THE STATE OF

THE CHEMICAL INDUSTRY

by Mark Thompson + Martin Valek

2016 REVIEW + 2017 OUTLOOK
The latter half of the 2010s is a period of significant change and readjustment in the chemical industry—with shifts occurring now that may well change both the face and the structure of the industry for a decade or more. There is significant opportunity for leaders in the industry to strengthen their companies’ positions and achieve compelling gains in market share. Conversely, chemical companies that fail to adapt or react quickly enough to these changes may well find their competitiveness hampered.
There are **four broad** trends currently defining the chemical industry, each of which affects a different element of business, from operations and structure through production and compliance.

1. Mergers and acquisitions
2. Regulations
3. Investment
4. Digital transformation
1. Mergers and acquisitions
The chemical industry is experiencing notable consolidation in the form of multiple mergers and acquisitions. This results from both a response to slow overall industry growth and a desire to consolidate resources and capabilities in the areas experiencing the most promising growth.

2. Regulations
For the first time in decades, governments and regulatory bodies around the world are overhauling chemical regulations. In North America, the chemical industry has even given unprecedented cooperation. While the full impact of this new regulatory environment won’t be clear for a few years, the new rules are beginning to come into effect and will influence chemical companies’ decisions, operations, and sales in the years ahead.

3. Investment
The industry is seeing enormous investment by chemical companies in North America. For decades, most major capital investments in the industry have been in Asia or the Middle East. But plentiful, cheap natural gas and increased oil output, combined with a large local market, and favorable regulatory environments in Texas and Louisiana that offer low political risk, has sparked a massive wave of new multi-billion-dollar production facilities in North America.

Seven major shale plays in the U.S.¹

4. Digital transformation
The same push toward adopting new digital technologies, cultural change within the organization, and the digital transformation of production that are impacting other industries are having an extensive effect on the chemical industry. Improved efficiencies, safety, and reliability can be realized through implementation of advanced technology—all of which can reduce costs for the producer. These transformations are also making possible new business models that could bring chemical manufacturers closer to their suppliers, their direct customers, and even their end customers.

¹ http://energyandresourcesdigest.com/invest-well-depletion-rates-production-decreases/
May 6
Air Products agrees to sell its performance materials division to Evonik for $3.8 billion USD.

May 13
Air Liquide SA wins US anti-trust approval of its proposed $13.4 billion USD takeover of Airgas, Inc.

June 9
Dow and DuPont announce that the U.S. Securities and Exchange Commission has declared the Form S-4 registration statement effective, seemingly clearing another milestone on the companies’ path toward merging.

June 22
Brazil’s Ministry of the Environment posted a draft bill to monitor, evaluate, and control the use of those industrial chemicals produced in or imported into Brazil.

June 30
Potash Corp. and Agrium, Inc. announce plans to merge and create a $36 billion USD company that would be the largest crop nutrient company in the world.

Aug. 22
The U.S. Committee on Foreign Investment in the US (CFIUS) approved China National Chemical’s acquisition of Syngenta.

Sep. 12
China National Chemical extends its $43 billion USD offer for Syngenta into January 2017 while working to achieve regulatory approval for the deal.

Sep. 14
The European Commission suspended its review of the proposed Dow/DuPont merger for the second time in three months, claiming that the companies did not provide information requested of them.

Oct. 25
Monsanto shareholders approve Bayer’s $66 billion acquisition bid.

Oct. 27
The European Chemicals Agency (ECHA) announces a proposal under the EU’s REACH regulation to evaluate 117 chemicals suspected by some of posing a risk to human health and the environment, including many used in cosmetics and sunscreen.

Nov. 1
German chemical manufacturer Evonik breaks ground on a facility in Berkeley County, South Carolina—another example of increasing North American investment.

Nov. 4
The European Commission suspended its review of the proposed Dow/DuPont merger for the second time in three months, claiming that the companies did not provide information requested of them.

Dec. 13
Representatives from Brazil’s Ministry of the Environment and China’s Ministry of Environmental Protection meet in Brasilia to discuss mutual management of chemicals. The similarities between the two countries’ levels of development and territorial dimensions lead them to see potential opportunities to cooperate on chemicals management.

