



Digital Acceleration in Specialty Chemicals

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Digital technologies can now guide improvements at all stages of an asset lifecycle – from unit design and operations optimization to maintenance programs.

The journey toward digitalization started a few decades ago in the process industry, when companies began to upgrade from analog and paper-based systems to digital instrumentation. Early solutions for chemical companies included replacing manual adjustments to production units with distributed control systems (DCS) and the use of computer models to predict behavior in reactors.

What began as disparate point solutions solving singular and local challenges has expanded to include solutions that can deliver productivity improvements and cost savings across the entire business. Digital technologies can now guide improvements at all stages of an asset lifecycle – from unit design and operations optimization (including production and supply chain) to maintenance programs. Many tools are further refined to meet the specific needs of chemical producers, across the broad mix of raw materials, technologies, production processes and markets.

The interest in digital tools is truly accelerating as many companies realize the power such tools can deliver and see rivals eagerly adopting the new solutions and capturing the benefits. In this competitive industry, companies cannot afford to be left behind.

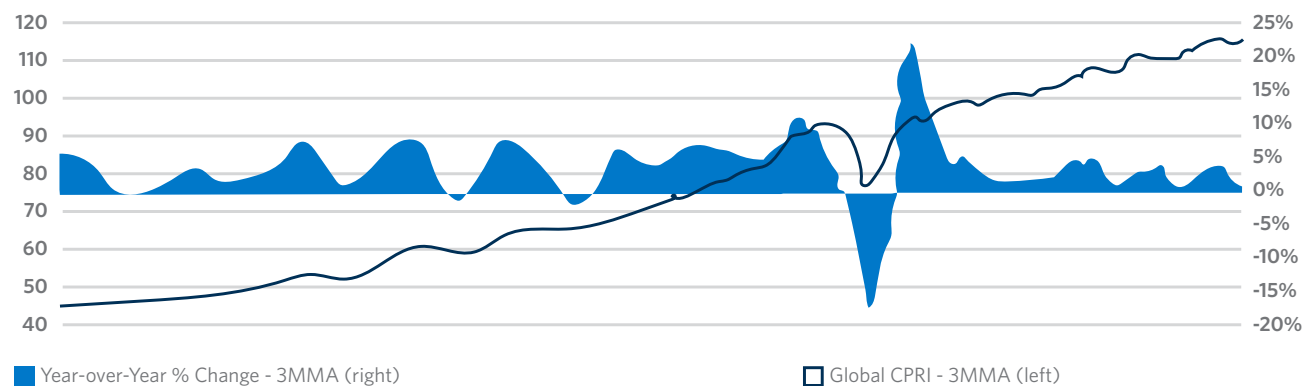
Producers of specialty chemicals face particularly demanding challenges due to the complexity of operations and the increasing variety and number of products their downstream customers require. Specialty chemicals requires greater efficiency in innovation and new product introduction compared to commodity chemicals.

Enabling Technologies Unlock Hidden Value

The global chemicals industry has been in a sustainable upcycle for several years now. Growth has continued on a positive trajectory since the financial crisis in 2008 with year-on-year growth of 0.7 percent from 2012.

Global Chemical Production Regional Index

Index where 2012=100 (3MMA)



Source: American Chemistry Council

"Global Chemical Production Index." American Chemistry Council, October 2018.

In a report released in fall 2018, Deloitte analysts summarize recent discussions within the industry: "Most executives in the chemicals and specialty materials sector are optimistic about growth, consolidation opportunities and realizing digital potential." At the same time, they are "concerned about regulation, geopolitical risks, and changing customer expectations and requirements. Innovation, sustainability, and supply chain remain the key high priority strategic areas for the sector."¹

Applying digital technologies is becoming a strategic imperative in many industries, including the chemicals sector. Leading multi-national and diversified chemical company BASF's website states "digitalization presents big opportunities for us. Using digital technologies and data, we are creating additional value for our customers and increasing the efficiency and effectiveness of our processes."



