the Covid-19 vaccine in months, compared to traditional legacy manufacturers that had already been working on some vaccine prototypes for years. A relatively small startup, Moderna was operating with a digital backbone from the beginning and used cloud technologies, AI, and a feedback loop to constantly iterate to arrive at an approved Food and Drug Administration (FDA) vaccine.

Digital investments have paid off big for other industrials as well. Accenture's survey found a strong, inescapable correlation between the amount manufacturers invested in digital capabilities—both infrastructure and platforms—and the resulting impact on their operating income. On average, the

return on digital investment is from 2.1% to 2.7% in operating income lift (as a percentage of sales) in up to three years, and 4% to 4.6% within five years, depending on the company size, with the largest companies benefiting the most.<sup>1</sup>

At another pharma company, London-based GlaxoSmithKline (GSK), automated data gatherings attended by workers that industrial software facilitated were initially meant to satisfy regulatory requirements and data integrity, but the benefits of this digital process go far beyond compliance. The company can use the data to better understand and thus improve its manufacturing processes and quality. GSK is monitoring product data in real time and is already using this information to increase the yield on the production of selected blockbusters. Antonio Buendia, director of automation, global industrial operations at GSK, estimates that certain products are experiencing a 3% to 4% yield gain on this use of performance intelligence.

Meanwhile, Ontario Power Generation (OPG) uses machine learning and physics based on modeling to monitor assets across the Ontario-based company's 75 power generation plants. The power company leverages predictive analytics to provide early warnings on equipment issues and ultimately avoids expensive equipment failures. Over the past two years or so, the data-driven monitoring and diagnostic program has helped avoid 100 equipment failures, saving the company \$5 million, says Daniel Foster-Roman, OPG's engineering manager of data analytics.



**“The decision making belongs to the human, not the machine. Having everything centralized in one system in one single environment with a proper interface allows humans to understand the data and make the right decision in real time,” says Daniel Morales, corporate automation manager at Braskem.**

OPG has also saved hundreds of thousands of dollars annually and protected worker health by eliminating regular time-based preventive maintenance at its nuclear sites. Thanks to the software-driven monitoring system that sends alerts about calibration issues, human maintenance crews go out into the field to respond to such alerts instead of performing routine sensor checks. This protocol also reduces radiation exposure to work crews who are not required to enter the field as often.

The use of industrial software to achieve positives beyond financial gain is being witnessed by other companies. Anthony Loy, vice president of smart and sustainable industrial ecosystem transformation at Rueil-Malmaison, France-based Schneider Electric, believes that a smart factory has to be a sustainable factory as well, which can be achieved by using industrial software. By combining energy management system solutions with process management systems, the company is able to define the right process parameters for energy optimization. That capability enables it to achieve its ambitious energy consumption goals, which include cutting energy consumption by 10% every three years and increasing the number of zero-carbon sites. Thus, data-driven industrial software enables humans to make data-driven decisions. “People are much more factual when they take actions based on data from root cause analysis,” says Loy. “There is no more gut feeling.”

## Translating Data Points into Actions

Data-driven information flow is at the core of industrial performance management. Having the industrial data that originates on the shop floor helps engineers with their decision making. However, such data is often being gathered

and retrieved from a dozen or so different systems that are not integrated, making it hard for people to analyze and use it for actionable, operational conclusions.

Braskem, a global petrochemical company based in São Paulo Brazil, installed a centralized software data historian in 2020 and has already seen benefits in the area of predictive maintenance by anticipating equipment failures. Its engineers have also been able to optimize furnace operations, thanks to data-driven insights about the best scenarios for reducing carbon dioxide emissions. The use of data-driven virtual analyzers has helped with increasing quality by reducing the amount of lab analysis and transition time between different products, increasing production and reducing the number of products that do not meet specified standards.

Local industrial data historians at the company’s plants worldwide retrieve industrial process data, such as temperature, pressure, or vibration, from manufacturing processes. These local systems are linked to the centralized historian, which is the cornerstone of the industrial data infrastructure that the company installed in 2020. Today engineers are able to retrieve data from the central historian’s platform and, depending on the nature of the application, upload it to the cloud solution.