Dec. 14
The European Chemicals Agency (ECHA) announces a proposal under the EU’s REACH regulation to evaluate 117 chemicals suspected by some of posing a risk to human health and the environment, including many used in cosmetics and sunscreen.
2015 ended on a high tide of mergers and acquisitions, with the biggest coming as Dow and DuPont announced their merger intentions in December. This trend continued in 2016. Over the course of the past twelve months, intentions for two more megamergers have been announced—China National Chemical (ChemChina) buying Syngenta for $43 billion USD, and Bayer buying Monsanto for $66 billion.
These megamergers were driven by a number of factors:

- Falling crop prices and slow growth in the agricultural segment
- The desire of the industry’s major players to realign and consolidate around more strategic and coherent business portfolios
- The need to shore up resources and capabilities in areas of the most promising growth while defending against modest overall industry growth
- The urgency of securing adequate food supply in high-population countries
- A push for greater efficiencies
- The availability of inexpensive financing
Assuming they are approved, these megamergers are radically altering the top of the industry—a fact that has not escaped the attention of farmers, legislators, and regulatory bodies. The consolidation of the industry and the external response to it bear continued watching in 2017.

Governments and regulatory bodies around the world are overhauling chemicals regulation for the first time in decades—and the industry is changing as a result. In a break from the past, the chemical industry has supported some of the new legislation, citing the effect that tougher government regulation appears to have in reassuring the public about chemical safety.

This new law covers both existing chemicals and those newly introduced to the market—and in a big win for the industry, it preempts future state and local regulation. With the Lautenberg Act, there is a single standard (plus existing state and local laws) for the industry to comply with and build toward, rather than seeing the regulatory environment balkanize into dozens of jurisdictions as other localities passed their own.

While the industry applauded the act, it was also cheered by American environmental and consumer groups. In other parts of the world, however, the relationship between the industry, environmental groups, and regulatory bodies remains more tense, with proposed regulation in both the European Union and Brazil attracting less enthusiasm.
The Shift to North America

After decades of taking a back seat to emerging markets in Asia and the Middle East, North America has experienced a significant wave of investments in new multi-billion-dollar production facilities from a number of large and mid-sized chemical manufacturers.

The North American chemical resurgence is driven significantly, but not wholly, by the continued low cost of natural gas liquids, which can be a primary feedstock for many foundational chemicals used across the industry. Strong global demand for these chemicals continues to provide export opportunities for U.S. producers, resulting in increased investment in the United States.

Other factors involved in North American growth include the considerable size and strength of the regional market, and favorable political and regulatory environments in American states with significant chemical production segments. Industry leaders may anticipate—if new U.S. President Donald Trump pursues the protectionist or anti-globalism agenda that he campaigned upon—that the uptick in investment in North America might be negatively impacted. While much of the production from new North American facilities is destined for the United States, many of the new facilities expect to sell elsewhere as well. A change in their ability to serve these markets might change their planning going forward.
Digital transformation

As products in the chemical industry become increasingly commoditized and end-users become more digitally sophisticated (and expect their chemical suppliers to be equally digitally sophisticated), leveraging advanced smart and digital technology becomes a clearer path to differentiation for those manufacturers prescient enough to begin adopting them.

Rising demand and growing competition have increased the pressure on all chemical manufacturers to adopt advanced technologies and undertake digital transformation of their operations and structures.

The Industrial Internet of Things (IIoT) and automation are radically changing the operating and business environment for chemical manufacturers:

- Identifying gaps in the manufacturing process to improve efficiencies in real time.
- Enabling Operational Excellence by embedding smart sensors in production facilities that monitor performance or provide data to facilities managers in order to provide insight into optimal operating conditions, or determine when to do preventative maintenance.
- Utilizing automation to improve safety conditions for plant workers.
- Monetizing on the new digital economy through staying much closer to the end customer than ever before while offering new, digital services.

The industry is undergoing more disruptive change than perhaps at any point in the past 40 to 50 years, and the pace of this change continues to intensify.
Rising standards of living and a growing middle class in emerging markets will drive ongoing strong demand for chemicals, as more end-users in these markets purchase and use appliances, consumer goods, automobiles, and other products that require a growing use of chemicals—especially advanced materials involved in additive manufacturing.
But despite this slow but steady demand growth, the industry is experiencing significant disruption as we enter the new year.

Relatively low feedstock prices, low interest rates, shifts toward modernizing and realigning chemical company portfolios for optimum growth, drops in agricultural prices, a regulatory environment that is changing for the first time in decades, and a retreat on both sides of the Atlantic away from globalism are driving an urgent need for chemical companies to modernize their development, planning, and production processes.

