

# The future is now

## Digital transformation ushers in new era for the chemical industry

Chemical companies are intensifying efforts to digitalize their operations and utilize advanced technologies to enhance their performance and make their processes more sustainable, efficient, and safe. They are partnering with technology firms, developing their own tools, and investing in high-tech, data-analytics startups to support and accelerate these initiatives.

▀ Sotirios Frantzas

**D**igitalization and automated processes have for years been part of the way that the biggest chemical companies, including BASF and Dow, have operated, according to the *Digital pulse of the chemical industry 2023* report, published recently by Nokia. However, in the past decade, digital technologies have become available at much lower prices and been more broadly accessible, and advances in technology have enabled more companies from across the industry to gather data that was not within reach before, Nokia says. During this period, the biggest

players have invested to upgrade their digital processes to stay competitive and ensure the processes are secure and running as efficiently as possible, the report says.

“Everyone in the industry is going digital. The largest chemical companies are well on their way while small and medium companies are not as advanced. They see digitalization as a means to make their businesses more efficient, eliminate human error, make better decisions faster, and improve the security, safety, and sustainability of their operations,” Stephan Litjens, vice president/enterprise campus edge solutions at Nokia, tells *CW*.

Communication between teams,

improvements in security, sustainability issues, and real-time data transmission are the key challenges the manufacturing industry aims to address through digitalization, Litjens says. Digitalization is particularly important to chemical companies because chemical manufacturing is a complex production process that involves more than just the assembly of parts, he says.

“Not only do the labs and processes consume and generate a lot of data, the necessity of obtaining information in real time, the need for advanced process simulations, and rising production costs have made digitalization a vital part of the operations,” Litjens adds.



## Cover story

Digitalization has evolved into more than simply improving communication or linking information, he says. It is now used to add intelligence to the system based on data, he adds. "Many are deploying condition-monitoring sensors to measure pressure, temperature, flow, and levels for processes that were not measured before. With improved monitoring of the processes and being able to see the real-time flow of materials, overall safety has been improved. Digitalization has enabled early-warning systems and with more automation of processes, it has reduced human error and interaction," Litjens says.

Most of the individual processes within a chemical or plastics plant today use digital measurement and control to manage production. The systems tend to be purpose-designed and built with proprietary hardware and software, including data formats that are incompatible with neighboring processes and systems. As a result, companies have many disconnected data lakes with little or no sharing between them. Removing the silos between legacy systems is expensive and additional custom integration means upgrades become more complex.

Digitalization allows chemical manufacturers to access data that was not accessible previously. With more data and more technology becoming available, companies need employees who can make use of this data, Litjens says. Attracting and maintaining digital-savvy engineers, data analysts, and other skilled workers is a challenge

the chemical industry is facing, as "the new generation is not as loyal as the generations before them. They often leave their roles after a few years, taking their knowledge and expertise with them," he says. "This is particularly difficult for chemical companies with fewer resources. People are needed to implement digitalization. The bigger companies can set up entire departments or dedicated steering committees that are focused on projects, but the smaller chemical or plastics companies, which are often dependent on stretched resources and have less access to digital-savvy engineers and legacy infrastructure, should pursue a long-term digitalization roadmap," Litjens says.



LITJENS: Chemical firms seek new ways to manage data.

As a result, the chemical industry is seeking alternative ways to retain data and transfer knowledge, he says. "Augmented reality [AR] can enable workers to have access to all engineering information," Litjens says. "Many chemical manufacturers are digitalizing their engineering information, twinning their processes with the technology currently available and creating metadata systems for projects."

Companies that have already digitalized their data and created a long-term roadmap may be looking to produce advanced stimulations, get responses in real time, and develop AR or virtual reality training modules and processes that involve advanced artificial intelligence (AI) and machine learning capabilities, in the next three to five years, Litjens says.

### Digitalization partners

Partnerships between chemical and technology firms is the traditional route for advancing digitalization in the chemical industry. The collaboration between Henkel's adhesives technologies business and Vegam Solutions (Bangalore, India), which started in 2007, is an example of how these partnerships can work.

