CHEMICAL MANUFACTURING TRENDS

By Embracing its Challenges, the Chemical Industry Will Continue to Thrive
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Throughout its 150-year history, the chemical manufacturing industry has produced products that enhance our daily lives, and its innovation has been a key driver of economies across the world.

Now a $4.3 trillion market¹, chemicals is one of the United States’ largest manufacturing segments, and one of the top exporting sectors of U.S. manufacturing. The industry’s more than 10,000 firms produce more than 70,000 products and in 2016 directly employed more than 811,000 workers².

Nevertheless, the chemical manufacturing industry faces unprecedented challenges. Consumer demands are rapidly changing – consumers want more versatile products, and more want those products to be produced using sustainable practices. To maintain the forward momentum the chemical manufacturing industry has enjoyed for years, its leadership must address the following key challenges:

> **Scarcity of raw materials.** Responsible stewardship of resources is not only what many consumers now expect, it’s good business. But minimizing waste and efficiently managing inventory can be complicated and often requires implementing new technology.

> **Rapid new-product development.** Rising demand for new and improved products makes it imperative that chemical companies quickly develop and test new products.

> **Growing demand for sustainable products and practices.** Consumers increasingly demand conscientious choice of materials, but meeting those demands can be difficult, particularly as regulations evolve and change.

> **Regulations.** Not only do regulatory requirements vary across states and regions, they are constantly changing.

To meet these challenges, the chemical industry must embrace technology that enables greater efficiencies. At the same time, they must assume a leadership role in addressing sustainability, working with governmental and regulatory agencies to craft new policies, restrictions and requirements.
Beating the Scarcity Challenge

Chemical manufacturers today understand that success now and in the future is not only about satisfying product demand, but also about using resources and raw materials wisely. That means maintaining ideal inventory levels, ordering only what is needed, and reducing waste.

The old model of harvesting a resource, making a product and throwing away whatever is left over simply is no longer viable. If we continue using resources at the current rate, by 2050 we would need the equivalent of three planets to provide the needed raw materials.  

A growing number of chemical production businesses are moving away from that use-and-throw away model, and toward one of using, re-using and recycling. This is an important step forward, because chemical manufacturers often are directly harvesting or otherwise acquiring natural resources and producing the raw materials needed to create their products. They know firsthand the challenges produced by resource scarcity—and the consequences the industry could face as those resources dwindle.

Reducing waste isn’t just good for the planet, and the future of the chemical industry – it is good for business.

With that in mind, many chemical manufacturers are now embracing technology to more closely track and use all inventory.

For example, working with the Alithya team, one personal care/cosmetics ingredients manufacturer has embraced a digital solution for more efficiently managing and tracking product. After a large batch of product is made, it is poured into large containers, usually drums, to store until it’s time to be packaged for sale to customers. Often, the last drum will not be completely full, and that “lightweight drum” can create a challenge for the manufacturer.

It’s imperative that the company track that lightweight drum and know exactly what’s inside it, down to the batch number. This way, the leftover product in the lightweight
drum can be used for testing or creating samples and won’t be mistaken for a full drum that’s ready for packaging.

The Alithya team worked with the company to implement two easy-to-use solutions in Microsoft Dynamics 365. One option allows the company to track the weight of filled drums, making it easy to identify the lightweight one.

The second provides visibility to all the product inventory on hand. For instance, if the company has 730 units available, they can easily see that 500 of those are full drums, and 230 are under-filled lightweight drums. That is just one example of how technology can drive responsible resource management and waste reduction. Manufacturers can also track the availability of waste products that can be repurposed.

Blockchain, a technology that is disrupting many industries, is being used by chemical manufacturers to securely and accurately track resource use and location throughout the supply chain. This not only helps manufacturers control and manage inventory, it also provides a means for exchanging materials and resources, including re-useable resources. With these and other technologies increasingly at their disposal, chemical manufacturers can position themselves at the front of efforts to adopt more sustainable practices.

Chemical manufacturers have a unique opportunity to be catalysts, driving change throughout the industry. Truly effective waste reduction requires buy-in throughout the industry, and of course must be accomplished with assistance and collaboration of regulatory bodies. However, forward-thinking companies won’t wait for increased regulation before exploring and implementing processes and technologies that drive change.

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Growing Expectations

In today’s culture of instant gratification and next-day deliveries, consumers have heightened expectations. They demand improved products and they want them faster. That is true whether they are buying socks and cellphones or paint, plastics or cleaning products.

