

NOKIA



Digital pulse of the chemical industry 2023

Industry 4.0 digitalization challenges and best practices

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Background and Objectives

Experts in digital transformation, the Nokia Team has conducted qualitative research with stakeholders in manufacturing to understand where the industry is in terms of their digitalization process today. Communication between teams, improvements in security, sustainability issues and real time data transmission are a few of the challenges plaguing the overall manufacturing industry. While these challenges also exist within the chemical and plastics sector, there are special nuances that make this sector unique.

Chemical manufacturing is a complex production process that involves more than the assembly of parts. 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.

The plastics and chemical industry also plays a significant role in the global production chain – from energy consumption (and generation) to global logistics and materials. The products and services created from this sector span the entire manufacturing sector from automotive to consumer goods, and disruptions along the value chain can be detrimental and have an impact on the world's economy.

Another big challenge is recruiting new talent. As long-time employees reach retirement, the sector is struggling to attract and maintain digital-savvy engineers, data analysts and other skilled workers to fill in the gaps and maintain operations. 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.

It is because of these and other issues, that Nokia has created this industry report. By conducting in-depth interviews with leaders in the chemical and plastics sector, the report aims to shed a light on the special needs of the industry. Another objective of the report is to reflect the current pulse of the industry in terms of opportunities, challenges and attitudes when it comes to digital transformation.

Interviews

Gathering information for this report involved interviewing C-suite executives, process engineers, supply chain managers and digital transformation engineers across Europe and the US to uncover some key trends. Company sizes, geography and where each company is at within their digital transformation journey span the spectrum from piloting processes to already well along in the implementation process.

Report Highlights

A few of the key findings from the interviews include:

- There is a big difference between the global chemical companies and the smaller specialty chemical or plastics companies when it comes to where they are in their digitalization process. Some of the specialty companies are just starting to digitalize their data and move away from excel, whereas the big chemical companies are already using digital twins and simulations.
- KPIs also vary between the different sizes of companies. Those starting their process are more concerned about getting the digitalization right than KPIs, but companies with more established digitalization also had more established and structured KPIs.
- Regardless of size, all companies are looking forward to new technologies in the future like machine learning and AI. The more automation that could be done with the processes and calculations, the less chance there would be for human error – which results in more efficiency, less waste and increased safety.
- Being able to see data that was not possible before is something that is a benefit to them - but with more data and more technology, it also means they need different types of employees - ones who can make use of that data. This is a challenge as finding this new talent is not easy.
- A common challenge was the lack of resources. People are needed to implement digitalization. The bigger companies could set up entire departments or dedicated steering committees that were focused on the project, but the smaller chemical or plastics companies often did not have this option and digitalization meant someone had to do it in addition to their full-time job.
- In the majority of cases, digitalization is put in place to boost efficiency, conduct automated simulations, reduce human error and connect data. Sustainability and increased safety were side benefits of going digital but were not the main objective.

Digitalization: What it means

Less paperwork, fewer printouts, more connected processes, better dashboards and easier reporting were common themes. The respondents mentioned that digitalization looks at how things can be integrated into process optimization and in the end, into business optimization. For them, digitalization has evolved to something more than simply improving communication or linking information. It is now used to add more intelligence to the system based on the data.

“Digitalization is not an easy word because we don’t work in analog in the chemical industry. We work digitally in the plant. All the information has been registered and the interface allows you to manage the plant,” said one respondent.

Another common thread was that while digitalization is essential, it is not a goal on its own. It’s put in place for specific purposes and to meet specific needs. The operators need to benefit from the digitized platform or software instead of what they call ‘feeding the monster’ or the CMS system.

Plans are underway, but still a long way to go

Most specialty and small to mid-sized chemical companies have already started their digital transformation process. However, they still have a long way to go and when asked, they said they believe that the chemical industry overall was only at level 2 or 3 on a scale of 1 to 5 (with 1 being just starting and 5 being fully integrated). In their opinion, there could be one or two companies that are already at a four, but the average range was between two and three.