We do not expect most of these trends to abate in the coming year. In fact, many of them will likely intensify, and will dominate the industry landscape in 2017. And virtually all of them will be touched by digital transformation.

Digital and autonomous technologies—and the structural and procedural digital transformation that must accompany them—have become an increasingly critical and urgent element for competitiveness and even survival in the chemical industry. Many of the core trends defining the industry in 2017 are influenced in some way by digital transformation.
Mergers and acquisitions: their impact on the industry

The chemical industry has witnessed several major efforts at consolidation in the form of mergers and acquisitions. The mergers of Dow/DuPont, ChemChina/Syngenta, and Bayer/Monsanto, assuming these mergers are approved and closed, will affect multiple chemical markets, especially agriculture, but also including commodity chemicals (principally the plastics precursors), and a variety of specialty chemicals.

Certainly, these moves are creating a sense of urgency within the industry, and some rather intense pressure among the remaining players to seek out potential partners or targets for mergers or acquisitions of their own. The chemicals industry has experienced steady but modest growth in the past few years, and formerly robust emerging markets like China and Brazil have slowed—so mergers or acquisitions, along with low financing costs, provide a faster, keep-the-investors-happy way of generating growth.

To understand what the chemical industry will look like after 2017 is over, it is important to review two factors: first, the industry dynamics that are leading to this burst of activity, and second, the possible response of governmental and regulatory anti-trust bodies to industry consolidation.
Drivers of mergers and acquisitions

The merger and acquisition outburst of the past twelve months has been driven largely by three factors, first among them, low sales in the agricultural sector. While the chemical industry as a whole has experienced steady (if slow) growth, the agricultural segment experienced an 8.5% dip in sales in 2015, according to AgroNews⁴, with fertilizer and agricultural chemical companies perhaps currently experiencing the most difficult conditions and lowest margins.

There are a number of reasons for this slide: elevated supply levels, sustained low crude oil and energy prices, global capacity expansion that contributes to oversupply, and even the China economy hitting a wall over the past 18 months.

Despite their economic slowdown, China maintains a pressing need to modernize and expand the capacity of its agriculture sector. Challenged by a burgeoning population that must be fed, as well as the formidable pricing and economic environment, China seems to believe that it needs more control over both the intellectual property and the primary output of the companies providing its ag-chem capabilities. China is currently susceptible to crop shortages thanks to long-standing practices of over-farming and overuse of chemicals that have degraded much land and compromised water supplies.

This concern almost certainly drove ChemChina’s purchase of Syngenta far more than any business need; food security is basic, more urgent and politically easy to sell for the Chinese government. Food security looms as one of Beijing’s top priorities, and acquiring control of both Syngenta’s seed intellectual property and top-level chemicals will be a significant step in that direction. Given the pressing need in this area, we can expect China’s government and its chemical companies to devote more focus to this sector in 2017, although we are unlikely to see individual acquisitions as large.

¹ http://news.agropages.com/News/NewsDetail-16903.htm
Beyond China, perhaps the biggest challenge to the agricultural chemical sector is depressed agriculture market fundamentals all around.

The U.S. Department of Agriculture (USDA) suggests that U.S. farm income would likely drop 14.6% in 2016\(^3\), which would be the third consecutive year of falling incomes—bringing such income to its lowest point in nearly a decade. Oversupply of major crops like corn and soybeans have led to multi-year pricing lows—and such a difficult environment can lead farmers to delay purchasing decisions, as they have less incentive to boost their yields or productivity through the application of fertilizers.

This sluggishness in the agricultural sector has resulted in stalled earnings for producers of seeds and agricultural chemicals, and pressures to reduce exposures and look for ways to stave off the current weak profits. The massive Dow/DuPont merger began as a discussion about joining their agricultural businesses for precisely this reason. This may have been driven primarily by leadership, or via investor pressure for the companies to more finely focus their portfolios—but either way, the wider merger developed out of the initial agricultural-based talks.

The burst of mergers and acquisitions has not been limited to the agricultural sectors. The industrial gas segment experienced a similar flurry, with the announced deals between both Air Liquide and Air Products, and Linde and Praxair as the most prominent examples. The Dow/DuPont merger will also generate major new players in the basic or specialty chemicals segments; the expected next step in that merger is that Dow/DuPont will split into three companies, one each with a core in agriculture, basic chemicals, and specialty chemical sectors.

