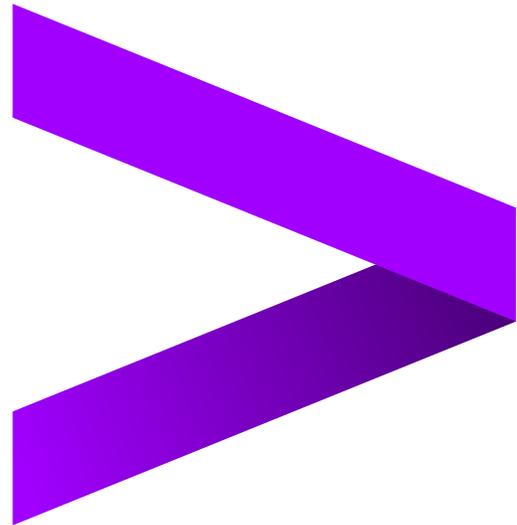


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**Driving chemical industry growth in an era of epic disruption**



Despite healthy appearances, the chemical industry is on the brink of profound change.

But while epic disruption will threaten the status quo, it is also creating tremendous opportunities—and rewards—for those bold enough to seize them.

Indeed, the chemical industry could provide answers to some of the world’s most urgent problems. But only if it rises to the challenge and embraces innovation, fast. With an understanding of the forces that are reshaping the industry and new approaches to organizational change, you can take the lead and formulate effective strategies to capitalize on new possibilities. Starting today.

**Chemicals at a Crossroads**

We hear a lot about disruption in established industries—and the impact of new players with new platforms like Amazon in retail, Airbnb in hospitality, Uber in transport and Netflix in entertainment. So far, this type of sweeping change has yet to be seen at scale in chemical markets. Consequently, the industry seems to be taking a wait-and-see approach, perhaps on the assumption that whatever happens elsewhere, customers will still need a steady stream of molecules, in one form or another.

At one level, this could be seen as a pragmatic approach. After all, over the past 70 years or so, the chemical industry has built an impressive and relatively consistent track record of growth. Although the factors fueling growth may change every few years, new drivers have emerged periodically to power each wave. And on the surface, today’s chemical industry continues in healthy shape. It’s seen earnings rise, peak cash and stable profits. Although some segments have performed better than others, overall, things have been good.

## Testing Times

But delve deeper and week-by-week hidden pressures are mounting, revealing telltale signs of risk. It's been almost a decade since the industry's last downcycle bottomed out in 2009. Since then productivity has remained anemic, with a long, shallow cycle and margins being squeezed. Despite some companies riding the wave of the shale gas boom, it's not clear what the next big growth driver will be or where it will come from.

The rapid growth cycles that had been driven by emerging economies are petering out. While efficiency measures and performance enhancements will continue to deliver some gains, they won't be gamechangers.

Hopes of a growth stimulus via consolidation are underlined by recent blockbuster mergers and acquisitions. But although these deals generate a short-term boost for individual companies, they have little impact on core industry fundamentals.

Furthermore, being asset-intensive, maintaining legacy infrastructure is an issue. Aging plants are becoming less reliable, as evidenced, for example, by the number of unplanned ethylene plant shut-downs which has been rising since 2010. For many years, the use of chemical products as substitutes for materials like steel, glass and textiles in industries such as automotive, has buoyed growth. But, further gains are getting harder to capture.

Now, profound changes in downstream markets and the supply chain are starting to dig in. Globally, big companies like Unilever, P&G, Siemens and Lego are moving to more sustainable materials.

Players in the extended ecosystem for chemicals—such as energy, natural resources and shipping—are experiencing volatility, while many chemical customers, such as automotive parts and equipment manufacturers, are also undergoing massive transformation.

In the meantime, megatrends and macroeconomic undercurrents continue to drive change at pace, which is testing and threatening to disrupt conventional business practices and models. So, what do we know about the threat of disruption in the chemical industry?

## Calculating the Risk

From adhesives to food additives, petrochemicals to paints, the chemical industry is extremely diverse, with much variation in the exposure to disruption between different segments and geographies.