**CURRENT AND EVOLVING TECHNOLOGY PROVIDES SEVERAL ALTERNATIVES FOR SPEEDING UP THE PROCESS OF BRINGING NEW AND IMPROVED PRODUCTS TO MARKET.**

Consequently, the chemical industry is facing unprecedented pressure to produce more advanced and innovative products, more quickly. To keep up, chemical companies must bring products to market faster. Fortunately, current and evolving technology provides several alternatives for speeding up the process of bringing new and improved products to market.

One of the most promising means for speeding up innovation is dry-lab testing, which uses high-powered computers combined with artificial intelligence (AI) to simulate experiments to enable swift, efficient innovation.

Dry-lab testing takes the physical world into account in experiments, allowing chemists to reproduce real-world results in a fully simulated environment. Dry-lab
testing accelerates product development by enabling chemists to run hundreds of thousands of experiments rapidly at the same time, then use machine learning to analyze the results to determine success rates and suggest ways to optimize conditions of the experiments for better outcomes.

As the experiments run, the AI collects and analyzes all the data, making the experiments more and more precise over time. These innovative simulated testing methods allow new products to be researched and developed in the span of months instead of years. This practice is also good for sustainability, as simulations reduce waste products.

Still, the most successful chemical companies are those that don't simply speed up testing and product development. To thrive in the current marketplace, companies need to accurately forecast tomorrow’s customer demands.

Here again, technology can provide companies with what they need to remain ahead of demand. For example, Microsoft Dynamics 365 machine learning uses complex algorithms to interpret sales data to identify product demand patterns. Using this data, machine learning can predict future demand. As technology grows more sophisticated, predictions become increasingly accurate, and can even incorporate data from third-party sources and publicly available information such as patent data. Future refinements in machine learning will allow modeling, and will consider things like economic changes, regional variances, political developments and weather patterns.

Using the information provided by these calculations, chemical companies can determine which products to develop next. In the coming years, information provided by machine learning and other evolving and emerging technologies will likely provide the chemical industry with invaluable insights that will allow them to not only keep with product demand, but also anticipate market shifts and lead the way in responding to changing demands.

Sustainable Products and Practices

Driven by a growing chorus of consumer demand, the chemical industry is recognizing the need for, and the wisdom of, developing and implementing sustainable and environmentally responsible products and processes.
In fact, the global market for “green chemistry”—as defined by Pike Research to include bio-based chemicals, renewable feedstocks, “green” polymers and less-toxic chemical formulations—has been projected to grow from $11 billion in 2015 to nearly $100 billion by 2020. The North American market for “green chemistry” is projected to grow from $3 billion to over $20 billion during the same period.

Much of consumers’ focus will continue to be on end-products purchased online and through retailers. However, chemical manufacturers and wholesale distributors are not immune from the pressure to develop “greener” business practices and products. More and more, every step in the supply chain will be examined, driven in part by regulation, but also by the efforts of retailers such as Target Corp. The nation’s eighth-largest retailer and tenth-largest private employer has announced a goal of attaining “full visibility” of chemicals contained in many of the products on its shelves by 2020. The retail giant says it will work with business partners throughout the supply chain to pursue safe chemicals and achieve transparency in all ingredients in a range of products including generic fragrances, beauty, baby care and household cleaning products.

The result will be that chemical manufacturers doing business with Target in those segments will have to document product components and ingredients as well as where and how raw materials were obtained.

While food, especially produce, has dominated the organic and “natural” consumer push until now, that interest is spreading to include a variety of products, particularly personal care and beauty products. “Natural” or botanically derived beauty products were projected to be a $13 billion market in 2018, and are expected to be the fastest-growing segment of the prestige skin care market for the foreseeable future. Growth in the synthetic cosmetics segment, meanwhile, has stagnated.

MANUFACTURERS WHO RECOGNIZE THE VALUE OF AUTOMATED DOCUMENTATION THROUGH TECHNOLOGY GIVE THEMSELVES A COMPETITIVE ADVANTAGE.

Frustrating chemical manufacturers attempting to compete in that market segment is the fact that there remains no legal definition for the terms “natural” and “organic,” a situation that shows no sign of changing anytime soon.

That sort of uncertainty combined with an ever-changing regulatory landscape and the evolving, unfamiliar nature of sustainable manufacturing techniques constitutes a doubly challenging scenario for chemical manufacturers. It is hardly surprising then that, to many in the industry, the idea that sustainable production processes may save money or even boost revenue can seem counterintuitive.