But while most of these companies said they were at a 2 for 3, what that rating meant in terms of digitalization goals and objectives varied greatly. For those who already had all their data digitalized and a long-term roadmap created, their next digital objectives included producing advanced stimulations, getting responses in real time and developing augmented reality (AR) or virtual reality training modules and processes that involved advanced AI and machine learning capabilities. These were generally the companies who had been working on their digitalization transformation for the last 3-5 years.

“We are not in the advanced stage yet, but we have a plan that we are working towards. For us, the topic is not about digitalization, but stepping it up to the next level to take advantage of data intelligence and other new technologies,” said a respondent.

Chemical companies in the early stages of digitalizing their data were focused on getting everything online and easily accessible for everyone. These were companies that started their digitalization project in the last one or two years. Augmented reality, simulations and using data intelligence were not yet on their project radar. Instead, they were focused on doing this initial phase right. Plus, their processes also involved changing the internal culture of the company to get the different teams on board to accept the new digital systems.

The one common theme across the specialty and small to mid-sized chemical companies was that they wished they had started the process years ago – in most cases, five years ago. Their reason for the delay was that at the time they didn’t have the resources – whether it was capital budget or people. Now they are working to get to where they want to be quickly.

Large global chemical companies farther ahead

When it comes to big global chemical companies such as DOW, BASF, SABIC and others, digitalization and automated processes have been part of how they have been running for generations. For these multinational companies, digitalization is ranked at a 4 on a scale of 1-5. “There are processes, particularly in the chemical industry, that simply cannot be run manually. They had to be automated and that’s digitalization,” said a respondent when asked why these big chemical companies are so far ahead.

In the last decade, these global companies have embraced and upgraded their digitalization not only to stay competitive but to ensure they were secure and running as efficiently as possible. Another reason was that in the last 10 years, digital technologies were available at a much lower price point and more broadly accessible. “At a minimum, it has been helping us to make better decisions, and where possible, automate those decisions and take people out of the loop completely,” said a respondent.

Advances in technology also enabled these big chemical companies to embrace digitalization quickly. Today, they can gather data that was not possible before. For example, certain process conditions that were once too difficult, expensive or impossible to measure due to the cost of wiring or because they were in hazardous locations can now be measured easily. The advanced speed of computing power to do calculations and infer conditions is also helping the industry conduct more online analysis and predictive controls.

However, while their internal processes are already at the far end of the scale, where these larger companies are looking for improvements is in their external processes. “As an employee at the company, I probably have access to 20 different tools. But it’s all internal. Where more digitalization is needed is with our growth pipeline and insights with the customer interface,” said a respondent.

One theory as to why they are lagging in this area is because they are B2B and not B2C. These large chemical companies may have 5000 customers in the plastics or chemical sector, whereas a global bank or insurance company has 50,000 or a million customers. These companies have external digitalization that is not only secure, but they have information at their fingertips.

“If you call them, they know your birthday, where you live, your last transaction and everything else. It feels seamless and the expectation is that everything is 100% perfect in the system and your information is safe. It’s an expectation of the customer. Because we have fewer customers, we still do a lot of things manually,” explained a respondent.

Common objectives across the sector

Much of the digital transformation that has been happening across the various companies has involved the integration of systems with each other, monitoring processes and tracking usage. “This industry comes from very specific systems that were designed to do certain tasks. In the past, it was very modular and island-based computer systems. Digitalization brings all this information together,” said a respondent.

In addition to bringing systems together, chemical and plastics companies want to do even more.

Objectives include:

- Integrating process automation systems in the plant and the ERP systems of the company. The more automation they can have, the less chance of human error.
- Creating a strong database for future analytics, developing user-friendly interfaces (moving away from excel) and having real time dashboards.
- Improving HAC to meet legal requirements and increase their levels of security.
- Improving security in OT systems – not just IT.
- Reducing production costs:
 - They want to improve their position within the marketplace – especially when it comes to their cost position compared with their competition in Asia.
 - They want to improve efficiency and reliability.
 - They want more accurate results and faster results (time-saving measures).