Our research shows that while chemical companies are not necessarily in great danger from imminent big bang disruption, the industry is exposed to the ongoing threat of growth and profit erosion. It's a silent but deadly slow deterioration of performance that creeps up on companies in asset-heavy industries over the years, opening the door to disruptive forces. We call this compressive disruption, where the business stagnates, incumbents lose control and new entrants can take the advantage.

Compressive disruption typically affects industries where large, long-established companies are heavily invested in plant and equipment. This, plus the gradual nature of compression, can lead to a false sense of security. Changes in performance can seem like the normal ups and downs of a cyclical industry. This can prompt the use of traditional methods like cost cutting to address problems, rather than investing in new approaches and business models.

In reality, companies are most likely suffering from compression in which healthy growth is replaced by 'empty growth'. The fact that the global chemical industry has struggled to grow product value since 2011 could be a sign of compressive disruption.

To measure the risk, Accenture built a bottom-up disruptability index (encompassing financial, venture capital, M&A, branding and other metrics) to examine the state of disruption and future susceptibility for chemical companies across four segments (basic, specialty, industrial gases and agribusiness). We concluded that the chemical industry is, in aggregate, in the stable durability stage. But there were wide differences. Agribusiness (fertilizers and pesticides), for example, is in the 'volatility' stage and seeing some of the most advanced digital transformations, like the use of drones, climate software and other technologies to create new value for customers.

The phase and risk of disruption an industry finds itself in can quickly change. Companies that neglect to make necessary technological, portfolio and business model changes will be left behind. That's why foresight is needed when scanning the extended ecosystem for disruptive exposure. It also requires the application of creative thinking and new capabilities, like digital platforms, to innovate and prepare for what's ahead, whether or not it's already on the radar.

## **A Collision of Forces**

The global chemical industry faces change on multiple fronts, with the combined impact of converging forces that will ultimately redefine its future. Depending on your readiness, adaptability and agility to respond, the collision of these forces—and ensuing disruptive impact—will bring opportunities and risks.

First are the multi-decade global megatrends, including climate change, pressure on natural resources, changing demographics, emerging markets and the continued drive to commercial efficiencies. Next are short-term economic trends including geopolitical change, exchange rate volatility, regulatory complexity and shifting patterns of supply

and demand—plus growing global political uncertainty and protectionist sentiment that could reverse some aspects of trade policies.

Then there is the Amazon effect, which has transformed customer expectations and raised the benchmark against which every transaction is gauged. Everyone is racing to offer customers personalization and improved, frictionless experiences. We're entering an age where mass production is giving way to mass customization—delivered with omni-channel ease and ever faster lifecycles, in ways that also comply with the sustainability agenda.

Finally, there's the immense impact of converging digital technologies. Automation, the Internet of Things (IoT), intelligent connected devices, virtual, augmented and extended realities, artificial intelligence (AI), data analytics, big data, new platforms, cloud-enabled ecosystems, blockchain and cybersecurity are all part of the technology explosion that's transforming every aspect of every industry. And the chemical sector is no exception.

## **Ensure Relevance**

With these changes underway, the key question is how do you stay relevant? How will you continue to deliver what customers and consumers want, with the agility to compete in the new digital age?

The chemical industry has the potential to be the most consequential industry in the world. By manipulating molecules, it has the power to resolve many of our most pressing challenges. From industrial biotech, fuel cells, renewable energy and nanotechnology, innovation through chemistry can change the world. But for incumbents, it will require a step change to adapt fast.

## **FOUR KEY DISRUPTIONS: A DEEPER DIVE**

With the convergence of these forces, we have identified four disruptions that we believe will most impact the industry in the years ahead and create new competitive dynamics. An understanding of these offers a valuable starting point for predicting new entrants who may disrupt the market, as well as what competitors and customers will do in the coming years. Equipped with this knowledge, you can target your capital investments, business models and innovation where they will be most effective.

### **Disruption 1: Circular Economy**

Replacing the 'take-make-dispose' model by designing for re-use and constant recycling.

In terms of circulating molecules, the industry is facing intensifying regulatory and consumer pressure to reduce its environmental impact and use more recycled molecules. Meeting these demands is key to the sector's future license to operate.