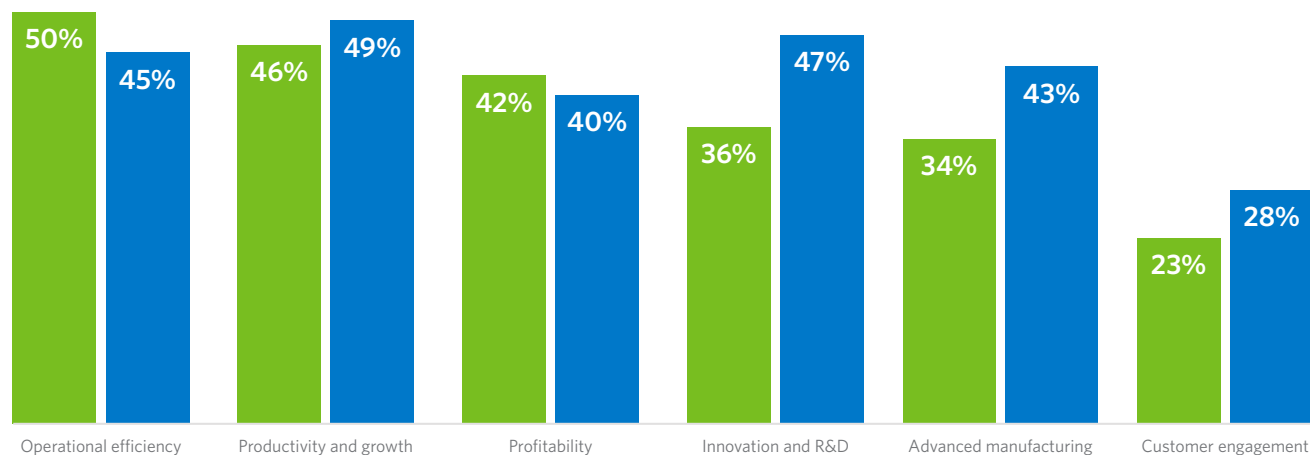
Chemical Industry Response is Lagging

Although many chemical companies are actively working to use digital technologies in their business, by most accounts, the industry is lagging. In 2017, the Deloitte report “Digital Transformation: Are Chemical Enterprises Ready?” stated that “most chemicals enterprises lack a digital roadmap or strategy.”² The authors cited several possible reasons for the slow progress – from the challenge of large capital projects to the lack of confidence in and knowledge of digital technologies.

In its 2018 update, Deloitte reported some progress but still rated the chemical sector as a 5 on a scale from 1 to 10, even as 85% of executives believe that the chemical industry is moderately to highly digitally mature.¹ This assessment comes in the context of optimism about growth in the market and with it a realization that digital technologies are a key tool to realize the full business opportunity.

At the same time, Deloitte reports that chemical executives acknowledge the value of deploying digital technologies to achieve operational efficiency and productivity, while also addressing key challenges in R&D and in complex manufacturing environments. These challenges are typically leading concerns for specialty chemicals companies. Chemical companies are similar to oil and gas companies in operational efficiency and productivity concerns but have greater need for innovation and advanced manufacturing.

Key benefits of employing digital



■ Oil and gas: For productivity gains and cost controls

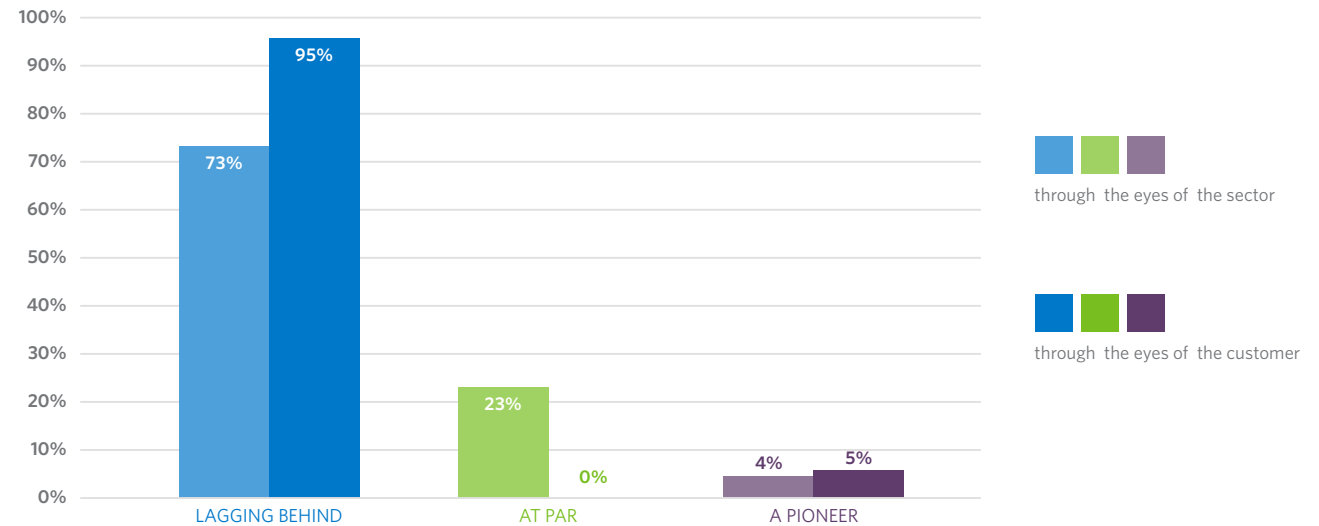
■ Chemicals: For both short-term results and long-term strategic thinking