Next-level objectives:

Those who were more advanced in their digitalization transformation were looking for continuous advancement in the above objectives, but they were also looking to:

- Use digitalization to help with research and development.
- Use digitalization to simulate processes.
- Use digitalization to help with design decisions and safety interlocks.
- Create 3D and AR models of the plants to help with engineering design and reduce the number of errors.

Additional objectives for large global chemical companies:

The big global companies are looking to do advanced versions of all the above. They are already running digital twins and simulating processes as well as tracking shipments globally. However, they are always looking to improve efficiency, reduce costs and reduce waste.

Their objectives include:

- Improved and even more secure real time tracking and monitoring of how inventory is put away to how it is returned to how it is brought to a truck/ship/rail – all the way to the customer's order.
- Using more automation to make decisions.
- Improved access to information to make both open and closed-loop decisions more efficient, consistent and faster.
- Even better simulations and twinning of processes. The more data that can be visualized, the better.

What has been done

Over the last decade, companies within the chemical and plastics sectors have put a lot of focus on digitalizing their supply chain, transport management systems and business intelligence capabilities. Efforts have been made to make the business processes faster and more flexible to meet the needs of the customer.

Imagining smarter systems

The next step is to add more intelligence into their manufacturing systems which will help them create advanced algorithms in AI and machine learning to make processes even more efficient. Already, some of the small to mid-sized chemical companies have been experimenting with pilot projects and trials in this area and have seen good results in such areas as improved color sequencing and productivity. Large chemical companies have been using digital twins for years and are looking for faster and more advanced computing power in this area. In addition, they are working towards adding more data visualization to make smarter decisions.

But AI is not for everyone in the sector – yet. It depends on the amount of data the chemical company has, how they want to use that data and how far along they are in their digital transformation. “A couple of months ago we had a meeting about artificial intelligence, but for our department, it's far away. We don't use that much data to make artificial intelligence useful in the production area. It might be helpful but there is not a business case goal to be fulfilled in that just yet,” said a respondent.

Road-mapping the way

Those who have been working on their digitalization for a while have developed a three-to-five-year roadmap for the future that they are using to evaluate the maturity of the processes and define where they want to advance their digitalization and integration.

However, those who are still working on getting people on board within the organization agree that while a roadmap will be essential in the future, at the moment they like the freedom and creativity they have without it. They say once a roadmap is placed, there tends to be more accountability and for certain people that will be confronting.

Collaboration is also happening between companies. Some chemical and plastics companies are clustered together into industrial areas such as Chemmed Cluster Tarragona. In this cluster, they are working together on certain aspects of their digital transformation to improve safety and decrease the risk of attacks.

Data collection across the supply chain

Large chemical companies have incorporated digital data collection systems and sensors using RFID and other technologies. The sensors are used to track containers, rail cars and inventory. Before the advancements of today's networks, they often had to use brokers who gathered that information on their behalf. Digitalization has helped to streamline this process and make it more efficient.

Another example of how digitalization is being used is with tracking dangerous chemicals. One respondent recalls how several years ago somebody took canisters filled with toxic agro-chemicals and released the gas into the Tokyo Subway. "U.S. Department of Health and Homeland Security came to the company and said, 'Do you make this chemical? How do you know you've got everything? And how do you find a canister that's missing? And if one is missing, how long before you would know?'" said the respondent.

Sensors were used to remedy this safety issue. They developed RFID tag technology with suppliers which would allow a wireless connection to tell them exactly where each canister was. They are now using satellite technology to do this, but data collection remains to be an important objective for these global companies. They want answers to: What is the data that I'm looking for?, How do I attach a digital tracker or sensor pointing to it?, How do I retrieve the information?, and ultimately, what do I want to do with the data once I have it?