And this move to the circular economy is happening much faster than anticipated. Take plastics, for example. In January 2018, the European Commission (EC) announced the first-ever Europe-wide strategy on plastics. Yet less than a year later, the European Parliament approved a ban on single-use plastics.

The circular economy is already starting to replace the traditional linear approach to resources—where many materials are made into products, which are then discarded. Within the circular economy, materials are constantly cycled back through the value chain for re-use. Or they are reduced, substituted with products with a better ecological footprint or ‘durabilized’. These changes result in less energy and resource consumption, while keeping products at their highest utility and value. It requires an entire lifecycle approach to design chemicals for re-use from the start through to the end of their life—which also creates new scope for phasing out toxic products.

The advent of the circular economy has profound implications for many industries, but nowhere more so than in chemicals.

Circulating molecules will shift where demand is in the value chain, significantly impacting chemical volumes and resulting in less raw material consumption. Durabilization of products from single use to multiple use should reduce total polymer demand. Although a durable water bottle, for instance, has five to seven times more polymer by weight than a single-use bottle, the durable bottle can be used repeatedly, so less polymer is required overall.

Based on a cursory analysis, we anticipate a 65 percent reduction of polymer volume due to applications converting from disposable to durable plastics. In fact, plastics recycling could equate to 81 million mtpy lost conventional capacity, equal to 160+ world-scale polymer plants, by 2030. Not only that, but we will typically see different polymer types involved in the circular economy.

### **What’s the Opportunity?**

The rise of the circular economy opens massive growth opportunities. Accenture research conducted in association with the European Chemical Industry Council (Cefic) pointed to two potential approaches to achieve a more circular, sustainable model: first, circulating molecules; and second, as an enabler for the circular economy in downstream industries. For example, more fuel-efficient cars require lighter materials; shared cars (which are used more intensely) require higher performing, more durable materials; and more energy-efficient houses depend on better insulation materials.

None of this is possible without innovation by the chemical industry. As re-use concepts become more pervasive and downstream demand shifts, there will be a shift from volume to value, driving strong growth in specialty and high-performance products.

For chemical companies the opportunity is to create new ways to retain a stake in the value of the molecule, wherever it is in the lifecycle. And the payback could be substantial. Successful enablement of circularity downstream is projected to drive additional and new demand for more sustainable chemicals—which could see a 26 percent rise from 2015 levels by 2030.

So, each chemical company needs to start assessing the impact on its own business and define where to make its play in the circular economy.

## **Disruption 2: Industrial Recalibration**

Technology-enabled transformation of manufacturing driven by changing consumer preferences.

Transformation of manufacturing is revolutionizing what, where and how things are made. This recalibration is being enabled by the combined impact of multiple digital technologies. Centering on Industry X.0—the digital reinvention of industry to create smart ‘living’ products, services and self-learning manufacturing systems—it’s all about exploiting the connectedness of equipment, people and processes.

Adaptive manufacturing enabled by 3D printing (3DP) is creating enormous potential for the customization, personalization, localization and deglobalization of finished goods at speed and scale. This goes hand in hand with a marked global rise in consumer spending power and affluence which is helping to drive up consumer demand for more personalized goods. Incremental manufacturing additions are now underway in advanced markets, and if the use of 3DP polymer continues to rise at its current rate, demand would equate to the output from 46 average scale engineering polymer plants by 2040.

Bringing production closer to consumers, at their point of need, could shift production back to Europe and North America, hence paving the way for new supply chains, smaller production units, better scalability, faster time to market, reduced waste and new efficiencies.

By leveraging Industry X.0 and cultivating 3DP opportunities, chemical companies can support their customers with new forms of production, innovation and improved performance, enabling them to respond rapidly to fast-changing consumer demands and market-test new products at low cost. Offering far greater design and creative flexibility, 3DP innovation could substantially impact material types and volumes. To accelerate innovation, chemical suppliers should be considering opportunities to collaborate via new alliances, ecosystem plays or equity stakes to pioneer new formulations, materials and value propositions.