“2018 Oil, Gas, and Chemicals Industry Survey.” Deloitte, October 2018



In a European Petrochemicals Association (EPCA) report published last year, 73% of petrochemical companies surveyed rated themselves as “lagging behind” in supply chain digitalization, while their customers rated their lag more significant at 95%.³ The survey results, analyzed for EPCA by the Vlerick School of Business, noted that customer behavior was an important driver in the need to develop new supply chain tools.

In terms of digital transformation, the petrochemical sector is ...



(Source: *Digitisation in the Chemical Supply Chain*, European Petrochemical Association, March 2018)

The challenge for many companies is gaining enough understanding to harness the advantages that are possible with digital technologies. Organizations struggle to learn the terms, correlate with current and future assets, harness data to ensure safe and secure operations and leverage advanced models to develop greater business expertise.



Leaders are Gearing Up for Change

Leading companies are introducing new organizational approaches to digitalization, as they see value across their portfolios and align their organizations to best capture the advantages.

Evonik established a digitalization subsidiary and named a chief digital officer in 2017 and has since moved to invest 100 million euros in developing and testing new digitization technologies. Executive board chairman Christian Kullmann noted, “for us as a specialty chemicals company, digitalization brings with it a world of possibilities.”

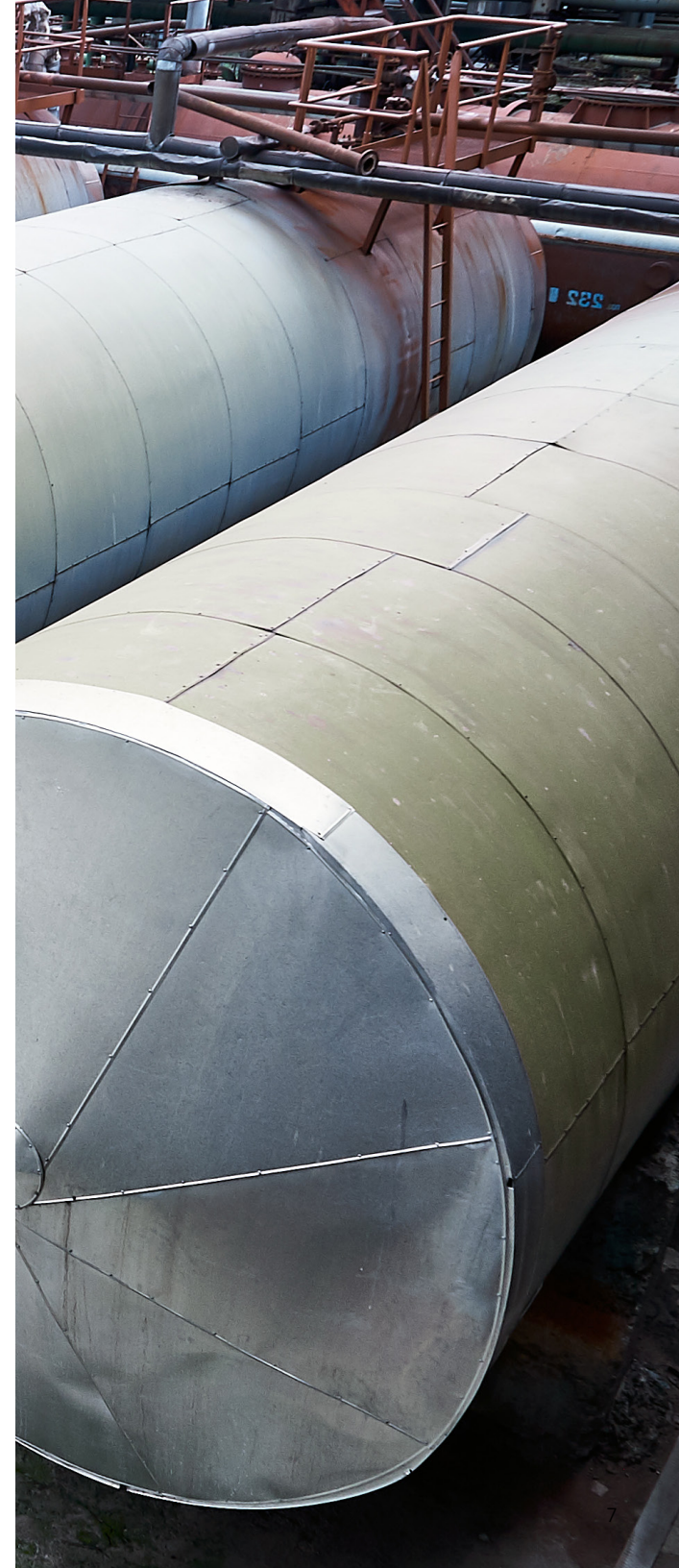
Wacker Chemie has launched a new program to advance digital transformation across its supply chain. In its 2018 annual meeting, President and CEO Rudolf Staudigl acknowledged the value, stating that “digitalization will help us satisfy customer needs even better. It is a topic that encompasses the entire supply chain, from product development and manufacturing right through to customer service.”