Better informed decisions

Regardless of where the company is in its digitalization process, they all agree that improved visibility and access to data, that might not have been readily available before going digital, is helping them make better decisions. Digital technology has provided them with better insights into their processes and an increased understanding. This has enabled them to optimize operations and improve efficiency and profitability.

In addition, today's fast computing speed is providing them with the opportunity to do computations that were not possible a few years ago. The challenge is having the expertise on the team to utilize and understand the data to make it worthwhile. "Throwing technology at the problem is not going to solve it. You need a plan. You need to know what technology you can use, how you're going use it and what outcome you want from it," said a respondent.

Improved safety

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.

"Because the process control equipment has been digitalized, the processes now run within that control. This cuts costs and produces better yields. Of course, it also improves safety because things can no longer get out of control," said a respondent.

The next phase of digitalization

Integration of systems and processes is only the first phase. Already chemical companies are looking ahead to the future. They believe that virtual reality will be great for training and demonstrating safety assessments. Augmented reality will be even better because it will enable maintenance and other operators to have access to engineering information.

While none of the companies interviewed were already using virtual reality, they know it's coming. They are digitalizing their engineering information, twinning their processes with the technology currently available and creating metadata systems for projects. They believe the potential for digitalization is limitless and are ready to embrace it. "Imagine that firefighters arrive at the plant and can see everything virtual through their glasses. They will know exactly where the safety issues are located," said a respondent.

Another concern for this sector is ensuring that knowledge remains within the company. Talent changes are happening more often than they did in the past as the new generation is less likely to stay in one company for their entire career. Digitalizing the knowledge helps with training and ensures that nothing is lost if someone leaves the company.

One more special need for the chemical and plastics sector is the ability to simulate reactions quickly. Digital models can be powerful for safety reasons, as well as for developing new processes and new products. While the larger chemical companies are already using digital twins for some processes, faster simulations are still in demand.

Some of the larger chemical companies are also in the preliminary phases of seeing what they can do with blockchain, especially in terms of how it can help with the supply chain. Other piloted projects include using drones to do inspections.

Challenges & concerns within the industry

Unlike assembly production and other manufacturing operations, communication and connectivity are not an issue in the chemicals and plastics sector because everything is already interconnected. Some of those interviewed have said that even 25 years ago, things were interconnected. It might have been a less sophisticated system, but things were connected.

However, the challenges they are facing include:

More advanced analytics and automation:

- One thing that is hindering digitalization is the availability of technologies for online analytics. "If you want to fully integrate your system, you need a lot of real time data about the composition of certain streams and other aspects. This piece of the overall digitization chain is lagging substantially behind in, in terms of development," said a respondent.
- They say that while there has been a lot of positive development, it's still not where it needs to be to really bring digitalization to the next level. It's still difficult to find trends and use the data for analytics.
- They are looking for as much automation as possible to reduce human error and boost efficiency. They say the most important thing is to reduce analyst interference from the instrument to the database. Anywhere an analyst must do something manually, there is a chance of potential error.

Lack of resources:

- A common challenge is the lack of resources – especially in the small-to mid-sized chemical companies. “I don’t have enough people with enough knowledge to face projects. Sometimes I have the money, but I cannot spend it because no one has time to support the project. This is the biggest challenge in our case,” said a respondent.
- Other similar-sized companies echoed this problem. If they had more resources, they could accelerate the progress and reduce time. But then there is the risk that if they go too fast, they may lose the support of other people within the company.
- To remedy this, some of the companies are scheduling projects in a long-term roadmap, while others are putting some projects on hold until resources are freed up. Another solution they are trying, is to add additional people to the departments, and move people to the process as needed.
- Others are worried that, even though they need do it, going digital will take too long and they don’t have the time to invest in it now. “If you introduce a new system, you need a lot of effort to integrate the processes. This involves time, manpower, cost and know-how,” explained a respondent.

