Sweet spots for excellence in asset operations

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The chemical industry has made significant investments in automation, remote control and digitalization over the past few decades. This can be seen from research studies that show that it has surpassed the cross-industry maturity in its digital operations transformation.[1] As a result, many chemical companies were able to keep their plants operating safely and robustly as the COVID-19 pandemic struck. In doing so, they upended many of the traditional assumptions about industry operations.

They demonstrated that many operational tasks can be conducted remotely—even from employees' home offices—with a minimum of on-site workers. They found that plants can be operated with fewer employees. And they saw that the use of contractors is scalable, and work can be flexed between contractors and shift teams with relative ease.

> **In short, COVID-19 defined a new normal for the operation of plants and assets.**

The question to ask now becomes: how can we continue to reap the benefits of flexibility, safety and efficiency that have been brought about by this new normal while using technology to further increase productivity? This is no small challenge. Despite years of investment in various technologies, many chemical companies have shown little improvement in labor productivity. From Accenture's research on labor productivity, conducted at 100 chemical companies over a 10-year period, 47 percent showed a decline in revenues per full-time employee, 28 percent had a labor productivity improvement of less than 1 percent per year, and only 25 percent showed a labor productivity increase of more than 1 percent per year[2]—all during a time when companies were investing in technology.

Typically, the barrier to increasing productivity is not the technology, but rather the way the technology is used and deployed. While this has long been the case, COVID-19 has made this issue more critical than ever by accelerating the need to change the way people work. To take operations to the next level of productivity, efficiency and safety, chemical companies can adopt a more comprehensive and systematic approach to focusing their technology initiatives while driving transformation across their networks of plants and assets.

The new normal: A foundation for further transformation

The pandemic clearly demonstrated that new ways of operating plants and assets are feasible using the technology that chemical companies already have in place. However, it also highlighted the potential and the need to use technology to extract more value from operations.

To do so, companies should work on the **following three principles**:

1. **Maintain "the good" that COVID-19 revealed**, such as being able to operate with smaller staff levels and make effective use of existing automation.
2. **Accelerate efforts to "build back better,"** such as closing automation or safety gaps highlighted during the pandemic.
3. **Reinforce pre-COVID-19 best practices** that are valid post-COVID-19, such as safety training.

These actions are straightforward enough, but for many companies, the question is how to get started.

The answer: Take a detailed look at all the everyday tasks needed to operate and optimize a plant. About 40 percent of operational tasks in the industry are already handled through a control room and can thus be shifted elsewhere with relative ease (Figure 1). The benefits of doing so include greater operational flexibility; better resilience to disruptive shocks such as pandemics or natural disasters; an increased ability to deploy scarce skills to support a broader set of assets; and last but not least, easier deployment of further analytics and artificial intelligence technologies.