In 2018, diversified major Dow added chief digital officer to its chief information officer title to reinforce the company’s emphasis on digital tools. In her role as CDO and CIO, Melanie Kalmar leads a team of executives, business-line presidents and functional vice presidents to develop Dow’s digital strategy.

At *Fortune's* 2018 Brainstorm Reinvent conference, Kalmar highlighted that digital technologies are not meant as an add-on to existing operations. "Many companies have failed because they looked at digital as an add-on to what they do already ... as a new tool. The reality is that you have to step back, simplify, and rethink how you execute your work on a day to day basis." The value of using digital tools, she asserted, is to be more agile and to become closer to customers.

In specialty chemicals markets, better alignment with customers is a key tool to achieving business success. With this digitalization emphasis, these companies are acknowledging that digital technologies are a differentiator in the competitive specialties segment.

In heavy asset process industries like chemicals and refining, leaders are embracing an asset optimization strategy to enhance the entire asset lifecycle using digital tools. Asset optimization has always been about digital technologies. Now it is accelerated through new developments like **artificial intelligence**, **machine learning** and **multivariate analytics** and further enhanced with concepts like innovation, vertical integration and asset lifecycle.



Value Opportunities in Digitalization

In the specialty chemicals market, digital technologies can effectively address the following emerging priorities:

- accelerating innovation
- optimizing across the value chain
- aligning with customer demands.

Innovation allows businesses to meet customer demands while also staying ahead of competitors. Specialty chemicals manufacturers are continually looking to innovate and enhance product performance at lower cost – often with fewer or alternative raw materials. Digital technologies can boost