## **Adidas Makes the Running**

Take for instance Adidas SPEEDFACTORY, which is setting the pace for the future of personalized consumer goods production. Two digitally driven, highly automated athletic shoe plants have been built local to market to create customizable shoes and rapidly replenish the most popular products.

The first opened in Ansbach, Germany in 2017 and a second in Atlanta, USA in 2018. Together, they will be making a million pairs of shoes a year by 2020, using robots, automation and 3DP, among other technologies. Each plant has around 150 employees, compared with 1,000+ in a typical factory in Asia, where most Adidas shoes are currently made. Being closer to the consumer makes it much quicker to ship shoes customized to local tastes and market trends.

To produce its state-of-the-art AM4NYC urban designs, for example, in the Atlanta SPEEDFACTORY, Adidas first analyzed years of aggregated sport science data. Through a unique process of fit programming, digital mapping and puzzling together varying stretch and stiffness attributes, customers get shoes uniquely customized to their requirements. To celebrate the Atlanta launch, Adidas opened a lab experience in New York City for guests to receive custom, private footscan data to learn about their perfect fit, receive individual, shareable content, and test the latest shoes through an interactive experience. Customers can co-create their shoes online and get them delivered in weeks versus the industry average of about 18 months.

More broadly, this points to a 3DP-enabled, data-driven future of localized manufacturing whereby consumers can create their products online. And chemical companies can lead the way by co-innovating with their customers and consumers to turn these exciting new concepts into reality.

## **Disruption 3: Digitalization Downstream**

End-to-end value chain digitalization to meet changing consumer needs.

Where B2C goes, B2B usually follows, with the waves of digitalization that have been transforming B2C becoming ever more frequent. But chemical companies have been relatively slow to tap into the digitalization trends that are transforming downstream customer industries, including automotive, consumer goods, construction, electronics, energy and food.

There is a huge opportunity for established chemical companies to tap into the disruptive potential of smart products. Even among those chemical companies that are taking a lead in digitizing, few are yet realizing the full range of benefits. According to our research, 40 percent of chemical companies are using digital technologies to increase efficiency and 32 percent are applying digital technologies to drive growth. But, perhaps unsurprisingly, it's the 11 percent which are doing both that are also financial high performers.

Embedding digital connectivity throughout the supply and value chain enables new levels of end-to-end visibility, traceability, transparency and data-driven insights. This makes it easier to dynamically sense and predict demand, personalize manufacturing to customer specifications, maximize margins, deliver quickly, price in real time, record transactions and close books fast.

Blending technologies to create differentiated customer experiences could be a major driver of new sales. In fact, according to our research, digitalization could unlock up to \$550 billion for the chemical industry over the next decade.

Forging new connections both within and beyond the enterprise enables you to expand your ecosystems to support collaboration, drive speed and improve efficiency. Cloud-enabled as-a-service models can streamline and facilitate no-touch back-office processes while replacing fixed costs with variable costs. Robots and drones can take on tasks such as plant inspections, eliminating the need to send workers into dangerous or difficult environments. And blockchain can verify payments, automatically validate contracts and manage activities such as shared chemicals storage—improving visibility for all partners involved.

### **AkzoNobel Navigates the New**

A prime example of how a chemical company can harness the disruptive potential of digitalization downstream has been pioneered by AkzoNobel. The company's marine coatings business created the first tool for the shipping industry using data analytics to accurately predict savings from different coatings on cargo tankers. Using billions of data points and proprietary algorithms, the tool generates a full cost-benefit analysis detailing the impact on estimated fuel consumption, fuel cost and CO2 emissions of different coating options before they are applied to the hull of a ship. In an industry where coating selection can significantly impact a vessel's operational costs and environmental performance, it brings a new level of transparency, enabling ship owners and operators to increase profitability, while improving sustainability performance.

### **Disruption 4: Reworking Work**

New talent models for new types of work in the digital age.

Across all sectors of industry, companies are transforming their talent models. For chemicals, an industry that has struggled to recruit and retain top talent, this represents a major opportunity.

At the same time, there is an imperative for chemical companies to access new expertise in data science, analytics, customer experience and other skills required to support work in the digital age.

