



ACCELERATING DIGITAL TRANSFORMATION IN THE **CHEMICALS INDUSTRY**

Truly transformative and sustainable innovation happens when technology, people, and data are combined.

NOVEMBER 2017

DANIEL NEWMAN
Principal Analyst

FRED MCCLIMANS
Analyst

IN COLLABORATION WITH SAP

Published: 11/2017

TABLE OF CONTENTS

3	The Innovation Challenge
7	Enabling Digital Innovation
12	The Value of Innovation
14	The Winning Edge
17	Taking the Next Step

THE INNOVATION CHALLENGE

Digital Transformation is much more than a technology play. It's a key driver for the survival of businesses across every industry in every market in the world. It's also an opportunity to overcome barriers and challenges to innovation. To leverage innovations to improve core operations. To reimagine business and create true business value. To become a disruptor, not the disrupted.

Providers in the chemicals industry, in response to both competitive and customer pressures, are rapidly embracing the shift to digital. And while many are just beginning this journey, others are well underway in the process, experimenting with different technologies in the hope of driving innovations to be nimbler, more competitive, and more profitable.

But innovation itself isn't the entire challenge—pockets of innovation can be found in most any company, from the wildly successful to those that have failed spectacularly. The real challenge is in being able to innovate at scale across an entire organization, all while creating a mechanism for those innovations to be shared, sustained, and to

The innovation challenge exists because digital transformation cannot be solved with technology alone.

drive value back into the core of the business. That is the challenge.

Overcoming this challenge, and getting sustained value out of a digital transformation effort, requires the ability to select, implement, and leverage technologies that work together; an innovation culture that includes the ability to adapt corporate and team behaviors to embrace new or alternative day-to-day processes; and the ability to manage and gain value from massive amounts of real-time data, sourced (and shared) throughout the organization.

Without question, the innovation challenge exists because digital transformation cannot be solved with technology alone. It requires the confluence of people, technology and massive amounts of data.



We have left the age of gut-driven decisions and have entered a world in which there is no such thing as a good decision made without data. With the maturing of technology trends, such as the rise of the Internet of Things (IoT), data creation is happening at exponential rates and companies must learn to evolve beyond systems of record and leverage the skill sets of their data analysts and scientists. This access to real-time data can allow chemical providers to run their businesses live and in the moment.

Unfortunately, there is often too much data, from within the organization as well as from external sources, across too many variables.

With rapidly changing business requirements, employees can easily get bogged down complying with customer data security or data use specifications, leaving the organization struggling to keep pace.

The answer to overcoming this data glut, and enabling innovation, can be found in the perfect orchestration of technology, for instance, machine learning, to create human-machine partnerships that allow companies to maximize their effective use of data to better prescribe and predict the changing customer environment, and to deliver on those more innovative experiences that customers desire.



The State of the Chemicals Industry

Dominated by large global companies, the chemicals industry is comprised of many sub-segments, including basic chemical producers, commodity producers, intermediates producers, and specialty producers. Examples of specialty producers include flavors and fragrances, paints and coatings, beauty products, and performance chemicals for industrial applications.

The industry is increasingly influenced by smaller, specialty producers that are at the leading edge of emerging demand. As the specificity of chemical application grows, the industry is moving from larger scale production runs towards increasing diversity of small batch-oriented production runs. Sales are dependent on performance of the substance, not just the innovation of the substance itself.

Interestingly, nearly 40% of chemical sales come from serving downstream adjacent markets including the following: oil, gas, construction, automotive, pharmaceuticals, cosmetics, food, clothing and fragrances. The innovations that disrupt the core sales to the chemical industry (60% of the market opportunity) also have the potential to impact these downstream markets.

Not surprisingly, the industry has changed significantly since the advent of the digital age. Merger and acquisition (M&A) activity in the chemicals industry is at an all-time high. Both companies and investors are seeking to quickly capitalize on operational and market opportunities through acquisition. As such, the chemical industry must be prepared to constantly integrate acquired operating systems into one single system to drive operations and useful insights.