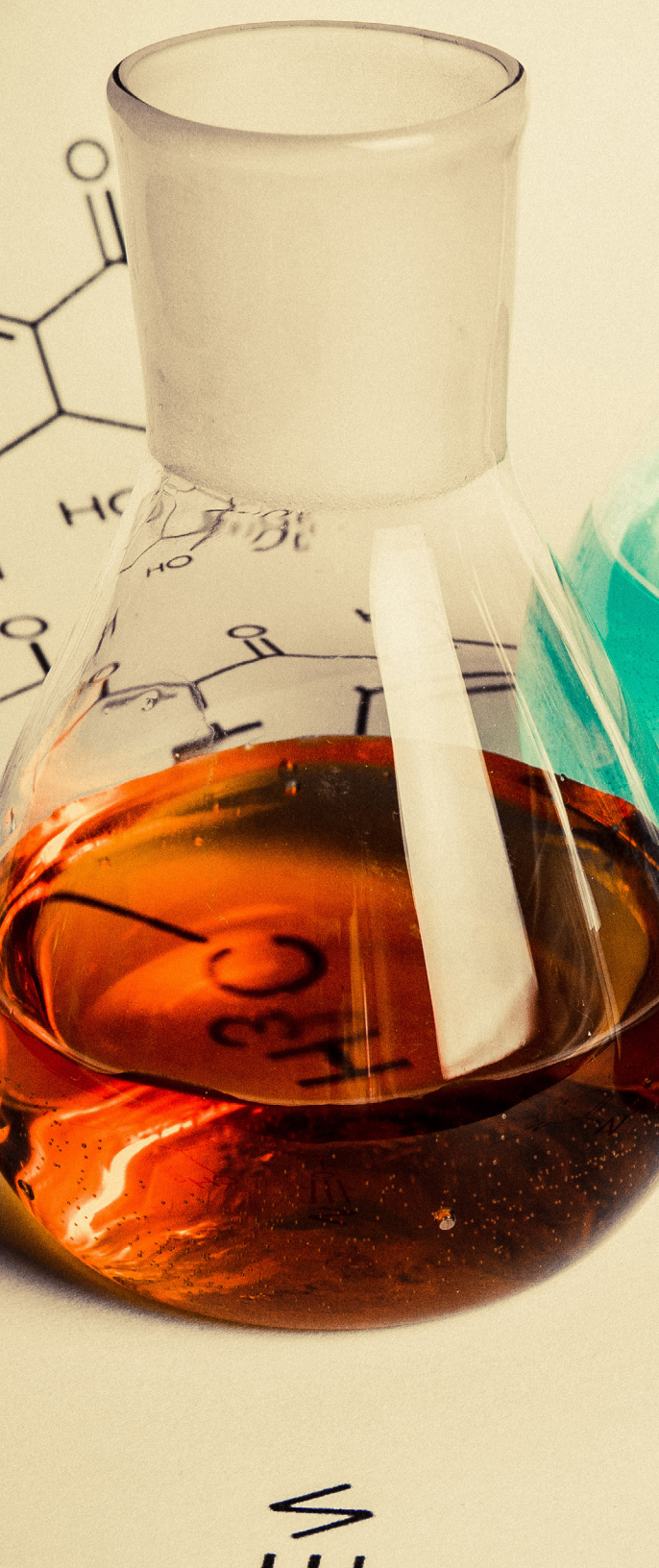
productivity and reduce errors by easing the transition from laboratory to plant production processes. Researchers at Dow Chemical call this “model-guided experimentation.” They use first-principles modelling tools to accelerate the time to market for new polymers, running simulations to adjust process conditions in advance of the plant trials.

Manual procedures, hand-written reports and paper-based systems are still common for critical activities such as recipe execution, quality monitoring and raw material management. These isolated tools limit visibility into data and often delay responses

to potential quality issues and regulatory requirements. Through digitalization, companies can gain insight that allows for improvements in quality and consistency.

Specialty chemical producers have improved quality 10 to 20 percent by implementing best practices enabled by manufacturing execution, advanced process control and asset performance management solutions from AspenTech. These systems deliver reduced variability that has directly contributed to improved outcomes for their customers.





For example, modelling tools can be used to better predict and control behavior in plant reactors. Qenos, a specialty polymer producer in Australia, accelerated its introduction of a new product by six months using Aspen Polymers™ and process data. Additionally, the company cut costs by \$135,000 USD per year by optimizing production processes to reduce monomer use and cut by-product wax production.

Specialty additives producer Lubrizol applied batch modelling tools to several of its production processes – both batch and continuous – and saw a 5-10 percent increase in capacity while reducing costs by \$750,000 USD. The company was also able to accelerate the time-to-market of new products by as much as 22 months.