Allied to this, chemical companies urgently need to redefine their purpose to inspire talented individuals to build fulfilling careers in the industry. Transitioning to a purpose-led, outcome-driven culture is a big change but one that will be key to creating an adaptive, liquid workforce that can flex fast as requirements change to keep your future business smart, agile and dynamic.

This is backed up by our research on what's changing, exploring factors such as what work is done, who does the work, why, when and where people work. It revealed that people want to do work with a sense of purpose, with 84 percent saying that making a difference means more than professional recognition. The findings also indicate that by 2025, 45 percent of workers will be contractors or part of the gig economy, and by 2030, 47 percent of tasks could be automated.

## **STEPS TO REINVENTION**

### **To Compete in the New, Chemical Companies Must Reinvent**

To capitalize on the forces for change, the time to reinvent is now—not in five, 10 or 20 years. As history so often tells us, those who wait and see instead of making the necessary technological, portfolio and business model preparations, get left behind while bolder players forge ahead.

Furthermore, the business case is clear and compelling. According to a recent Accenture study, the impact of transformation on profit and loss (P&L) for a typical chemical company with 10 percent EBIT can create an additional three to six percent—adding significantly to the profit potential.

So how do you embrace disruption and turn it to your advantage to transform your business?

In this changing environment, chemical companies need to ask some key questions about where best to position themselves for long-term success. It's not simply about chemical formulae, but understanding where you will best fit and stay ahead as the industry evolves.

- What business are we in?
- What are our core competences?
- If we radically reinvent, what will our business look like?
- Where do/will we fit in the changing chemical value chain?
- Where do we want to be in the future?
- What are the limits and constraints on our organization—and what needs to change?

## **Embrace Elements of Success**

Success will require chemical companies to use connectivity and data-driven intelligence to embed new behaviors or attributes as vital building blocks for future growth.

### **Be Consumer-Driven**

Look beyond your immediate customers and intermediaries to get to know the people who are ultimately consuming your products—and how differentiating your products can influence their buying decisions.

### **Be Inspiring**

Reimagine your offerings, engage customers and inspire your workforce to attract and retain the best talent with strong brand appeal and a compelling sense of transformative purpose.

### **Be Collaborative**

Break down traditional silos and company boundaries to co-create smart products, drive open innovation, share knowledge and extend your ecosystem and network of partnerships.

### **Be Intelligent**

Adopt new technologies to become agile, faster and smarter, using analytics to be truly cost efficient and maximize the value derived from data.

### **Be Circular**

Drive new value by controlling the molecule lifecycle and enabling downstream circularity, for example, through new business models, like renting rather than selling molecules.

## **Build New Business Models**

As the chemical industry continues to evolve, new business models will emerge. The challenge is to understand how and where your business can best thrive. Having identified where you want to play, it's then a matter of mapping the transformation journey to get you to where you can best capitalize on future potential.

Currently, chemical companies broadly fit one of five business models:

- Large-Scale Operator
- Commodity-Balanced
- Specialty-Balanced
- Service Provider
- Portfolio Player

Over the coming years, we expect these to evolve into five core new business models:

- 1. Supply Connector:** A chemical product and service broker, typically using online direct selling and/or distribution, with few or no manufacturing assets.
- 2. Outcome Provider:** Selling a product and/or system which addresses a client challenge or need, transforming a problem into a value proposition.
- 3. Product Steward:** Focusing on producing one or a few molecules, with global, flexible supply chains. The aim is to monetize the lowest-cost feedstock and bring products to market at speed through the value chain—wherever it's needed in the world. And to also recycle it back again to close the loop. We see big opportunities here, for example, in plastics such as PET.
- 4. Ecosystem Innovator:** Tapping into the broader business ecosystem with multiple partners to co-innovate new products and services, using multiple technologies for research and commercialization.
- 5. Portfolio Orchestrator:** Operating as a diversified company linked by core technologies, competencies or chemistries.

Basic research drives new business, with regular acquisition and divestment of businesses to maintain an overall target performance.