The impact of these significant mergers and acquisitions should not be understated. Some argue that they essentially reduce the competitive landscape, leaving behind only a few strong players which dominate the market, set the rules, and through their size and influence push smaller producers out to niche segments.Anti-monopoly policy and regulators will pay close attention, certainly.

But the industry can credibly point out that while consolidation will undoubtedly give pricing power in some areas, the chemical industry is very diverse—with less of the total market captured by the largest companies than in many other industries. Many markets within chemical will remain quite competitive, and many parts of the market will see limited effects, or even none at all. It will be interesting to observe the efforts to maintain the balance between the competitive pressure to search for potential M&A partners, anti-monopoly watchdogs, and the natural competitiveness within the industry.

Perhaps partly influenced by concerns about regulators’ responses, companies are also looking for ways to better differentiate on the consolidated market through spinoffs, such as the Bayer spin-off Covestro (announced formally in 2015 but taking effect in 2016). This trend toward spinoffs is even expected to impact the newly merged companies within Dow/DuPont, per the aforementioned planned spinoff into three independent companies.

Whether through M&A or spinoff, companies will look to make sure to realize the attractive cost benefits behind such a move. Readiness for digital transformation will be seen as the key enabler for successful ROI delivery.

We can anticipate that none of these pressures will lessen in 2017. In fact, they may intensify as a result of the intended mergers or acquisitions already announced—and if interest rates remain low, an M&A option would remain attractive. Although more mega-mergers like Dow/DuPont are certainly possible, we expect to see fewer among the largest companies in 2017. However, we may well see the merger trend continue among the next tier of companies as they try to position themselves to withstand the market effects of the events of 2016.

\(^3\) [https://www.ers.usda.gov/topics/farm-economy/farm-sector-income-finances/highlights-from-the-farm-income-forecast/]
A new regulatory environment

It’s not just anti-trust regulators that will impact the chemical industry in 2017. Broader industry regulation, either just enacted or currently proposed, will have significant influence on the industry’s business in the coming year. While the impact of these regulations and proposals will vary depending on which sector a company is in, or the geography in which it’s located, it is safe to say that every chemical business will feel at least some effect this year.

In the United States, the Lautenberg Act—signed into law in the summer of 2016—is the first major legislation in more than four decades. Perhaps unexpectedly, both the chemical industry and environmentalists supported this new legislation. Environmentalists were pleased at the new controls imposed in the Act—including mandated safety reviews of chemicals already in market, and required safety findings for new chemicals before they can enter the market. But the industry also appreciated the fact that the new law finally established a consistent legal safety and reporting standard for companies to meet, by setting one national set of US requirements and preempting most new state and local legislation.

It will be several years before we clearly see the full impact of the legislation, but it is very possible that pre-clearance may provide some liability shield for the chemical industry.

Additionally, leadership of many chemical companies have begun to recognize that consumer comfort and confidence that commercial chemicals are safe and are being used safely is significantly higher when consumers perceive that oversight and testing is more stringent. The new regulations are seen by many in the business as aiding the industry’s image or addressing a PR problem.

The chemical industry largely perceives that the Lautenberg Act provides it with the regulatory certainty necessary for innovation, growth, and global competitiveness—while providing the important public health and environmental protections that are needed for both chemical producers and end-users to feel confident. Because the law took effect only in June 2016, its actual impact in practice on the industry is still being assessed; we expect it will take three to five years to realize its full influence.

In other jurisdictions, the regulatory environment is still less cohesive, with the industry, regulatory bodies, environmental, and consumer groups still a bit more at odds. In one example further south, Brazil is also in the process of initiating new standards around the management of chemicals—and the impact of its effort could extend beyond its own borders.
As a result of this effort, on June 30, the country’s Ministry of the Environment posted a draft bill to monitor, evaluate, and control the use of industrial chemicals produced in or imported into the country.

The timing of the Brazilian Congress’ consideration of the proposed regulation is still uncertain. Due to heavy public comment and response, the Ministry opted not to issue its final bill in 2016, opting instead to target the spring of 2017 for its presentation to the Brazilian Congress. Depending on the urgency with which the Congress chooses to act on the regulation, it is foreseeable that the law may not take effect until well into 2018.