The industry is also witnessing a shift in talent, due to an aging workforce. Many workers are rapidly approaching retirement. Additionally, the chemicals industry is struggling to attract digital natives, aka younger employees, who could more easily propel the industry forward. However, there is an



increasingly environmentally conscious (“green”) movement within the chemicals industry, which often appeals to new talent. Green innovation is interesting to young chemists, and may open an avenue to bring in tech-baptized young workers to help ease the transition into digital.

Globalization is perhaps the number one driver of change in the chemical industry. It’s nearly impossible to be a truly “small” chemical company, given the safety regulations required. And while the digital revolution has transformed the entrepreneurial market in many industries, it’s difficult to “digitize” the chemical business. Regionally, demand is shifting towards Asia, with the demand on the product portfolio growing from multiple industries (e.g. consumer electronics and consumer health). The supply side is heavily affected by the shale gas exploration in North America, as is the coal-to-chemicals policy in China.

How far has the industry evolved? Consider a customer at home, using an app with augmented reality to visualize, and design, a custom paint color for their room. The order is placed directly with the paint supplier overseas, who uses knowledge of its distribution channel to ensure the right paints are spot-delivered to the nearest hardware store, which custom-blends the one-of-a-kind color on demand when the customer arrives.

While these trends have clearly ignited the evolution of the chemical industry, there are certainly several challenges for this mature space.

Industry Challenges

Some companies are finding success in the digital age of chemical manufacturing while others are struggling to address some common challenges:

1. Finding New Revenue Streams:

Chemical companies need to find new revenue streams beyond products, often requiring the adoption of service-based models. These may include lease-based services to complement a firm's products, customized consulting services, or closed loop service models (e.g. providing wafer cleaning services for high-tech semiconductor companies.)

2. Evolving a New Workforce:

Chemical companies need to both attract new talent and educate existing employees on the opportunities digital offers, from engineering process challenges to innovative product and services development.

3. Leveraging Digital Effectively:

Chemical companies have long used technology, such as IIoT (Industrial IoT), on their production lines and process controls, but did so in a closed ecosystem, only recently beginning to strategically merge this data with business management information. In this highly regulated and safety conscious industry, cybersecurity will be key to finding an elegant and secure way to cluster data, find common patterns, and transform sensor data into actionable insights.

4. Leveraging Consumer Insights:

Chemical companies must shift focus from just selling chemicals to selling value or the business outcome a chemical product can deliver. Leveraging consumer data will be key to embracing this shift, enabling opportunities such as online paint cost calculators, offering to take on the end service as a subscription-based payment to open-up secondary revenue streams, or finding ways to inject value directly into the end consumer's purchasing process.

5. Moving Past Blockbuster Molecules:

The "old days" of molecules that change the market and bring tidal waves of profit are over. As with the movie rental store, chasing the "blockbuster" model of profit is no longer a viable means to stay in business. Companies that survive in this industry will seek to improve the entire end-user experience, and will benefit from platforms that support increasingly complex supply chains from businesses to consumers (B2C), to businesses (B2B), and even to business who then sell to consumers (B2B2C). All while offering customer support as well.

To overcome these challenges, companies must learn to apply the right technology and create a culture of innovation at the business process level, and embrace both internal and customer data sources. Companies must also engage and activate both employees and customers, drive to understand the end-use value of products, recognize that ***the blockbuster molecule era is over, and cost-plus sales must shift to value-added sales, which is only possible through a digital transformation.***



ENABLING DIGITAL INNOVATION

One of the biggest hurdles for any company is the development of innovation-ready cultures and ecosystems, including internal teams, partners, and customers. While innovations may be unique to individual businesses, the basic building blocks that enable transformative change are consistent and can be replicated to manage the technology, business processes, and data necessary to drive innovation to the core business.

To build a culture of innovation, companies must marry the most capable of technologies with a business culture that embraces change and properly leverages technology and a wealth of data to drive better business outcomes. This requires a willingness to explore both open and closed-lab approaches that involve all employees; embracing a fast failure mentality that focuses on the rapid testing of ideas; and the desire to leverage partnerships and successful innovators to focus and drive efforts.