But visionary leaders in the chemical industry view the challenge to develop environmentally friendly products and practices as less a burden than an opportunity. For example, Dow Chemical has built a $1 billion water and process solutions business. And startup Newlight used captured carbon emissions to develop AirCarbon. To capitalize on that opportunity requires not only financial commitment but company-wide buy-in. Real progress toward sustainability begins with listening to customers and gauging their needs. It requires efforts within and among research and development, procurement, operations and product stewardship departments.

Chemical manufacturers can turn to technology to improve sustainability, and advanced technology will allow them to intensify their sustainability efforts. Rapid advances are putting a growing number of game-changing tools within firms’ grasp. For instance, when artificial intelligence (AI) optimizes data-center energy efficiency, it can
significantly reduce manufacturers’ energy use and expense. Over the next decade, leaders in the chemical manufacturing industry will be those who recognize safe and sustainable practices as an opportunity to derive competitive advantage and brand differentiation.

Keeping Pace with Changing Regulations

More than ever, companies within the chemical industry must adhere to a wide variety of regulations that govern more than just safe shipping or the mixing of materials to form a particular substance.

An alphabet soup of agencies and regulations, including the EPA (Environmental Protection Agency) OSHA (Occupational Safety and Health Administration). FDA (Food and Drug Administration), HCS (Hazard Communication Standard) and REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) look over the shoulders of many within the industries – and those are federal and international enforcement organizations and laws. Most companies must also comply with state and local regulations; those operating or doing business in Washington, Oregon, Maine, Maryland and Vermont must also comply with the so-called “Green Chemistry Laws” in effect in those states. What’s more, in addition to chemical substances themselves, production techniques, materials, packaging, and working conditions also are subject to the rules of multiple agencies and jurisdictions, which force chemical manufacturers to maintain strict quality management, diligent record keeping and detailed product information. These extra steps add cost to the development and manufacturing processes.

By implementing systems for documentation and rapid access to and sharing of information, manufacturers can respond quickly in the event of an audit or recall.

Adding to the difficulty faced by the industry in complying with the requirements of various regulations is the fact that those regulations can and do change rapidly. For example, effects of the Frank R. Lautenberg Chemical Safety for the 21st Century Act, which was signed in June 2016, continue to ripple through the chemical industry. The law reformed the Toxic Substances Control Act (TSCA) and put in place new rules for the chemical industry.

Among other provisions, the law has resulted in a new Environmental Protection Agency rule, announced in 2017, that requires industry reporting of chemicals manufactured or processed in the United States over the past 10 years. Further, the law prohibits the exporting of five specific mercury compounds and gives the EPA the power to determine whether new chemicals are allowed to enter the market.

In response to such ongoing concerns as climate change and resource scarcity, companies throughout the chemical industry find themselves increasingly involved in research and development of new products, including more sustainable products. This additional role has meant that many chemical companies are now subject to new sets of regulations that would not have applied to traditional chemical companies.

To ensure compliance with what can seem like a tangle of regulations dictated by numerous authorities, chemical companies should keep in mind this simple rule: It’s good to know, but more important to document. Given the complexity of regulations
across federal, state and local enforcers, successful documentation for today’s chemical manufacturers is a challenge that likely can be met only with leading-edge technology, such as Microsoft Dynamics 365. Ideally that technology employs process automation that offers built-in checks and balances – and protects the company from human error.

By implementing systems to facilitate thorough documentation and rapid access to and sharing of information, chemical manufacturers can respond quickly and effectively in the event of an audit or recall. Even in the absence of a critical event such as a recall, chemical manufacturers who recognize the value of automated documentation through technology give themselves a competitive advantage and the best opportunity for staying ahead of myriad federal, state, local and international regulations.

Looking Forward

In the coming years, information and data provided and managed by machine learning, blockchain and other evolving and emerging technologies could potentially transform chemical manufacturing. The insights provided by those technologies will allow chemical manufacturers to not only keep up with product demand, but to stay ahead of market shifts and lead the way in responding to changing demands.

Armed with these new resources, chemical manufacturers are ideally positioned to address the challenges and demands posed by scarce resources and environmental concerns. By embracing technology and adopting a leadership role in a global ecosystem of manufacturers, governments and technology partners, chemical manufacturers can lead the world in establishing more sustainable economic practices.
Sources

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