Significantly, Brazilian environmental officials have had discussions with their Chinese counterparts regarding mutual approaches to managing chemicals produced in or imported into their countries. Should these nations agree upon similar approaches, it’s conceivable that significant portions of Brazilian laws could influence the regulatory environment in multiple emerging markets.

It’s really too early in the Brazil process to know exactly the actions chemical manufacturers should take in Brazil, or the long-term impact of what’s happening there. It probably means tighter regulation in that market is almost a given since they have comparatively little today (although it could easily get gutted in the legislative process). However, reasonable regulation aligned with other jurisdictions might have relatively low impact on the industry.
The European Union is also moving forward with new regulation—though virtually all other affected groups, from the chemical industry to environmental and consumer groups, appear less than pleased about the direction of the regulation.
In June 2016, the European Commission presented draft rules regarding whether pesticides contain so-called “endocrine disruptors.” These proposals are primarily intended to fix some largely unenforceable previously passed regulation that defined endocrine disruptors too broadly and didn’t differentiate between compounds that are relatively harmless and compounds with well-established negative effects.

The proposed new rules would try to establish a framework around this type of regulation. The industry is hoping that the Commission makes the regulations clearer for the industry and easier to enforce for the Commission. Most environmentalists oppose any simplification of current regulation, seeing such moves as a loosening of restrictions; however, they are not necessarily advocating or proposing anything better that would address the issue. This sort of standoff leaves the European regulatory picture somewhat uncertain for 2017.

On top of all this tumult, another factor adding possible uncertainty is the specter of potential UK-specific regulations in the wake of the 2016 British vote to leave the European Union. Any potential changes in the United Kingdom may well have considerable impact on the industry as a whole, as a significant percentage of the chemical manufacturing base in the UK is owned by non-UK companies. Any non-EU companies with UK operations might be impacted by restrictions on exchanges and trade regarding labor, goods, services, or capital. If the UK starts to promulgate its own regulation, Brexit could become a more significant issue, as the UK has more of the European chemical industry than its economic size would lead you to expect. However, the current government is unlikely to take a more restrictive approach to industry, and changes are likely at least two years away.

The debate of the rules regarding whether pesticides contain endocrine disruptors

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For many years, few new chemical production facilities have been built in the United States or the rest of North America. But after decades of seeing most new capital investments made in Asia or the Middle East, we are now seeing chemical companies making enormous investments in North America. Plentiful, cheap natural gas, and increased oil output—combined with a large local market and low political risk—has sparked a wave of new multi-billion-dollar production facilities in North America.

In fact, the American Chemistry Council reports that U.S. chemical industry investment has reached $164 billion. Recent and announced investments are expected to increase the revenue of the American industry by $105 billion-per-year.

Among the potential projects are:

- A rumored joint venture between Exxon and Saudi Arabia Basic Chemicals (SABIC) to use U.S. Gulf Coast natural gas in the production of plastics, reportedly at a site in either Texas or Louisiana.

- A similar facility that Royal Dutch Shell has announced it will build near the Utica and Marcellus gas fields at an expected cost of $6 billion USD.

- A high-density polyethylene (HDPE) plant LyondellBasel plans to build on the U.S. Gulf Coast with a capacity of 500,000 metric tons annually. LyondellBasel, which currently produces 3.5 million metric tons of HDPE, reportedly plans for the plant to be the first to use its proprietary Hyperzone PE technology, and the company is also expanding capacity at three other sites in Texas.
U.S. CHEMICAL INDUSTRY INVESTMENT HAS REACHED $164 BILLION
The Italian company M&G Chemicals, one of the world’s three largest producers of PET resin, announced plans to increase capacity of its newly built Corpus Christi, TX facility for producing polyethylene terephthalate (PET) for packaging applications—giving the facility one of the largest production capacities in the world once production begins in early 2017. The Corpus Christi M&G facility will be the largest PTA plant in the Americas, and the largest vertically integrated single line in the world.

This resurgent activity is driven primarily from the abundance of both natural gas for heat and power, and the consistently low cost of natural gas liquids (NGLs) like ethane—which are crucial inputs to chemical manufacturing and a core feedstock for foundational chemicals like ethylene. Some industry observers have speculated that up to 10.5 million tons of ethylene capacity are expected to come on stream in North America by 2018 or 2019.