Braskem’s corporate automation manager, Daniel Morales, says that such centralization of the industrial data, as well as integrating it with business data, are the key elements of a well-functioning data-driven architecture. Another plus is having all the data and the analytical tools in an integrated environment, which means that the decision making is not based on isolated pieces of software, each of which is giving just a piece of the truth.

To be sure, the industrial software tools should help tell good stories from the data. This capability, in effect, reflects the system’s ability to present insights derived from relationships among multiple data points in a coherent, actionable, and easy-to-understand pattern. “The decision making belongs to the human, not the machine,” says Morales. “Having everything centralized in one system in one single environment with a proper interface allows humans to understand the data and make the right decision in real time.”

Centralization in Braskem’s case unifies data design and context—and thus creates easy understanding and better decision making. “The user experience and the contextualization of the data are where the magic needs to happen,” says Accenture’s van Verseveld. “You need something like a virtual presentation of the data relevant for the person who is interacting with it.” Tools like local no-code platforms can further help “citizen scientists” create their own apps for the plant operations, he says.

OPG’s Foster-Roman explains how the data on varying parameters collected at the power company’s hydroelectric units is analyzed by software that understands the





**Tools like local no-code platforms can further help “citizen scientists” create their own apps, says Maikel van Verseveld, global manufacturing and operations technology lead at Accenture.**

interrelationships among multiple parameters and can predict how these assets should be operating. It would be impossible for humans to analyze such complex systems by looking at separate data points. But at OPG, this analysis is received and packaged by the central analytics group, who put it in the context of maintenance and outage data combined with the historical data. That “story” is then sent out to the subject-matter experts at the site, who take action to address whatever the issue might be.

OPG is trying to develop citizen data scientists by empowering employees all around the company to experience and apply data science and analytics in their jobs so that it’s not just the central group that is building statistical models and doing analytics work. Industrial software often comes with features that enable low-code or no-code analytics. “It gives process engineers the ability to take analysis and data science in their areas of expertise into their own hands,” says Foster-Roman.

At Charlotte, N.C.-based Albemarle, Jonathan Alexander, manufacturing data analytics leader, stresses the benefits of being able to analyze real-time data in a historical context. The global specialty chemicals company sees opportunities for savings in the millions of dollars from installing industrial software at its manufacturing facilities. These savings are being realized thanks to raw material utilization improvements, waste reduction, and improved quality and increase of throughput. The latter is especially valuable for the organization’s lithium business, which is growing and

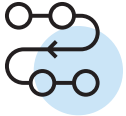
currently operating at capacity. Thus, any increase in the production rate translates to direct profit, Alexander says.

The company has created predictive modeling, which involves real-time data from chemical-making processes and machine learning models based on historical data about how these processes were run in the past. “We can leverage that to predict how we may perform in the future based on our current operating conditions,” says Alexander. “And we look back at that data to find opportunities for improvement. We leverage historical data to become more efficient.”

### **Creation of an Enterprise-wide, Strategic View**

Today’s industrial software systems are often comprised of individual applications that often function in isolation. There’s limited interaction from one stage to the next when it comes to the software tools used among R&D, manufacturing, quality control, and design. This deficiency is important because what manufacturers are looking for is integration, analysis, and contextualization across the whole company—an end-to-end system that would lead to an enterprise-wide view.

The definition of an end-to-end capability varies depending on the company’s needs and processes. For OPG, for example, end-to-end means having an intelligent, automated system to promote and maintain the reliability of equipment. Such a system would require having all the necessary sensors in place in the plants without leaving any blind spots. All



**“It is really an end-to-end integration of information. Combining supplier, on-site, and customer data helps us anticipate and prevent issues before they happen. We are extending detection analytics capabilities to additional product ranges,” says Anthony Loy of Schneider Electric.**

this data would be automatically fed into machine learning models that predict when any assets might fail, which would, in turn, feed into the reliability management system. This system then initiates an order for the appropriate work that needs to get done, including when it needs to get done. “Our goal is to have end-to-end monitoring that allows us to optimize maintenance resources while ensuring high levels of reliability,” says Foster-Roman.

Creating such an end-to-end system requires filling the monitoring gaps by installing more sensors and connecting machine learning models with engineering processes. This process can be challenging with older physical equipment and with the installations needing to be done while the plants are operating. Many companies, including OPG and Braskem, are retrofitting their plants with new networking Wi-Fi capabilities to install the software.