Talent and maintaining knowledge:

- In the past, the main knowledge of the plant was held by critical people who stayed for years. Today, the talent with the knowledge leaves and takes the knowledge with them. They are looking for ways that digitalization can help maintain this knowledge so that it is not lost.
- Another issue is that while the people who implement the new digital processes understand how it works, the people who run the plant using the data on a daily (and nightly basis) are not as intimately involved with the technology. When something goes wrong, they don’t know what to do. They say the challenge is to implement improvements that are easily sustainable.

Cyber security:

- Cyber security is a challenge as the main targets for attacks are governments and big companies such as chemical companies. In addition, insurance companies don’t want to cover them and take on the risk. Each year chemical companies are asked about the number of incidents and safety measure actions they have taken.
- There is also some worry that they could be vulnerable when starting to integrate systems that were island systems to a larger suite of systems that more people have access to. They feel there is a higher risk that through certain gateways there could be someone going in remotely and changing things.
- However, their true weak spot is not technology. It is people. “You can put all the systems you want, but if someone leaks the password – whether by accident or on purpose, you are dead. And you cannot control this,” said a respondent.
- Global chemical companies have the same cyber security concerns as small-to mid-sized countries, but because their systems are interconnected across countries, they have additional concerns about hacking.
- Another area of security falls under third-party connection – such as with their customers or suppliers. As the internet of things is now connecting customers more with suppliers, this brings on new challenges. Chemical companies like the idea of being able to monitor how a customer is using their products to help them improve efficiency and track usage, but at the same time they worry about security gaps when connecting outside their plant.

Legacy systems:

- Like most manufacturing plants, legacy systems are a problem and so are creating interfaces to link to them. The challenge they face, regardless of the size of the company, is deciding if they can afford to isolate the legacy part of the business until they can invest in it. “There’s lots of technology out there that helps bridge the old to the new. The downside is that the more creative you get, the more complex it gets and the more difficult it is to replace in the future,” said a respondent.
- Another problem is sometimes an enormous amount of money is spent on customizing a system into something to fit existing processes, but when the next release comes out, all the customizing must happen again. They said that in certain cases, it might be better to adopt existing processes to the new tool rather than adapting the tool to the processes running today.
- Another issue is often all the machines within the plant come from various machine manufacturers. “Each manufacturer has their own system. To connect them together in one factory to one system or through mobile phones or tablets can be a challenge, and to connect all the plants together globally is an even bigger challenge,” said a respondent.

Fear of change:

- A common challenge is that when a digitalization project moves from a pilot to a roll-out, those implementing the project are not getting support from the staff. People often worry they will lose their job due to digitalization.
- Another issue is that some people will not be ready to learn new technologies. “The ease of transition has to do with the affinity of people. If they have energy for a certain topic, they go with it easily and then with other things, they feel like it’s bureaucracy,” said a respondent.

Changing legislation:

- Legislation within the sector is always changing and the changes can sometimes be restrictive. Companies need to comply with legislation, but sometimes it’s hard to fit into the processes or with what they have in the digitization system.

Leading the digitalization process

In most cases, the companies interviewed had created a digitalization steering committee with representatives from all departments, but who led the process in each company varied. In some cases with the specialty chemical or smaller chemical companies, it was the CEO, CFO and Chief Information Officer along with the controlling department and the production department. In other cases, it was the analytics or quality assurance department leading the process.

Accountability was mostly lying with the production or the team who would be using the new digitalization processes. “We have our own ideas of what we want and where we want to go, but in our case, production is our main customer, so we also listen to them about what they want,” said a respondent.

In the companies where the digitalization process started 4 or 5 years ago, matrix road maps have been put in place. When the committee meets, they use this roadmap to see which processes are colored red and disconnected and which processes are green and already connected with others. This has been helping them make decisions on budget and project priorities.

Departments set up in large chemical companies

The large global companies often had a vice president of operations or a similar role that was responsible for making sure that the fleet was operating efficiently. They did this in partnership with the IT and engineering departments.

However, the actual people operating the plant often played a critical role because even if a vice president or the CEO said that performance had to improve, it would be the people running the process who knew how to make that happen.