As long as global demand for ethylene and other foundational chemicals like methanol and ammonia remains robust, U.S. chemical producers should find ongoing export opportunities, which would in turn result in further investment in the U.S. Of course, like many other sectors or industries, much depends on the policy directions pursued by the president-elect. Should the United States embrace a protectionist or anti-globalist trade policy, these export opportunities might become less plentiful over the course of the year.

That said, the North American boom will likely continue, unless we experience a recession, or if the coming years see amplified protectionism and trade wars. However, many markets—including natural gas exports—are making big investments at the same time. There may well be short-term shortages in gas production, but these will likely quickly abate. The massive investment in North American chemical production facilities may slow somewhat from its feverish 2016 pace, with some investments being delayed, redirected, or cancelled, but the industry seems poised for continued rapid growth.

A few decades ago, growth in the chemical industry was driven largely by product breakthroughs, especially in plastics, but across the industry it was the science that drove differentiation and profit. Over the past twenty years or so, the scientific advances have been fewer and more far between. The result has been that, to an extent, products have become commoditized, leading companies to seek out new ways to set themselves apart from the competition. In 2017 and beyond, besides new materials for additive manufacturing and 3D printing, it will be other technologies—particularly new digital and autonomous technologies—that provide chemical companies differentiation and competitive advantage.
Embarking on digital transformation will help chemical manufacturers improve Operational Excellence and maximize efficiencies, reduce costs, increase safety, and might even allow a chemical company to get closer to not only its direct customers, but perhaps even the end-users of its products.

This could alter the game for this industry structurally in unprecedented ways—taking chemical companies from the role of vendor or supplier to strategic partner, or even giving them a relationship with end-users for the first time—shifting from a producer/consumer model to more of an individual customer-oriented collaborative approach.

But the harsh reality is that most chemical producers are already behind in terms of both planning for and executing digital transformation. Many still think simply in terms of technologies, when digital transformation is much more than that. It includes everything from organizational structure and considering capabilities to a strong partner ecosystem, and the openness and agility to engineer culture change in terms of people and processes—as well as the technologies.

The first logical step for chemical companies’ successful digital transformation involves rethinking the organizational capabilities needed to start, scale, and sustain such a transformation. It requires developing an end-to-end view of the competencies, tools, processes, and governance needed across all functions—including sales, services, R&D, operations, and finance—as well as the accompanying component capabilities needed to succeed. This wider view also serves as a tool to identify capability gaps, in addition to the plan for filling them. Companies also need to identify where and how these capabilities are organized and executed within their organizational structure—establishing the foundational capabilities needed to develop digital industrial solutions.

Digital transformation is being enabled by new generations of multiple technologies, from the smart sensors that make possible the Industrial Internet of Things (IIoT), to augmented reality, to artificial intelligence and robotics, to big data and advanced analytics, to advanced materials. And the push toward digital transformation and the more strategic use of these new technologies will be an underlying core factor in how 2017 plays out in the chemical industry—perhaps less overt and less connected to external factors like regulation or mergers—but no less fundamental.

Digital transformation first targets business operations such as improved productivity and reduced risk, and second looks at business growth—adding uplift to existing revenue, tapping new revenue streams, and allowing the company to monetize on the digital economy.
Building new, updated, modern facilities is expensive and time-consuming.

The competitive landscape is shifting rapidly to wait for new facilities to come on line. Instead, the general trend we observe is for manufacturers to try to get the maximum out of the installed base—which calls for efficiency improvements, cost savings, maximized performance, overall Operational Excellence through digital technologies, and the data they generate.

But before building digital applications, chemical companies must set up the necessary infrastructure to support them—integrating software stacks, deploying and collecting sensor data, managing data and meta data, and building out top-of-the-line IT and OT security.

The drive to improve and optimize Operational Excellence is not new with digital transformation. But the potential for improvement has never been greater. Once a chemical producer has strategically thought through their connected infrastructure, the use of smart sensors and advanced data analytics allows for a greater, much more finely detailed understanding of a plant’s operations, for example. Smart sensors installed at key points in the plant and in the manufacturing process collect data regarding temperatures, pressure settings, flows, and other factors. The data is stored and analyzed, affording plant managers and operators the ability to make better-informed decisions based on real-time information during every phase of production, as well as helping to avoid unplanned downtime and reducing unscheduled maintenance costs.