The tools that are employed by today's leading business cover a wide range of technologies, that when bridged together can provide business-wide value in any number of combinations. They include:

Analytics: the applications that help digest massive amounts of data to provide understanding of the past and present, while driving predictive insights and actions for the future

Big Data: the tools that allow for the massive collection and storing of diverse data sources from hardware to software, from supply chain to consumer

Blockchain: a distributed ledger that offers the ability to bring trust, transparency, and security to transactions, from smart contracts to supply chain management



In working with leading companies across the globe, Futurum Research sees successful firms investing time and energy around five strategic priorities, all of which require a balance of technology, business processes, and data:

Embracing customer centricity: Putting the end customer point of view at the center of every decision, particularly from a design thinking perspective, is a key prerequisite for success in the digital age, applying not just to sales and marketing, but to products, services, and overarching business strategies.

Serving the "segment of one": Providing solutions that precisely fit the needs of one single customer is not new in traditional engineer-to-order environments. Now, however, the ability to capture customer requirements effectively and drive mass personalization at scale is achievable.

Deploying digitally smart products: Using digital capabilities like self-awareness of technical health and operational status or business system connectivity to create product differentiation and enabled value-added services bundled with products.

Digitizing the supply chain: Applying digital technologies and innovating processes to production and logistics to intelligently connect to the rest of the business to deal with unforeseen supply, demand, or manufacturing issues.

Adopting new business models: Developing a strategy to uncover and embrace new business models and revenue streams, such as combined product and data-centric service offerings designed to increase life-cycle customer touch points and improve long-term margin opportunities.

The Cloud: the underlying platform that serves as a common foundation across applications and technology, integrating things, people, and processes into a single accessible system

Design Thinking: the transformative process that places the customer first in the design of all technology and processes, through a highly collaborative and rapid iterative prototype/testing approach

The Internet of Things (IoT): the connected sensor network that collects data on products, assets, software, and services from the supplier to the customer

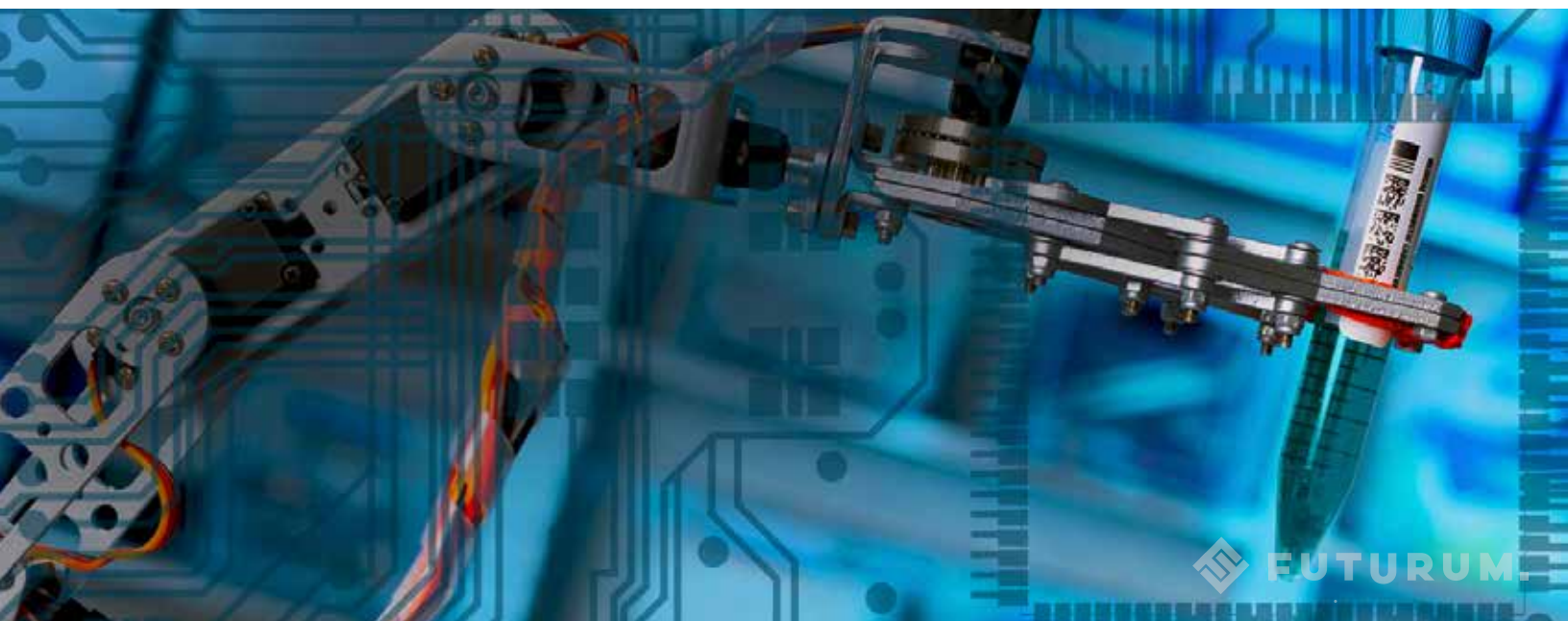
Machine Learning: the intelligent applications that learn to understand and leverage human behavior to predict and solve both business and consumer issues