Maria Alice Ferraz, Braskem’s global automation digital strategist, describes the ultimate vision as having a central data hub—a control tower with an enterprise-wide view—that can be used to optimize the business as a whole, instead of helping manage one plant or one asset. Ferraz distinguishes between the end-to-end industrial view, which entails connecting maintenance, production, and process pillars, and the supply chain end-to-end view. Connecting the two would lead to a full-on enterprise view.

“We are working on creating a strategic view by seeing through all the layers of the business, from asset to enterprise, so that all the industrial managers can be aware of what is going on without actually being at the plant physically. This approach is especially useful during the pandemic,” says Ferraz.

The end-to-end strategy of connecting all the industrial pillars to create the enterprise-wide view would lead to new capabilities. Having such a view, for example, would inform a company how an issue with maintenance can impact business.

A control tower with data-driven insights from the company’s plants worldwide would make it possible to compare plants with similar processes and manage production according to the efficiency of each plant considering factors such as energy cost, demand forecast and maintenance.

Such data can also help a company successfully accomplish its strategic goals, including the ones for sustainability. For instance, the data hub allows Braskem to retrieve data and calculate real-time carbon dioxide emissions. It can also keep track of the effectiveness of the efforts put in place to reduce the emissions.

Industrial software allows Schneider Electric to achieve customer service goals by combining customer feedback on some products with the information from the quality performance of the production line. By combining the company’s view of quality with the customers’ perception of it, Schneider Electric can notify engineers where there is still room for improvement. Similarly, the company connects information from suppliers with the customer feedback and production lines data, enabling it to anticipate and prevent any issues that may be caused by underperforming components and then adjust the production process accordingly.

“It is really an end-to-end integration of information,” says Schneider Electric’s Loy. “Combining supplier, on-site, and customer data helps us anticipate and prevent issues from happening. We are extending these weak signals detection analytics capabilities to product ranges in phases.”

Implementing an end-to-end industrial software system is a multiyear endeavor, with value that can also take time to realize. Accenture advises manufacturers to consider early value creation initiatives when embarking on software implementation because of the time and effort involved.

Very often, manufacturers deploy specific digital solutions across work sites or their various entities on a piece-by-piece basis, such as implementing an analytics tool across all their factories. But in so doing, a company can’t come close to seeing the full value of such an isolated solution. To create the required change and its corresponding value, manufacturers should concentrate on scaling up asset by asset—implementing a fully digital solution set in one site. That solution engenders a true transformation of an asset, which not only creates far greater value but also demonstrates the kind of results a company could achieve when it similarly transforms the enterprise as a whole.<sup>2</sup>

While achieving a data-driven strategic view of the whole enterprise may be the ultimate goal, GSK’s Buendia prefers a twofold approach to bolstering an organization’s data-driven industrial systems. He is pursuing automation both narrowly and enterprise-wide at the same time. “While we build the corporate foundations, at the same time, we need to focus on implementing industrial software pilot programs in a smaller, specific area so we can see the results,” he says.





“When it comes to artificial intelligence, I always stress the importance of domain expertise. You need to ensure that the right context is considered when you create your models,” says Daniel Foster-Roman, OPG’s engineering manager of data analytics.

## Human Change Management’s Role

Industrial software is successful when it yields benefits, which cannot happen without its adoption by employees, whether they are data scientists or not. Having a user-friendly interface with good storytelling capabilities and low-code or no-code solutions for building specific applications is crucial. But human change management is also crucial to successfully implementing industrial software solutions.

For one thing, the teams executing the necessary implementation of industrial software must be staffed with the right number of people with the required skills. Accenture’s survey indicates that these resources should represent about 1% of a company’s staff within three years and 1.8% within five years. Overall, companies plan to increase their digital capabilities teams by more than 75% within five years. However, these data scientists or network administrators alone cannot successfully usher in the digitalization of industrial engineering. To succeed, they need buy-in from all relevant employees.<sup>3</sup>

At OPG, the engineering experts operating and maintaining power generation assets are not typically versed in data science and AI at a high level. However, to create continuity between technical and domain knowledge, the members of the Monitoring and Diagnostic Centre team have all started as process engineers in different plants. “When it comes to artificial intelligence, I always stress the importance of domain expertise. You need to ensure that the right context is considered when you create your models,” says Foster-Roman. Context is important because the low-code AI applications that can be easily digested by engineering subject-matter experts help ensure that their domain expertise leads to models grounded in engineering and science, as opposed to being blindly data driven.