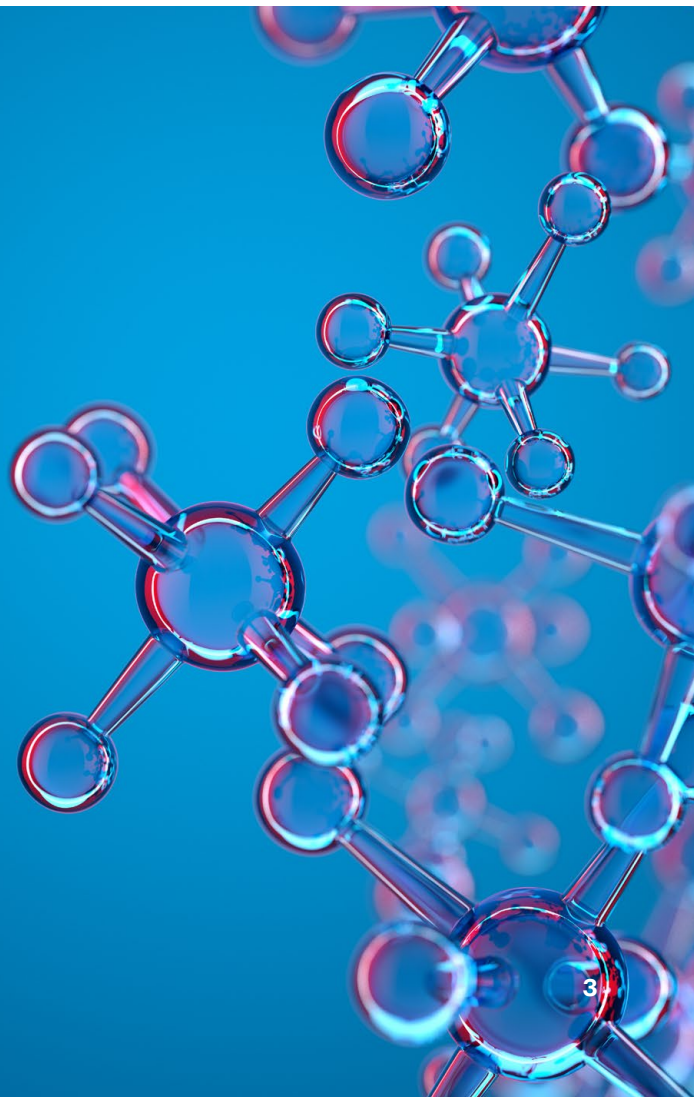


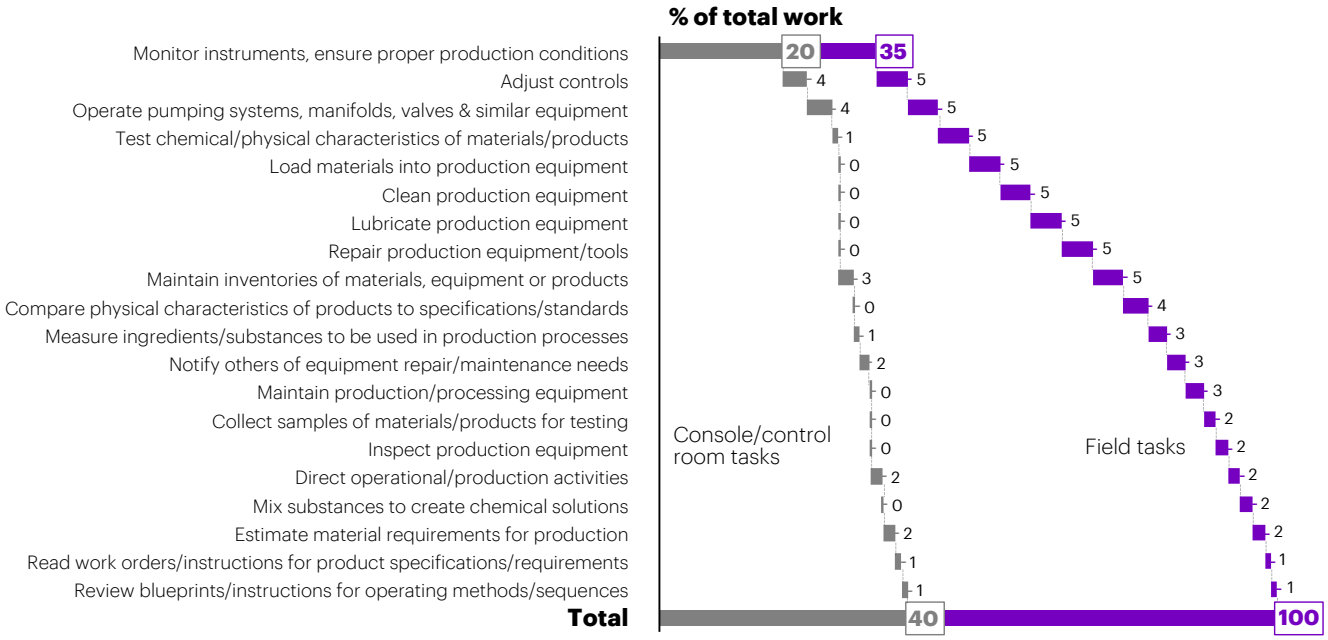
Figure 1: The next stage of remote asset operation