When assessing the entire **value chain** for specialty chemicals producers, technology solutions enable monitoring, execution and control of the manufacturing process. In addition, planning and scheduling tools offer important capabilities that boost responsiveness and related profitability. Rapidly changing market and customer demands force frequent changes in production schedules; according to some producers, adjustments of 25 percent to 45 percent each month are not uncommon. Scheduling tools deliver the best value when linked with manufacturing execution systems, often referred to as *vertical integration*, so commercial systems are synchronized with process automation.

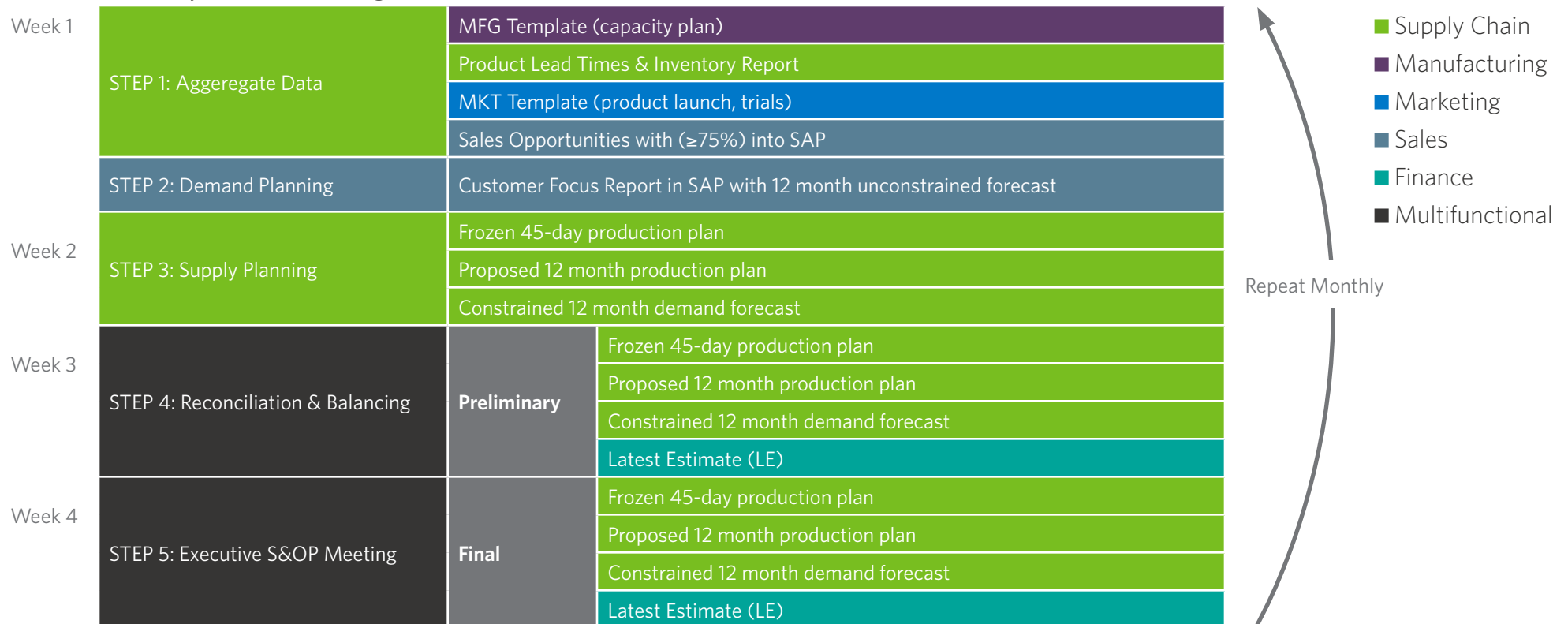
Improved scheduling tools help companies make better business decisions as variations occur by incorporating key constraints – such as storage limitations, throughput rates and variable lead times – while minimizing excess inventory and off-spec production. Better scheduling capabilities can also boost asset utilization. At the same time, schedulers can see the impact of their decisions and make adjustments to avoid problems along the supply chain before they happen.

With targeted plant scheduling tools, the scheduler can rely on the model to inform decisions such as batch size determination, resource selection and batch sequencing and disposition. The technology enables better asset utilization and improved customer service by clarifying the profit opportunities and the extra costs in less than optimal operations.