Other global companies treated digitalization similar to the specialty companies – and that was with a steering committee who set the agenda. Digitalization was often treated as either a strategic initiative which would span over several years with the help of an outside company, or it was set up as a program with a specific project to solve a specific problem.

With big digitalization projects, these companies often allocated dedicated leaders and process owners, who were freed up from their other roles. From there, they went through the phases of designing the plan, testing user acceptance and implementation.

“Before implementing SAP, we had a hundred different systems that were glued together over the last 25 years. Each plant had different processes and everything was not connected,” said one respondent. “We went from over 100 systems to 5 systems, and the project took two or three years before it was finally implemented.”

Industry personas

Because the titles and departments varied in each organization, when creating personas, we looked at how those leading the transformation approached the project, the current challenges they were facing and where they were in the process.

We found there were three common personas managing the digitalization of the various chemical companies.

Summary: Persona 1 (Nikolas)

- Nikolas is generally someone working in a specialty or small to a medium-sized chemical company.
- He has done some digitalization projects in previous roles. He's comfortable with technology and understands why it's important. However, rolling out this project isn't his only role at the

company. It's an additional project he has taken on so he doesn't have a lot of time or resources at his disposal.

- He takes an entrepreneurial approach to the project and prefers to have things structured as a project rather than a more formalized roadmap tied to KPIs. This gives him the freedom to test, pilot and try new things with the digitalization process.
- He's likely not using outside consultants to help him. He may not have the budget to use them or doesn't feel his project is complex enough to involve them at this time. Most of the figuring out on how to get the thing done lies with him and he's okay with that. He loves the challenge.
- He's curious and while he's not ready to implement advanced tools like AI just yet, he likes to learn about them so he can keep them on his radar for the future.



Nikolas, 33

Occupation: Engineer

Years of experience: 12

Archetype: Experimenter

Bio

Nikolas is a QC team lead, process junkie and for the past couple of years has been interested in digitalization. In his last few jobs, he has helped implement the process. He enjoys the challenge of making change, the creativity of figuring things and seeing results.

Goals

- Integration of systems and data
- User-friendly interfaces to make things easier for the team
- Improve processes

Frustrations

- Getting people on board
- Lack of resources
- Changing legislation
- The time it takes to get things done and see results

Personality

-  Risk taker
-  Innovator
-  Go-getter
-  Results driven
-  Optimistic

Opportunities:

- Road mapping the future
- Educating on new technologies in digitization (AI, etc.)
- Easing on-boarding support

Obtains information from:

- LinkedIn
- External colleagues
- Email marketing & newsletters
- Conferences

Summary: Person 2 (Sergio)

- Sergio may not have rolled out a digitalization project before, but from his years of experience, he understands the chemical processes and knows where digitalization can help. He is also seeking advice on how to use digitalization in ways that are the most effective and efficient.
- Like Nikolas, he works for a specialty or small-mid-sized chemical company, and running this project is not his core role. It's an additional task he has taken on.



Sergio, 48

Occupation: Manager

Years of experience: 23

Archetype: Architect

Bio

Sergio is a Production Manager who enjoys managing big projects. While he may use consultants to advise on best practices and the most efficient ways to achieve success, he knows his processes inside out and has a strong vision on where the industry is going in terms of AI and technology.

- Sergio consults with other departments within his company and there is a steering committee set up. But he's also using outside consultants to help him with road mapping the project and implementing it.
- He is already thinking five years ahead and making sure he has a structure in place to support the new AI and machine-learning technologies that will be coming out, even if he's not ready to use them today.