Leverage quick wins with the transformation of console/control room tasks (~40 percent)

- Activities that are easily transferable (e.g., planning and scheduling can be moved to off-site or home-based locations)

Prepare for the future with the transformation of field tasks (~40 percent)

- Plant- or process- and equipment-specific push
- Analytics- and automation-based enablement



The industry's various field tasks that aren't handled through control rooms provide a greater challenge. These are often specific to equipment, chemical processes or plants, and include tasks such as monitoring instruments, cleaning and lubricating equipment, maintaining equipment, and taking and testing samples for quality control. To bring these types of field tasks up to the next level of performance, chemical companies should focus on three areas:

Fully leveraging today's technology—implementing new ways of working and increasing adoption through training and change management.

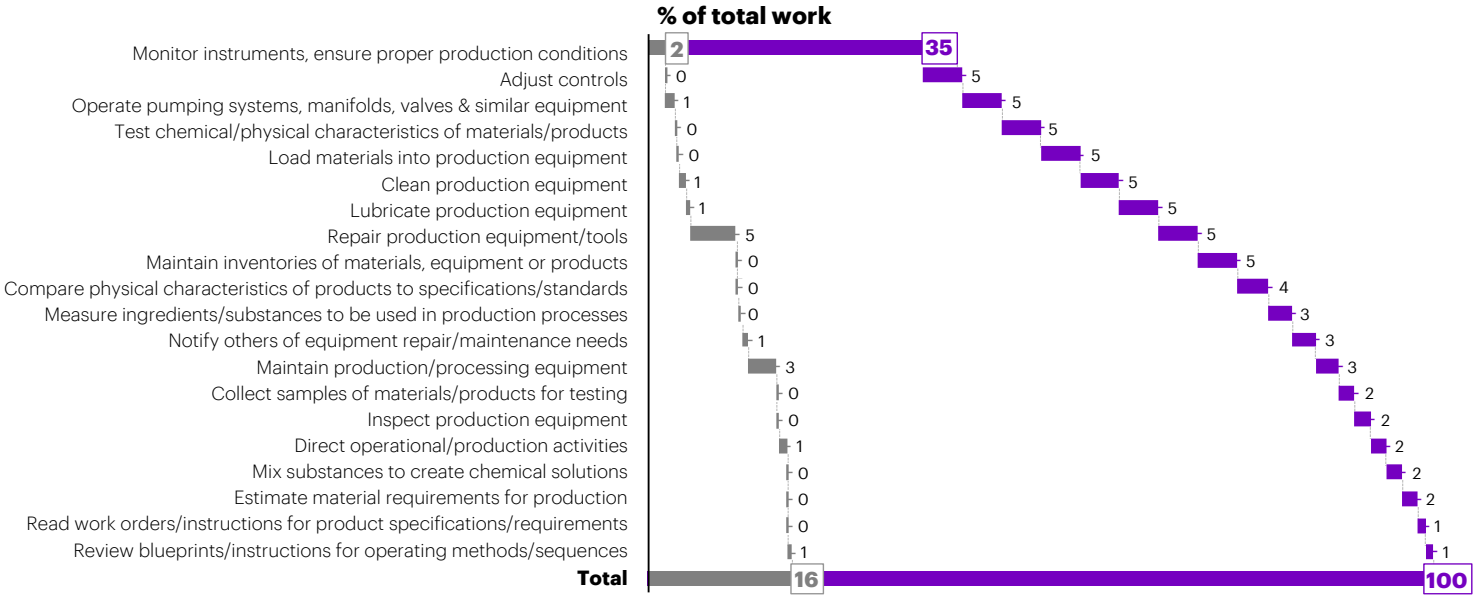
Expanding analytics and artificial intelligence—developing insights from operations, shift books, maintenance and other sources of data generated within a plant. Typically, companies invest significant amounts to store data in historians but rarely use it to generate insights to optimize asset operations.