While many organizations have begun implementing cloud, big data or analytics, other technologies,

such as machine learning, IoT, and blockchain—if they are implemented at all—are often limited to controlled pilot programs that have limited opportunity to transform the entire business. More importantly, the real value in these technologies isn't in the tactical application, but rather the coordinated use alongside business processes driven by design thinking that, focus on priorities that collectively drive value to the customer, the core business, and the extended ecosystem.

This requires a culture of innovation that can enable—and embrace—changes to basic business processes, changes that place the customer at the center of every business decision, that embrace a fast prototype/fast fail philosophy of constantly iterating to meet customer requirements, and is designed to add value to the application of technology.

It also requires a willingness to embrace the value of data that can drive specific business decisions and uncover insights that lead to better, more scalable, innovations.



Industry Use Case: Improved Equipment Reliability

For both finished goods and materials in process, the chemical industry relies heavily on the plants and equipment used to produce, distribute, and store its products. Traditionally a complex and continuous production model, interruptions in the cycle due to unavailable or poorly maintained equipment can cause operational slowdowns and unexpected maintenance costs, not to mention severely limiting the maximization of throughput and the efficiency of output. And, of course, there are the obvious delays to product availability or often-reduced quality of product, both of which impact revenue directly.

Improvements in the reliability of equipment and the availability and uptime of operating

equipment can significantly strengthen a firm's competitive position and bottom line. By employing technologies such as shop floor connectivity, predictive analytics, and machine learning, real-time data can be gathered and analyzed to help companies visualize problems before they occur, and "what if" simulations can be run to determine the best time to do maintenance, allowing for changes to business process that can result in increased reliability and availability of components. By learning how and when equipment is likely to fail, more accurate scheduling and budgeting for machine maintenance can result in reduced maintenance and services costs, as well as an increase in operational predictability.



 **FUTURUM.**

Industry Use Case: Process Optimization

A business can only be as efficient as the processes it employs, and in the chemicals industry, optimizing processes in production can be critical to success and competitive positioning in what has become a volatile industry. The optimization of processes and the resulting efficiency requires data, and the power to analyze it, in a timely even real-time fashion. Being unable to gather operational data, or delays in finding insights, can result in slow decision-making or uninformed actions.

Chemical firms across the board can gain great

value and insight through technology that gathers and analyzes the vast amounts of real-time data generated directly from the shop floor. When properly automated, the gathering of operational data throughout the corporation can enable a company to quickly identify problems, perform real-time reporting, and compare operations across the company to identify “best in class” technology and business processes, further leveraging the data into distributed value. Insights can be provided in context, allowing assets to be managed by exception.



Industry Use Case: Quality Control

As chemicals weave their way into new and innovative uses, the quality and predictability of these products becomes paramount. Reworking of product, and additional materials and production expenses, can be significant, and allow for competitors to make inroads to customers who are forced to wait for products. Additionally, industry regulators and consumer groups are fast to identify problems – often publicly. Being unable to identify, adjust, or respond to production problems (both material and operational) greatly increases business, financial, and legal risk to a company.

As is often the case, being able to gather and analyze data in near real-time is key to quality control. By leveraging embedded sensor technologies to capture massive amounts of product and operational data throughout the materials acquisition, production, and distribution processes, producers can have a common system of record to gain and share insights with suppliers, distributors, and even customers and partners. By being able to identify and trace quality issues in the moment, both the company and its extended ecosystem can perform detailed analytics at a granular level, make better-informed decisions, and more effectively respond to issues as they arise (or are predicted).