Goals

- Using data to do advanced analytics
- Taking digitalization to the next level
- Reduced production costs and boosting traceability

Frustrations

- Lack of resources
- Maintaining knowledge within the company
- Results of simulations and analytics taking too long

Personality



Calculated



Problem solver



Visionary



Process driven



Planner

Opportunities:

- Ways to boost ROI
- Facilitating advanced tech like machine learning/ Simulations
- Easing the burden on resources

Obtains information from:

- LinkedIn
- External colleagues and suppliers
- Trade magazines (not ones specific to digital transformation, but chemical trades mags)

Summary: Persona 3 (George)

- George has been working in the chemical industry for decades and has expert knowledge of the entire supply chain – both from a manufacturing process perspective and from the business side.
- His experience comes from working in large global chemical companies, and he has been implementing large-scale digital projects for decades.
- Unlike, Sergio and Nikolas who are implementing the digital projects for their company in addition to their other role, George's sole role is likely to focus on the digital strategy or operational strategy.
- KPIs and return on investment are essential.
- Solutions that are sustainable, efficient and can be duplicated in other plants or globally are appealing to him.
- His projects either sets the best practices other companies will follow or he implements best practices.
- He is interested in what is coming next as his work sets the agenda for the industry in terms of security, simulations, safety and other standards. In fact, he has helped create the industry policies in some of these areas.



George, 59

Occupation: Consultant

Years of experience: 40

Archetype: Processor

Bio

George has worked in the chemical industry for over 40 years for large multinational chemical company. He started as an engineer and has worked his way up to a leadership position. He is now considered an expert in his field. He is strategic and understands both the capital and process side of the business.

Goals

- Reach KPIs to maximize investment
- Sustainable programs/processes
- Seamless monitoring and process simulations (automation)

Frustrations

- Cyber security
- Lack of standardization
- Global tracking and connectivity of data from raw materials to customer order

Personality



Strategic



Organized



Business-minded



Big picture focused



Planner

Opportunities:

- New technologies that reach goals and maximize investment
- Solutions to use in multiple locations
- Advanced data security

Obtains information from:

- Working directly on big digitalization projects
- Conferences
- Trade magazines (not ones specific to digital transformation, but chemical trades mags)

KPIs are not a priority...yet

KPIs are not a high priority for the specialty or small to mid-sized chemical companies at this time. “For now, we don’t have KPIs. It’s something on my wish list as KPIs are one way to get people energized,” said a respondent.

“We aren’t worried about KPIs yet, but we can already see some things are much faster and more reproducible with regards to the results,” said another respondent.

While they were not concerned about KPIs, the stakeholders said they were concerned about getting the right processes in place. Once they were in place, then KPIs would come next.

For the companies that did have some KPIs, the ideas came from suppliers, case studies from other companies and from the executive team.

But KPIs are important for global chemical companies

Because the large global chemical companies tended to be more advanced in their digitalization process, they saw digitalization as a measurable investment that was usually anywhere from two to ten times the original investment.

To measure the ROI, the plants usually choose performance indicators to verify quantitatively that they achieved the expected return. Energy efficiency tended to be one indicator that was common to measure along with product quality. “Consistency itself is a KPI. If the product doesn’t come up consistently at a certain level, day after day, week after week, year after year. Then you have got a problem,” said a respondent.

In many cases, the KPIs would start out as performance based. Then later they used the same data to look at the investment and measure if the improved performance was increasing efficiency, reducing energy consumption, reducing waste, etc.

Positive early results

With the specialty and small to mid-sized chemical companies, a lot of the digital integration was still in the pilot phase, but already results were visible. These included:

- Dashboards that showed a traffic light approach. They now know when they are running well and not as well. They are also now able to detect a lot of problems they did not realize existed before.
- Some of the new tools they have put in place have systems diagnostics. They now see when values and other equipment are not working efficiently which is improving their diagnostic capacity and event management.
- Overall, they are experiencing more consistency and reliability, as well as more productivity gains, less downtime and scheduled downtime at more efficient times.
- Digitalization has made it easier for them by making certain calculations automated, which has resulted in less handwork and less room for human errors. It has removed a lot of the variations in production.

Sustainability improvements expected

Sustainability is important when it comes to the chemical and plastics sector regardless of the size of the company. However, when it comes to their digitalization goals, sustainability tended to be a by-product and not the primary objective. With digitalization, they were able to better manage their processes and analytics system, more effective event management enabled them to detect and react ahead of problems, and improved efficiency resulted in generating less waste. Because of this, they say it's only typical that their sustainability KPIs have also improved.