Building out mechanical and physical automation—increasing automation in areas such as the unloading and loading of raw materials and products, the manual start-up or ramp-down of equipment and the monitoring of production conditions.

To understand the potential of such actions, consider the monitoring of equipment to ensure proper production conditions, a process that currently accounts for one third to one half of labor in many plants. Here, it is feasible to cut the physical effort involved by about 50 percent by leveraging today's technology—for example, by applying advanced process controls and predictive analytics to push alerts to operators, reducing the need for monitoring in the field. Companies can also use analytics and soft sensors to enable state- and context-sensitive asset monitoring backed up by machine learning, which can help further reduce on-the-ground effort by one third. And while mechanical/physical automation can play a vital role in many activities, its usefulness in equipment monitoring is limited. That's because effective automation of the remaining work would require intelligent robotics, a technology that significantly skews the investment-to-benefit ratio—but that is likely to change as the technology evolves.

A broader review of the tasks associated with asset operations shows that significant improvements are feasible and that digitally driven transformation could potentially eliminate about 80 percent of today's asset operations workloads (Figure 2). About 20 percent of tasks would still require equipment and maintenance engineers, data scientists and field workers, but the tasks and skill profiles of these workers would differ significantly from today.

Figure 2: The potential to eliminate 80 percent of today's workloads



The widespread use of remote management in operations—that is, the ability to "operate and optimize from anywhere"—is closer than many might think. The necessary technologies are available today, and many are already implemented within companies as pilots, proofs of concept or, in some cases, on an industrial scale (Figure 3).

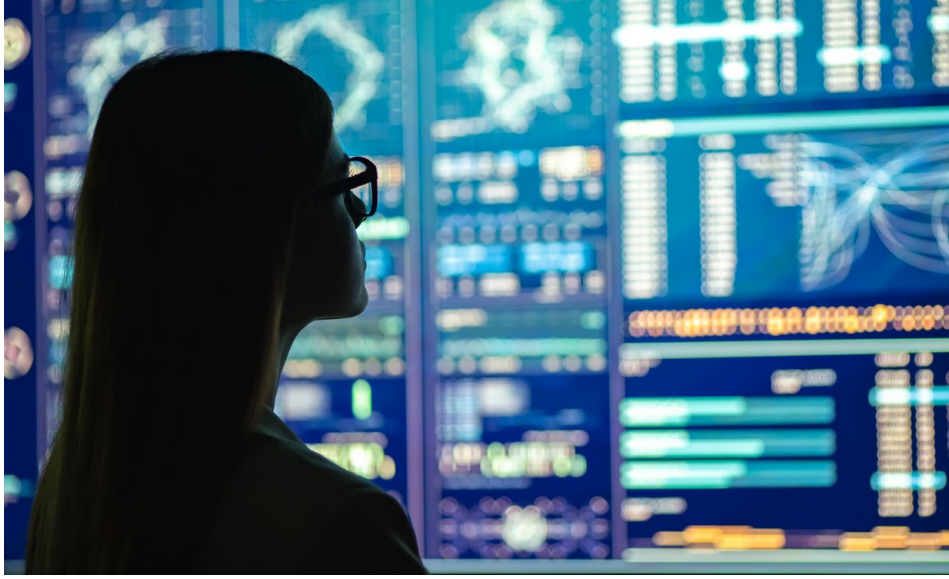


Figure 3: The underlying technologies of transformation

Once the asset-specific target state is defined, the transformation journey can be taken step-by-step.

Typically transformation measures:

- Console tasks that are transferrable between plants.
- Field tasks that are often equipment-, chemical process- or plant-specific processes that are not easily transferrable.