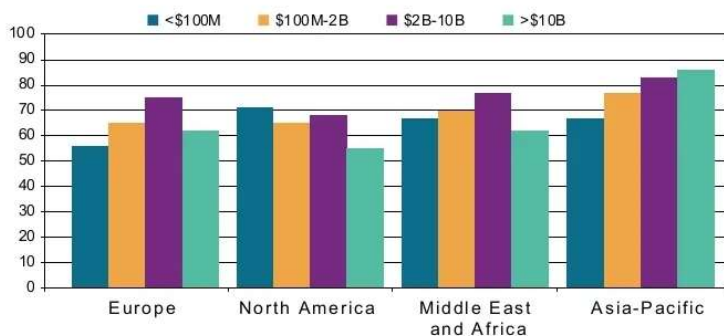
Vegam has a workforce of 150 who are mainly located at Bangalore with registered offices in Dubai and Singapore. It has partners spread across the globe and works with many manufacturing verticals including operation-intensive batch production facilities that make products such as adhesives, coatings, pharmaceuticals, and steel.

Vegam is developing and enabling adoption of the latest digital approaches and technologies to address the complexities of businesses such as Henkel's adhesive technologies, which has a wide range of products and many different product specifications and expectations, says Subramanyam Kasibhat, CEO of Vegam Solutions. "Vegam Solutions has been an innovation-driven, problem-solving company. Our partnership with Henkel started in 2007 and we really are an extension of Henkel in a lot of senses. Vegam collaborates very closely with Henkel's innovation team and in our work with the adhesive technologies' team we keep pushing the envelope continuously," Kasibhat tells CW.

Henkel's adhesive technologies business operates 134 manufacturing sites globally, serving more than 800 verticals or industry segments, and has four main areas of activity: automotive and metals, which is roughly 23% of the overall business; packaging and consumer goods at 33%; electronics and industrials, 14%; and craftsmen, construction, and professional, which accounts for the remaining 30%.

Björn Jackisch, vice president/operations and supply chain, APAC at Henkel adhesive technologies oversees the business's regional activities in APAC and is also responsible for coordinating its global digitalization for operations and supply. "Data is very important for us, as it is the objective source of truth rather than a biased source of truth. We want unbiased data, and this means we aim to record data that comes straight from human actions and from the physical flow of goods. Eventually, we want to come to real-time decision making, and we know that data will enable us to get there. This will create value for shareholders and stakeholders," Jackisch tells CW.

### Implementation of digitalization status



Current status of the implementation of digitalization projects by company size in terms of revenue.  
Source: Ernst & Young DigiChem Survey 2022.  
© 2023 S&P Global

Henkel's adhesives business has a broad asset base that is partially customized across all its sites, Jackisch says. "We need to find a common denominator, to make sure we treat all our assets with the same rigor from a data perspective," he says.

Vegam has the capabilities to customize its system to the needs of the Henkel adhesive business's differentiated asset base, Jackisch says. "It took us several years to fully deploy Vegam's smart factory systems across roughly 10% of our global manufacturing footprint and following the approval of our comprehensive digital strategy last year, we are now in the position to scale and accelerate the system, building on the experiences and insights from the 10% deployment," he says.

Vegam's Smart Factory Solution (SFS) platform is a complete package that the company is enhancing continuously. It has multiple pieces of technology, software, hardware, sensors, integration connectors, and mobile applications. "We have over 20 functional modules within the platform which would address every operational need of a manufacturing plant related to production, quality, receiving of raw materials, maintenance, and functionalities related to safety, sustainability, and energy," says Kasibhat.

Various functional aspects are involved and the platform has workflows and tools to address each of them, Kasibhat says. It also provides analytics that generate information on performance regarding, among other things, certain customer requests and production line requests, he says. It makes it possible to go back to historical production data and identify what can be improved in the production of a batch, or find out why a specific batch was of particularly high quality, he adds.

Nevertheless, the basis of the relationship between the two companies has not been "fancy technology," Kasibhat says. Instead, the human element has played a key role in building Vegam's relationship with Henkel, he says. "It is about solving core problems and making a business case about the main needs of real operations and how the life of operators can become better, simpler, and safer," he says. "Another fundamental aspect of our relationship has been trust and the openness and willingness of Henkel's leaders to listen and respect our ideas, to understand the value our technologies can bring."