The next step is vertical integration, which links manufacturing systems to scheduling. These systems can give visibility to storage tank levels, for example, so scheduling tools can decide when raw materials should be put in tanks and when they should be emptied. This link can also alert the scheduler if processes are taking longer than expected, allowing for adjustments across the production plan. The scheduler can proactively identify optimal solutions in real time.

Specialty-producer Criterion Catalyst & Technologies applied Aspen Plant Scheduler™ to its complex and demanding sales and operations planning (S&OP) process. Legacy tools provided less than three months visibility on asset availability, even as sales staff could not gain customer requirements in less than a six-month window.

Revised Sales & Operations Planning Process at Criterion



The redesigned scheduling process using Aspen Plant Scheduler (shown above) helped to better align customer demand timing with plant scheduling across 21 production lines at 8 manufacturing sites. ⁴

Aligning with customer demands is crucial for success in specialty chemicals markets. Models of manufacturing assets can be used to automate identification and evaluation of a variety of production scenarios across a variety of timeframes. These models represent the full complexity and options possible, including production rates, constraints, efficiencies, set-up times, sequencing and site logistics. Specialty companies cite an 8 to 12 percent increase in on-time order fulfillment when these tools are applied.

Meeting customer needs includes ensuring that assets operate well and produce the targeted products. Leading companies are using multivariate tools to analyze interrelated operational data to identify and eliminate sources of process variability. Businesses apply this analysis to batch and continuous processes to ensure more production that meets specification.

At FMC Corporation, Aspen ProMV™ technology determined that simple changes in standard operating procedures for a batch herbicide could rescue close to 50 percent of production that previously had been out of specification. In a batch emulsion polymer process, Mitsubishi Chemicals used ProMV to eliminate off-specification production, which has been running at as much as 15 percent of production.

Specialty chemicals producer Momentive is focused on aligning with its diverse customer demands across its silicones, quartz and ceramics business units. In a recent webinar, scheduling and planning leader Michael Reifer highlighted that “demand prioritization is something that we must do every single day given seasonality and product portfolio complexity.”⁵

Momentive applied AspenTech supply chain tools across a complex mix of 16 manufacturing sites in 3 regions that operated batch and continuous processes and bulk and packaging assets. The company was able to optimize scheduling for the variety of asset capabilities and business demands for each, improving customer fulfillment and decreasing supply lead time by 10 days while also cutting some site inventories by 25 percent.

Aspen Technology has been working with leading chemicals manufacturers for nearly 40 years. This experience provides significant insight on how companies can best succeed by enabling digital tools. The following observations have emerged from our engagement with industry leaders:

Leaders execute differently and know that acting on new technology developments is key to staying ahead of the competition.

Leaders have a relentless focus on operation excellence. This focus provides a structure to select and measure digital transformation approaches to ensure a meaningful impact on asset-intensive businesses.

Leaders have a holistic asset optimization strategy that moves beyond operational considerations. Technology can assist in all stages – from design, operation and maintenance – of the asset lifecycle and can continue to deliver value at each stage.

Leaders leverage technology to ensure an ongoing competitive advantage and improved business decision-making. Today, that means having real-time data, applying advanced analytics tools and ensuring rich process knowledge to succeed in your business.

Leaders have a strong organizational focus and understand that this is key to successful implementation.

Benefitting from Digital Acceleration

The tools, services and solutions specialty chemicals producers need to manage their complex operations and achieve new levels of reliability and profitability are accessible to companies now. The first step is to consider the primary challenge for your business and identify relevant digital solutions. Adopting such tools will set you on a 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. Digital technologies enable opportunities that do not stop with operations but expand to address key drivers in specialty chemicals markets, such as accelerating innovation, optimizing across the value chain and aligning with customer demands.

References:

1. "2018 Oil, Gas, and Chemicals Industry Survey." Deloitte, October 2018
2. "Digital Transformation: Are Chemical Enterprises Ready?" Deloitte, January 2017
3. "Digitisation in the Chemical Supply Chain." European Petrochemical Association, March 2018
4. "Case Study: Transforming Sales and Operations Planning at Criterion." Aspen Technology, May 2016
5. "Momentive Boosts Customer Service & Profitability with Detailed Scheduling and Finite Capacity Optimization." Aspen Technology, October 2018



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 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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