

Digitalization is the next step in chemicals excellence

Digital transformation is a common theme at many industry gatherings and events, as operating companies are more readily sharing their digital success stories and audiences are becoming more comfortable with the digital themes. As the discussion grows, many companies are expressing their concerns that competitive positioning is increasing their drive toward digital tools.

For many of us, comfort with the topic of digitalization builds from our experience as consumers as we talk to appliances at home and carry tiny computers in our briefcases, pockets and even on our wrists.

While adoption has come relatively quickly in our personal lives, it has seemingly moved slower in many workplaces. A key driver in the personal use of new technology has been the ease of use—the simple interfaces that allow quick engagement and confidence in the result. This capability is now becoming increasingly available in the workplace and in the digital tools that are applied to chemical production processes and business operations.

In a recent podcast, Dow CEO Jim Fitterling highlighted this evolution of the industry. “Manufacturing today looks different,” he said. “It is more digital and feels more automated and much more modern than what I remember 35 yr ago joining Dow.” He reflects what many companies have been experiencing for the past few decades and now can seize to enable the next level of performance.

For many years, and even decades, data observation and collection have been familiar exercises for many chemical and refining companies. The next step is utilizing that data to boost performance to the next level. “The data is there,” a senior executive at a refining and petrochemical company reflected recently, “but we just cannot see it.”

Digital technologies offer significant opportunity for improved quality and cost savings across the chemicals industry by enabling more efficient *design, operation* and *maintenance* of assets throughout their lifecycle (FIG. 1).

TABLE 1. Global digital transformation¹

USA	<i>Smart Manufacturing</i>	Germany	<i>Industrie 4.0</i>
Great Britain	<i>High-Value Manufacturing</i>	Netherlands	<i>Smart Industry</i>
Belgium	<i>Made Different</i>	Czech Republic	<i>Průmysli 4.0</i>
France	<i>Industrie Futur</i>	Lithuania	<i>Riga IT demo centre</i>
Portugal	<i>Produtech</i>	Finland	<i>Business Revolution</i>
Spain	<i>Basque Industry</i>	China	<i>Made in China 2025</i>
Italy	<i>Fabricca Intelligenete</i>	South Korea	<i>Innovation in Manufacturing 4.0</i>
Austria	<i>Production der Zukunft</i>	Japan	<i>Industrial Value Chain</i>

However, many chemicals companies are still in the early stages of understanding how such opportunities can be applied effectively to their businesses.

The next level of operational excellence. In many ways, this early discussion is not unlike the early stages of previous excellence programs that the industry has adopted. Operational excellence was a key theme in the 1980s as companies targeted key metrics to help drive improved performance from production assets. Later, Six Sigma tools enabled a deeper dive into defect reduction throughout production processes; these tools then moved into business processes. Several companies fully engaged their organizations to drive these efforts, often reorganizing commercial structures and developing skilled teams to enable full adoption of these capabilities.

At the heart of the Six Sigma efforts is utilizing detailed metrics that help align and drive the organization toward achieving the next level of performance. The need for metrics that track progress and define success, and the awareness of the possible accrued costs and obtained value, are inherent in any business initiative and can improve decision-making across the business.

Digital technologies offer the same depth of transformation for optimal performance, with accessible metrics

to enable success. Effective adoption of digital technologies will also demand the same level of business engagement and realignment.

The chemical industry has progressed with digital technologies at a slower pace than some—finance and telecommunications have been early leaders—and has only just begun to move toward digitalization in greater numbers.

Harnessing the advantages of digitalization. Certainly, some early chemicals leaders, such as Dow, Evonik and LyondellBasell, have quickly acknowledged the tremendous value of such programs and have implemented these tools across large portions of their organizations. However, the key value for many of these activities will come when the tools expand from targeted point solutions to be engaged across the business enterprise.

Several consultants and industry organizations are charting the progress of digitalization across the chemicals enterprise. In its 2017 report, “Digital transformation: Are chemical enterprises ready?” Deloitte noted that more than 50% of chemical enterprises lack a digital strategy and transformation roadmap. The report cites 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.



FIG. 1. Using a targeted approach, companies can leverage their existing excellence programs to drive digital tools and metrics.

In a March 2018 report published earlier this year by the European Petrochemicals Association (EPCA) titled, “Digitization in the petrochemical supply chain,” 73% of petrochemical companies surveyed rated themselves as “lagging behind” in supply chain digitalization, while their customers rated their lag higher, at 95%. The survey results, analyzed for the EPCA by the Vlerick School of Business, noted that customer behavior was an important driver in the need to develop new supply chain tools.

The challenge for many companies is to gain enough understanding to harness the advantages that are possible with digital technologies; for example, understanding the terms, correlating with current and future assets, and ensuring safety and security of current operations and business knowledge.

An important step in this process is acknowledging that current operations and behavior are quite costly. For example, deviations from the defined operating plan lead to lost production time, wasted raw material and often charges to dispose of or blend the resulting undesired product. The impact translates into missed orders and inadequate inventory for the supply chain.

Less obvious impacts include polymer production schedules that are not fully optimized to deliver maximum throughput, or limited scope on process options that can improve existing operations. Digital tools can readily solve each of these challenges, although many companies remain hesitant to apply them.

Again, the similarity with Six Sigma adoption applies. Early efforts in the late 1990s targeted select manufacturing operations, and organizations were critical of the broader value. Eventually, many more companies adopted the tools and methodologies and applied them across their businesses. For some companies, the establishment of separate corporate teams was key to ensuring that the diagnostics, methodologies and implementation were logical and structured.

This specialized structure is emerging with leading companies’ digitalization efforts as they see the value across their portfolio. Evonik established a digitalization subsidiary and named a chief digital officer (CDO) in 2017. The company has since moved to invest €100 MM (\$113 MM) in the development and testing of new digitization technologies. The company’s CDO, Henrik Hahn, says, “It is not just about data and technology, but especially about new business models, solutions, services for customers and training qualified staff.”

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

Most companies are not as far along their digital journeys as these examples, and they can still gain significant value with their efforts. Some may also leverage their existing excellence programs to drive digital tools and metrics.

Targeting a focused project is a good way to begin their efforts:

- **Design:** Develop a digital twin—the digital representation of an existing process—to test boundaries and future opportunities of current operations. Digital twins can also be used as training tools for new operators.
- **Operate:** Implement process control technology to improve production operations or use a scheduling tool to optimize a polymer production process to ensure that the unit maximizes production of on-spec product while minimizing any transition grades.
- **Maintain:** Use data analytics to understand process unit failures, and to plan for abnormal process conditions, avoid unplanned shutdowns and successfully manage unpredictable feed and demands.

The chemical industry has become increasingly complex as the variety of products and processes expand and competitive intensity has grown. Digital tools address these challenges well. Digital projects have delivered tens of millions of dollars in savings by optimizing production and business processes. By using data to drive business and operational decisions, many companies are progressing with their own transformation to the next level of performance and operational excellence. **HP**

LITERATURE CITED

¹ Mindas, M. and S. Bednar, “Mass customization in the context of Industry 4.0: Implications of variety-induced complexity,” *Advanced Industrial Engineering*, Wydawnictwo Fundacji Centrum Nowych Technologii, Warsaw, Poland, 2016.



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