Another benefit of smart sensors in chemical manufacturing is their ability to monitor the operating conditions of literally every batch produced in a facility. By employing these sensors and using their data in predictive analysis, operations managers can identify optimal operating conditions across all variables, leading to more predictable and reliable quality, which in turn leads to reduced costs.

Among the other benefits of this kind of deeper insight is improvement in energy efficiencies. Energy consumption and supply are a significant cost outlay in chemical production—so energy efficiency is vital to the growth and survival of chemical companies, which look toward improving their energy efficiency not only to control their direct consumption costs, but also to shield themselves from volatile prices on energy markets and to drive reduction of their overall carbon footprint.

The same connected sensors that provide operational insights can also monitor energy consumption patterns—and, along with data analytics, help to control costs, potentially anticipate failures or maintenance issues in production, and even ensure compliance with energy usage regulations.

Making this kind of a system work seamlessly is not easy; wise leaders in chemical will recognize that most producers aren’t really equipped to engineer these technological implementations throughout their ecosystem on their own. Chemical companies will need to partner more openly and effectively—partnerships in the truest sense—with their distributors and customers. They will also need to seek out leading technology partners, independent software vendors (ISVs), and the developers who will create and innovate the industry-specific tools that the chemical industry will need in the digital industrial age.
Digital transformation is much more than smart sensors. The adoption and embrace of advanced robotics and artificial intelligence within a manufacturing facility can drive marked improvements in both reliability and safety.

By some estimates, up to 40% of mishaps or errors in chemical manufacturing—those that lead to unplanned maintenance or unscheduled downtime, or worse, to employee injury, or even problems for the surrounding community—are primarily caused by human factors. Sometimes, this is the result of improper work procedures. Other times, it’s bad maintenance execution. But incorporating autonomous technology into the production process could eliminate those issues—reducing liability, unproductive downtime that costs the manufacturer money, improving employee health, lessening employee risk, and lowering costs.

In addition, being able to adequately run a facility with fewer workers can reduce production labor costs—freeing up resources to invest in supply chain and feedstock, preventive maintenance, advanced employee retraining for new skills, and investing in enhanced community relations.

That last part—community relations—has always been important, but becomes even more important in the age of digital and autonomous manufacturing. Experts and manufacturing companies themselves may recognize the additional safety and lowered risk of automating factories. But when the public hears “automated factory,” imaginations often run astray, and some members of the community may question the safety of “machines running the local plant.” Perception issues and challenges could not only complicate the implementation of autonomous production, but could threaten the reputations of the companies working to implement them.

A strong community relations program, geared toward earning community trust and heavy on education and transparency, will become as vital to chemical manufacturers’ success as efficiency and Operational Excellence.

This will not only mean physical interaction, though that will be important. Chemical companies and local facilities should avail themselves of digital communications channels to interact regularly with members of the community around them. Chemical companies will need better and more frequent interfaces with the communities they serve as digital transformation takes hold in the industry—working with the community to promote and maintain trust in not only the technology, but also the people at the companies implementing them.

A strong community relations program, geared toward earning community trust and heavy on education and transparency, will become as vital to chemical manufacturers’ success as efficiency and Operational Excellence.
When companies talk about disruptive processes, they should think beyond operational upgrades or gained efficiencies. They should be thinking outside established parameters and identifying ways to expand not only their own business models, but also perceptions of how the chemical industry could, or should, operate. The “Uberization” of the chemical industry could occur through changing our definitions of who our customers truly are and how we interact with them. The digital transformation requires chemical producers to stay much closer to consumers.

Technology now makes it possible for large chemical manufacturers to establish direct access to, and interaction with, end customers. The realities of the digital industrial age dictate that public stakeholders expect that kind of access. A chemical company wishing to differentiate itself—especially in this period of consolidation and hyper-competitiveness—might well be the company that facilitates that kind of interaction with the end customer.

Imagine a chemical manufacturer that opens its expertise to the end customer. For example, a consumer who has questions about the safety of a bottle of shampoo for a toddler with sensitive skin would traditionally contact the shampoo producer with questions. But what if the originator of the chemical used in the shampoo were available to the consumer to directly answer questions—whether through a portal established by the chemical company, or an intelligent chat bot on the company website, or even on Facebook Messenger?

How might direct consumer interaction with a chemical producer affect that producer’s reputation for transparency and trustworthiness? Could the producer, by disintermediating consumer product customers and opening themselves directly to the end customer, open up a new model in which end customers begin indicating a preference for products sourced from a specific chemical producer—kind of like an “intel inside” for chemicals in consumer products?