Kasibhat says there is a complex human element in the data, which is generally

underrepresented. "The human touch is an essential part of that entire process," he says.

Human and cultural aspects are key to the success of a plant's digital transformation, Kasibhat says. User interface plays a fundamental role, since it can empower the operator on the shop floor—who is likely an expert in production but does not understand data—to make the right choice based on the data, he says. To achieve that, the user interface in China may have to be different from the interface in South Korea or a European country, Kasibhat adds.

It is vital to make sure that the people and teams at plants are part of the deployment and implementation process, Jackisch says. "Why would I go through all this extra effort," is the main question usually asked during the implementation of digital tools and technologies at various plants within the business, he says.

"In Asia/Pacific, where I am based, people took our digitalization agenda very positively and actively embraced the challenge. They realized that data improves their ability to deal with their day-to-day job and tasks," Jackisch says.

The implementation of digitalization is not only about the new technology, but first and foremost it is a change-management effort to convince people their lives will get better, Jackisch says. "During deployment at a site, we build a business case, and this is not something that we impose from a senior management perspective. We let the team come up with their wish list and match the digital aspects with it, demonstrating how a digitalization approach could help them. The next step is to work with the teams on a good level of standardization as an important basis for digitalization, and finally, the implementation is done by an expert team," he says.

Andreas Eschbach, founder and CEO of Germany-based software vendor Eschbach, which focuses on the chemical and pharmaceutical industries, tells CW that making local people allies to the digitalization journey, including enabling them to adjust the transformation process, is key. "We provide people-focused software and we are bringing

the people element back into our digitization initiatives. We have 60,000 users around the globe using our platform on a daily basis," Eschbach says.

The main challenge for the digital transformation of the chemical industry is that no two chemical plants are the same, so every facility has its own specific requirements that relate to its processes and to the specific environmental or worker safety regulations of its region, Eschbach says.

The company's Shiftconnector platform helps chemical manufacturers digitally transform their operations to ensure safety and improve plant effectiveness, Eschbach says. This solution is trusted worldwide by leading chemical firms such as Bayer, DuPont, BASF, Covestro, and Albermarle, he says. "The key advantage of Shiftconnector is to digitize communication and documentation in production," says Eschbach. "We have repeatedly heard from Shiftconnector users that a great advantage lies in the simple, continuous recording of tasks to make all relevant information immediately available during shift changeovers, promoting efficiency and safety."



**JACKISCH:** Digitalization is a change-management effort.



**KASIBHAT:** Human element of data is underrepresented.

#### Developing the tools

The development of in-house digital tools and solutions is how some companies, such as Lanxess and Archroma, are advancing digitalization within their organizations. Lanxess announced recently that it had developed a tool that automatically calculates the carbon footprint for each of the company's products. With its Product Carbon Footprint Engine, the company says it aims to help its customers achieve their sustainability goals.

"Being able to calculate the carbon footprint of our products is really a competitive advantage, as we are now able to get a deep understanding of our carbon footprints along the entire value chain and we can focus and understand what the hotspots are and what we should work on. [Meanwhile,] customers are increasingly asking us about the carbon footprint of our products, and we made a big step toward being able to provide

this information,” said Lanxess board member Hubert Fink in a webinar on 7 March during the Lanxess Virtual Days event.

The methodology the tool uses to calculate the carbon footprint is certified by TÜV Rheinland according to the ISO 14067 standard for quantifying the carbon footprint of products, Erik Denkena, head/IT data analytics at Lanxess, said in the webinar.

The quality of the input data is the most important factor when validating the tool’s calculations, Denkena said. “The better the data we receive or have in our systems, the better the quality of the calculation of the carbon footprint will be,” he added. “That is why we not only calculate the carbon footprint of all our products, but we also calculate a quality factor for each carbon footprint we calculate. [This way] we calculate a weighted quality rating of all our products and all the carbon footprint, and this is how we can tell in the end how valid our data is for the calculation of the product’s carbon footprint.”

There is a minimum level of data quality and if this level is not reached, Lanxess does not communicate the calculation of a product’s carbon footprint, Denkena said. “This is because we only want to communicate the valid calculations,” he added.