Using today's technology	Process control	Advanced process control	Predictive analytics	Automated feed/bag loading
	Clean in place technology	Automated lubricators	Inventory tracking & automated reorder	Descriptive analytics reporting
Building out analytics and artificial intelligence (AI)	Machine learning (ML) context-based monitoring	Analytics/predictive quality	Video-analytics/ advanced sensor	AI-based recipe management
	AI/ML-based operating windows	Predictive/next best actions	Analytics-based set points	Simulation-based analytics
Building out mechanical and physical automation	Advanced sensors	Autonomous intelligent vehicle	Advanced robotics	Modernization of sensor arrays
	Quality control & sampling optimization	Production integration	Autonomous & connected robotics	Closing control loops based on R&D insights

The economics of the required technologies are becoming more favorable as well. For example, closed control loops have long required the physical hardwiring of actors, sensors and processors, and significant investments in instrumentation and resources to implement and manage over time. Now, however, data science, analytics, artificial intelligence and advanced user interfaces enable the "soft-wiring" of components, which involves less cost and effort, opening the door to broader uses and applications.

Targeting the “sweet spots” of transformation

With the increased availability of sophisticated technology and declining technology costs, the main barrier to digital transformation in operations today lies largely in the implementation and rollout of new systems and processes in plants. In the chemical industry, the technology landscape is far from uniform. In a given company’s operations, some plants may be 50 years old, while others have just been brought into production. What’s more, systems within and across plants can vary widely. As a result, companies need to take a targeted approach to changing technology and processes—one that is differentiated for each plant—rather than simply pushing forward across the board with one-size-fits-all efforts.

To tailor and prioritize their transformation efforts, companies need to weigh two key factors:

The remaining lifecycle of the plant, taking into account factors such as its cost competitiveness and profitability and the demand for its products. This can help companies determine what level of investment makes sense in light of the expected payback time that will be required.

The maturity of the installed automation based on the technology upgrades that have already been implemented and the gaps that have yet to be closed. This helps determine the investments and improvements that will be needed to achieve the next level of performance.

An analysis based on these factors can help companies find the "sweet spots" for investing in improvements where changes are likely to create the most value for the money in each plant (Figure 4).

Figure 4: Finding the "sweet spots" for investments

Taking a more comprehensive, systematic approach

For the industry, the situation is promising. The required technologies are available, and chemical companies have established various proof-of-concept and pilot projects that clearly demonstrate the value of digital technology in operations. But too often, these efforts are taking place in silos. Technology and transformation initiatives are fragmented and limited, and few chemical companies are pursuing large-scale projects. To take digitally enabled operations to the next level, they need to adopt a more programmatic approach that will allow them to scale up new technologies and processes rapidly and effectively.

When pursuing technology-led transformation programs, chemical companies need to incorporate all the proven elements of any successful program—clear targets, sound governance, change management and training, a structured way to measure and track value, and access to the right skills and experts. Each of these factors plays a vital role in an effective program.

But a technology-led program targeting operational excellence requires more. For example, companies will need to implement digital twin solutions to support engineering and operations. They will need to define options for "pre-assembled" technology stacks and standard toolsets for mechanical and business process automation—options that will accommodate different plants' needs while ensuring high levels of standardization across plants. They will need to take advantage of data science platforms to develop and continuously optimize predictive and prescriptive operational models. And they will need to implement cloud-based data lakes with preprogrammed data-management capabilities to support those platforms.

With chemical companies often having networks encompassing hundreds of plants and sites, this kind of structured, programmatic approach—with a carefully planned technology roadmap—is critical to avoiding the ongoing fragmentation of systems, processes and effort.

The opportunity for action

> Digital technology, analytics and automation are not new to the chemical industry. But the COVID-19 pandemic clearly showed that adopting new ways of working is critical—and demonstrated the effectiveness of these tools in enabling those changes.

Companies can now draw on an array of existing technologies to "optimize and operate from anywhere." To do so effectively, however, they will need to tailor their efforts on a plant-by-plant basis—and at the same time, create an overall programmatic framework that will enable them to target various incremental improvements in individual plants while driving overall transformation across their networks of facilities.

The pandemic has created challenges for people and industries around the world, but it has also shed light on how chemical companies can operate more effectively in the future. At the same time, it has provided a powerful impetus for change. As a result, chemical companies now have a unique opportunity to use the lessons of the pandemic as a springboard to take their plants to the next level of operational excellence.

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Note

Statements and modeling in this document come from Accenture analyses.

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