There are admittedly risks in opening to public interaction—activist campaigns, the security of the interaction channel, and liability concerns among them. And while chemical manufacturers most certainly are not looking to establish direct distribution channels for any number of reasons, might direct end-customer interaction be the kind of wholesale industry disruption observed in ride-sharing and travel lodging?
Getting to digital transformation

There is no shortage of consultants who appeal to CEOs, and who speak to companies about new technologies that disrupt the market.

But this is not what the chemical industry is actually looking for. What CEOs and other industry leaders truly want are technologies that do not disrupt, but enable the industry and help companies gain efficiencies, lower costs, and increase safety. Chemical company CEOs want to experience the benefits of the Industrial Internet of Things (IIoT)—not to see it as a threat.

It is that eagerness to identify new benefits, to reconsider models, and to adopt new technologies that will separate the digital industrial era’s winners from its also-rans. That said, digital transformation is not one-size-fits-all, and is not a golden ticket that can be wound up or plugged in for guaranteed success. Digital transformation involves trial and error, a streamlined culture built around rapid decision making, a willingness to embrace failure as a path to learning, investing in the right technologies, investing in the right people, new skills, and training to operate in this new environment, and improved or wholly new people management processes. It often requires dramatic shifts in recruiting approaches, and how companies develop and incentivize talent. Chemical companies must recognize their need for software and data science talent—and be prepared to identify and competitively compensate the talent they need to win in the digital industrial age. Successful digital transformation will require chemical companies’ willingness to disrupt their own processes and even entire business models.
Even with the right people in place and the right leadership directives to change the culture and to be more flexible, there will still be a “show me” mentality around digital transformation.

Wise architects of a chemical company’s transformation will look to score incremental yet tangible wins early to prove the concept of digital transformation, then sell those early wins to the rest of the organization. Leaders should look for early internal champions to help them build the momentum needed to drive more radical transformation.

Success breeds success, and building credibility is the key to any successful transformation. With the data, insights, and improvements from these early wins, leaders will stake out a credible position to take those improvements to the broader company in the form of best practice sharing or even developing new revenue sources through new products and services.

Because the non-technological factors are so variable and subjective, every chemical company’s digital transformation will be unique and look slightly different. The companies that most quickly and most enthusiastically pursue their path and learn what their unique digital transformation looks like will be the winners in the next few years.

Success breeds success, and building credibility is the key to any successful transformation.
The chemical industry has much to teach other industrial sectors. The realignment of portfolios and consolidation within the industry as a response to shifting market conditions could be a benchmark for other industries’ reactions to similar changes in their own industries. And the chemical industry also appears to have had a few years’ head start in responding to the retreat from globalism and the increased appetite for the localization of manufacturing. Granted, the chemical industry’s motivation was driven by other market factors like the low cost of core materials, but nevertheless, the industry’s investments in North American production and distribution could provide learning opportunities for leaders in other industries to study.
Most instructive to other industries might be the chemical industry’s changing attitudes toward external publics.

In the United States, the chemical industry’s embrace of updated regulations resulted in a Lautenberg Act that provides it a more favorable and consistent operating environment, and may well increase consumer confidence in the industry’s safety and corporate citizenship.

Moreover, as the chemical industry looks for ways to differentiate and excel in a fiercely competitive consolidated environment, its leading companies will seek to accelerate their digital transformations—technological, procedural, and through people. The most successful companies may be those willing to take the most disruptive, challenge-the-conventional-industry-wisdom approaches to their very business models—and that could provide inspiration or at least a “safety in numbers” example for companies in other industries to follow as they challenge and disrupt their own models and processes.

About Mark Thompson

Mark Thompson focuses on how the chemical industry is changing and how technology can help companies both drive change internally and react to the evolution of the industry around them. He believes that technology can drive greater returns from existing assets as well as maximize the value of new investments.

About Martin Valek, Ph.D.

Martin Valek is an Industry Director at GE Digital. His primary focus is in the global chemical and pharmaceutical verticals. Recently, he lead GE’s innovation initiatives in Chemicals. Working with an ecosystem of partners, he helps companies succeed on their digital transformation journey.
About GE

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive, and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure, and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology, and scale, GE delivers better outcomes for customers by speaking the language of industry.

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