Heike van de Kerkhof, CEO of Archroma, says she is a “big believer” in digital tools and considers digitalization one of “sustainability’s pillars.” In line with the company’s purpose to drive a more sustainable future in the textile chemicals industry, Archroma has developed digital tools such as its One Way Impact Calculator and Safe Edge.

The One Way Impact Calculator is a process simulation and calculation tool designed and used by the company’s textile-processing experts to provide its customers and partners with an accurate estimate of process costs, resource utilization, effluent-discharge quality, and carbon dioxide (CO<sub>2</sub>) emissions of existing production process and of newly evaluated systems, the company says. The tool has helped Archroma reformulate the recipes of its customers, reducing CO<sub>2</sub> emissions and using less water, energy, and chemicals, van de Kerkhof says.

Archroma’s Safe Edge is an online platform launched by the company in 2021 that allows its customers to have instant access to product-related regulatory compliance certificates and information, van de Kerkhof says. “With our Safe Edge tool and online platform, everything is

visible and immediately downloadable, and our customers have responded overwhelmingly positively to this. We are the only ones with this platform and it is really helpful,” she adds.

In June 2022, electroplating materials maker Atotech announced that it had expanded its product offering with a digital factory suite, a platform that combines a new set of data-driven applications, systems integration capabilities, and remote services, enabling customers to take the first steps in the transition to smart, data-driven manufacturing operations.

The platform forms part of the software solutions and digital services that the company added to its product portfolio, to facilitate the future production needs of its customers, according to Atotech.

#### The power of startups

Investing in or acquiring technology and data-analytics startups is another way chemical companies are looking to advance their digital transformation and add digital tools and technologies to their offering.

BASF announced recently that its venture capital arm, BASF Venture Capital, is investing in WayBeyond, an Internet of things (IoT) and software-as-a-service (SaaS) company that aims to improve crop yields, crop quality, and grower profitability for low-to-mid tech controlled-environment agriculture (CEA) operations using data capture, farm management, and prediction tools.

WayBeyond’s FarmRoad is an AI-powered agronomy insights platform that gives growers farm- and crop-specific insights and recommendations to transform their growing decisions, improving yield, consistency, and quality for more sustainable farming, BASF says. WayBeyond also partners with seed producers to utilize the FarmRoad platform and FarmRoad’s crop-contextual AI to transform seed efficacy and quality, the company says.

Kemira acquired the shares it did not own in SimAnalytics (Helsinki, Finland) earlier this year and is now the sole owner of the

startup that is known for its advanced process harmony prediction and analysis tool. Kemira had bought a minority share in SimAnalytics in 2021.

With this acquisition, Kemira has strengthened its capability to support its customers’ business with data-driven predictive services and machine-learning solutions, the company says.

“Services are an integral part of our growth strategy, and this acquisition is a logical step forward in the strategy execution,” says Antti Pirneskoski, director/services business line, pulp and paper at Kemira. “SimAnalytics has for years been one of our key partners for developing digital services for paper and board production. Now we can continue, accelerate, and expand the collaboration, also to benefit the other industries Kemira serves,” Pirneskoski says.

The Kemira KemConnect Harmonizer digital service is the result of a collaboration between the two companies that started in 2019. KemConnect Harmonizer helps paper and board mills run production more efficiently and with less disruptions, and save on raw materials, energy, and water, the company says. Kemira says it is broadening the service offering to include the

company’s water-treatment customers.

Other examples of chemical companies investing in technology firms include Nouryon’s investment in November 2022 in Ageye Technologies (Raleigh, North Carolina), a company developing an automation platform for indoor farming.

Ageye’s digital technology combines the principles of plant eco-physiology and precision farming, Nouryon says. It uses AI to turn visual inputs into crop growth development insights and autonomous actions that improve the predictability and profitability of harvests for growers, Nouryon says.

Nouryon will bring its expertise in crop protection and crop nutrition to the collaboration and enhance Ageye’s precision-farming technology to optimize indoor growing at scale for growers, the company says. ■



**ESCHBACH:** Including the user in implementation process is key.



**VAN DE KERKHOFF:** Digital tools support sustainability.