Foster-Roman also recognizes that the digital automation of production requires a cultural change. He starts with early and consistent communication and celebrating wins early, monitoring and tracking projects, showing ROI, and publicizing the metrics among the leadership at the company.

This kind of change requires an adjustment in the cultural mindset and takes time, however, even though automation enables companies to eliminate low-value tasks in engineering, such as manual monitoring, data collection, and tedious data processing. Eliminating low-level tasks allows engineers to

focus on the high-value tasks around data analysis and complex decision making to address equipment and production issues. “When you have a new way of working, there will always be people who are not comfortable with, or even fear, change,” says Buendia. “The best way is looking for early adopters, those who are enthusiastic about new technologies and rely on them to help us increase adoption. So that change is not coming from the technical department but from people who are using the tools and spreading the word,” he advises.

Indeed, adoption of new technology can be more challenging than domain knowledge since it entails new work processes, competencies and a cultural mindset that take advantage of the technology. Braskem created a special digital center area with the goals of implementing a digital framework, improving the culture of the company, introducing more agile ways of working, and adding a new set of competencies.

Such an effort, Loy says, requires transparency so that all relevant employees can have access to data to make decisions based on shared information. To make the information flow more easily, Schneider Electric has created application programming interfaces that, in effect, connect information with solutions and people. Rather than having to go through unfocused data presentations, employees get a walk-through of the information flow that moves from one person to another to better understand the insights relevant to them.

For such shared factual decision making to happen, industrial software tools need to be adopted at all levels of the enterprise. Digital transformation can’t be scaled if leaders don’t embed it in their leadership role, because if leaders are not fluent in using data-driven analysis to make decisions, digital transformations will fail to live up to their potential. Accenture’s survey reveals that in the area of leadership and the use of data analytics, companies still have a lot to accomplish, as only 13% of companies have more than half their leaders trained to use analytics to help drive their decisions.<sup>4</sup>

It may be the conventional wisdom that digital transformation must be driven at the highest level of governance possible, but that’s not a common practice among a majority of companies in Accenture’s research. In only 39% of companies responding, digital transformation is led by the executive committee of the board.<sup>5</sup>

At the same time, the operationalization of data analytics is necessary on the frontline employee level. Witness Albemarle,



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which makes sure that data-driven insights are clear and useful to shift workers who are running the plants day to day. To provide these advanced tools in an approachable way, engineers build so-called dashboard action boards with green or red lights instructing the operators when to take action on the data. "Traditional dashboards are there to provide guidance, but it's almost up to the user if they want to do anything with that data. So, theoretically, a dashboard can stay on the wall and never be looked at," says Alexander. "We try to make sure that we provide dashboards that are easy to consume and are actionable."

## Achieving Performance Intelligence

For a factory to deliver optimal results and meet strategic corporate goals, people who work there need access to industrial data analytics as it flows across its processes, assets, locations, and the whole organization. Such a smart factory also needs to be part of a modern supply chain that is an integrated, connected, end-to-end network that's "always on." To make that happen, the data-driven information needs to flow among all parts of the operations and supply chain value chain, including the factory floor.

Achieving such intelligent performance, however, is predicated on the use of state-of-the-art industrial software that is driven by real-time and historical data, integrated with other applications, and powered by AI that's paired with human intelligence. Industrial companies that are implementing performance intelligence are already seeing multiple benefits, such as cost savings, improved yields and product quality, and sustainability gains. They will also be able to harness data to predict and weather the as yet unknown disruptions in the future.

"Having [performance intelligence tools] enables a level of transparency on what's happening on the shop floor so that production can happen in the most efficient and sustainable way," says Loy. "It also allows other functions to react to make sure that the company will deliver the highest-quality products to the customer on time. It enhances the role of a factory in a modern end-to-end supply chain."

### Endnotes

- 1 Accenture, "The race for digital operations transformations," November 2020. <https://www.accenture.com/us-en/insights/industry-x/race-for-digital-operation-transformation>
- 2 *ibid.*
- 3 *ibid.*
- 4 *ibid.*
- 5 *ibid.*





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