In turn this shift will be enabled by six capability pivots:

- Outcome selling
- Supply chain mastery
- Recirculation/sustainability
- Brand management
- Ecosystem innovation
- Combinatorial Science & Technology

## **Seize the Moment**

As we have seen, there are clearly opportunities for those willing to grasp them. Over the next three to five years, more chemical companies anticipate stepping up their efforts. But while they say they can see the future potential in new businesses, our research among global chemical companies indicates that most are not embracing the new opportunities fast enough. In fact, in the last three years, only eight percent have decisively pivoted towards new businesses.

Also, 67 percent of executives say their companies currently generate less than half of revenues from new business activities started in the last three years.

In an era of epic disruption, the choices are clear. Hold back, wait to be driven by regulation and risk being left behind. Or make the bold move, step up to the challenge and take the lead.

## **Rotate to the New**

The digital age calls for a new approach to organizational change (rotation to the new) that enables companies to successfully make a 'wise pivot'. Leaders in the new have mastered the art of continuous reinvention, enabling them to stay in a permanent state of readiness to adapt to change. So, what does it take to achieve this?

The wise pivot is a comprehensive, end-to-end change journey designed to help chemical companies manage the dynamic tension between transforming their core legacy business while expanding into new businesses. It's a perpetual journey that demands discipline to master four areas and adopt the right mix of new technologies and investments—continuously and synchronously, to ensure that the timing, scale and direction of investments are calibrated adequately.

## **Transform the Core Business and Reduce Costs**

Drive up investment capacity by building agility and creating more competitive cost structures to improve flexibility and unlock value from the existing core business model.

Key priorities include increasing operational reliability, improving supply chain efficiency, managing complexity, reducing indirect spend, standardizing and automating processes and improving process yields.

## **Grow the Core Business and Grow Revenue**

Use the new investment capacity to gain data-driven insights that optimize operations, improve customer experiences and activate new demand to refresh the core business.

With the focus on growth, key objectives are to increase share of wallet from existing customers, improve price realization, accelerate speed to market for new products, increase exposure to higher growth segments/markets and invest in core segments, such as new builds.

## **Scale New Business and Grow Revenue**

Build new architectures (e.g. innovation hubs, labs, partnerships, your ecosystem, etc.) as a prerequisite for rapidly scaling innovation efforts from startup community to global enterprise size.

To scale growth, develop new products and align supply chains to meet the needs of adaptive manufacturers. For example, by creating sustainable products for the circular economy, using blockchain to track and trace products across the lifecycle, leveraging new technology to transform the customer experience and developing new solution provider business models.

## **Continue to Pivot Wisely**

The transformation journey requires a delicate balance: pivot too quickly from the core to the new, and you will over-invest and be financially stretched too thin. Pivot too slowly, and you risk becoming obsolete. That means carefully planning to decisively execute a wise pivot and remaining in a constant state of readiness to adapt fast in response to change.

## **Start the Journey to Reinvent**

Just as every chemical company is unique, so is every transformation journey. Depending on where you are on your transition, your first steps may start with:

- New business models, e.g. recirculating molecules
- Building new ecosystems for collaborative innovation
- Developing adaptive digital plant or AI-driven operations
- New digital sales platforms for data-driven customer experiences
- Implementing frictionless back office systems
- Linking with downstream customers as their geographic footprint and requirements change

## Focus on the Future

Looking ahead, chemical companies can expect change on many fronts, from today's sudden shifts to the subtle but dangerous effects of compressive disruption. With existing growth drivers losing momentum, it could be easy to assume that the outlook is bleak. But this would miss the mark.

Change, as they say, is a double-edged sword—one that increases risk, but also creates opportunity. Wherever your starting point, understanding what's changing and embracing it will better prepare you to harness disruption to your advantage.

By refocusing on core value drivers—and simultaneously taking proactive steps to optimize production processes, embrace digital technologies, capitalize on the circular economy and develop new talent models—chemical businesses can trigger their next wave of growth.

In our view, the chemical industry is at a defining moment. Decisions taken today will shape growth and dynamism for decades to come. The opportunity to reinvent is clear. It's time to seize it.

**The time to reinvent is now. Are you ready to lead in an era of epic disruption?**

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