This being said, they mentioned that sustainability will play a bigger role in their digitalization goals in the future. ISCC certification is becoming more important and so is the passport of materials. "I think traceability will be a big part of the puzzle in terms of sustainability. The time of mass balance and free allocation will slowly but steadily come to an end," said a respondent.

A few of the companies interviewed mentioned they are already looking into preparing their systems for enhanced traceability as they suspect in the near future, proving sustainability circularity was going to be critical in the sector.

Takeaways and future opportunities

The industry sees a lot of opportunities in digitalization going forward. Currently, they are focused on improving the safety in the plant, improving efficiency, enhancing security and reducing the cost of production.

Private WiFi, the benefits of 5G and the Industrial Edge are still new concepts to the specialty and small to mid-size chemical companies. But they see a potential opportunity in the future to share data knowledge within the sector.

While the larger companies are already utilizing 5G and some of the newer digital technologies, they say there is always more to do. One example they gave is advancing how employees connect with the data. People want more visibility and that means more glass which tends to be something like a tablet. The "connected-worker" is already in place and that connectivity will continue to be enhanced.

"In one project, I asked the people building the plant where the control room was going to be. They told me 'We don't have one. Our control room is wherever the operator is.' Each operator would have a device to see exactly what was happening with each operation in real time," said a respondent.

Another area of growth they foresee is how digitalization can help them solve supply chain challenges: How much needs to go where? How much do we need to buy for and what work? How is the demand developing and how do we react to it?

"The biggest problem humans have is that we interfere in the process. We are not mentally equipped to do this. When you talk about business or supply chain and value chain, you are talking about 100 variables. We think we can manage those variables, but it is not possible to keep all of them under control," said a respondent.

The industry is hoping for a digital future where decision-making can be more solid, as well as more effective and data-based as opposed to relying on human interference.

Overall, the future of digitalization and where it is going is positive for this sector – even if a constant change to keep up with technology is inevitable.

Concluding remarks

As noted throughout the report, digitalization varies greatly between the smaller specialty chemical companies and the global companies. Regardless of the size of your organization, two key learnings from this report are: purposeful digitalization and flexibility.

Whether you are just starting out or are planning to enhance your existing digitalization, ensure you have a purpose in mind. You need to know what you want to accomplish and why. All of those interviewed mentioned that adding digitalization for the sake of digitalization or because it sounded interesting could result in wasted time and money later. They said often new processes that were added on because they “might be useful in the future” were never fully adopted or accepted by those who had to use them or the data collected was too advanced and they did not have the in-house expertise to take advantage of the new information. Even the big companies said that it’s not always beneficial to be an early adopter in these cases. Sometimes, it’s good to wait and see how other industries are using it and then incorporate best practices.

When it comes to the second learning, flexibility, make sure to keep your eyes on the future as technologies are changing quickly. It is recommended to implement processes that are flexible or can be built upon as your needs grow.

Those interviewed said that from their experience rigid structures led to problems later or resulted in having to start all over with a new system when legislation changed or new technologies were implemented. In addition, adding a “bandage” or bridge solution to an outdated legacy system was also not a long-term viable solution as the bridges became outdated when new software updates occurred. It is often better to implement a new system rather than trying to patch up an old one.

One final piece of advice: take advantage of the knowledge of others. Time is valuable and all of those who took part in the study mentioned that they didn’t have a lot of time to learn the latest trends and got their information from social media or scanning articles.

Speaking with digitalization experts about best practices and how others are using the digitalization to improve their KPIs can be beneficial. These experts have their pulse on the industry and are ready to help you implement the next level of Industry 4.0 to help you improve efficiency, decrease waste and reduce the chance of human error.

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As a B2B technology innovation leader, we are pioneering the future where networks meet cloud to realize the full potential of digital in every industry.

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