Takeaway: Many companies get stuck focusing on continuous improvement when true innovation is what they need most. Every company must identify those use cases core to its business and then seek ways to exponentially improve upon the status quo.

Summary

In each of these use cases, there is significant benefit from improved end-to-end process visibility. This is made possible through the incorporation of big data, machine learning and predictive analytics. The use of machine learning and predictive analytics in particular are enablers for high-level managers to more clearly predict the future of their business. They can then deploy these real time insights to better manage resources to improve revenues, control costs, and improve business outcomes. Specific ways they can accomplish this include the reduction of waste and coinciding disposal costs. Data can also be used to measure against product specs, allowing for in-process adjustments to ensure correct supplies, inventory, and product, eliminating warehousing of excess materials.



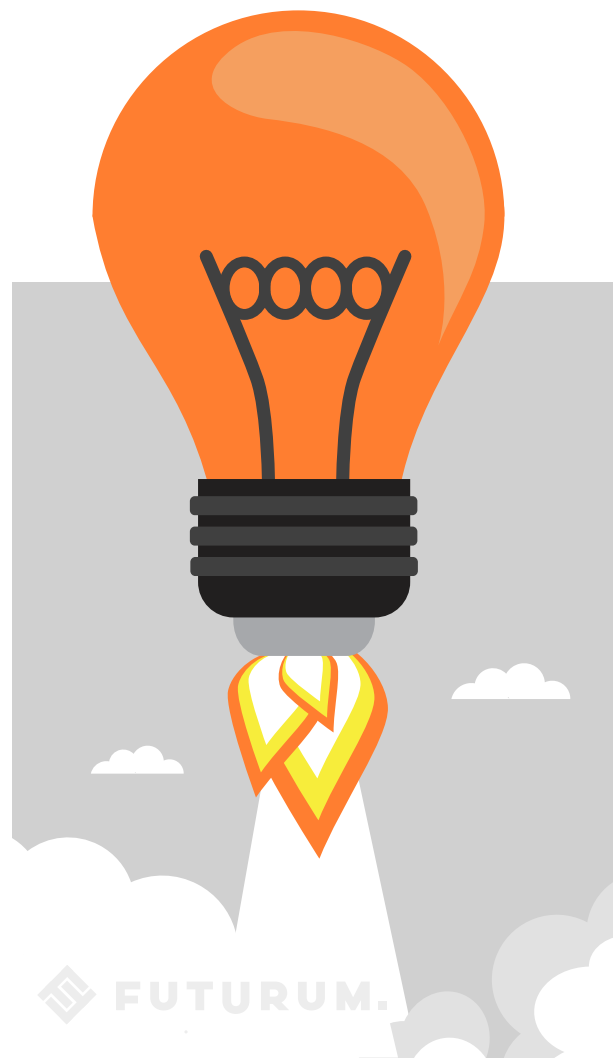
THE VALUE OF INNOVATION

The path to realizing scalable innovation can be difficult and beset with obstacles and barriers. Lessons learned in one industry, while beneficial and of use in shortening innovation cycles, may not directly translate to other industries, where unique use cases and competitive landscapes may differ considerably. However, there are lessons to be learned in common best practices and use cases that can help define digital transformation goals and shorten time to value. These lessons can also help define the value of innovation for particular companies, as well as overcome “islands of innovation” that can diminish, or mute, the value of individual innovation efforts.

In the chemicals industry, the value of digital innovation can be found in the ability to gain a much better understanding into how products are being used by partners and end users, providing insights that can guide both product and process innovations and new service offerings. Within operations this can lead to improving insights throughout the manufacturing process, increasing the capability to bring operations and products back to specification, eliminating waste, and improving first pass yields. It can also cut down on inefficiencies across the company, whether that’s time in the front office or time awaiting equipment repairs.

From an operational perspective, digital innovation offers a number of key value propositions to the chemicals industry:

Driving Top Performance: Volatile feedstock prices, ever-changing equipment and material availability, and complex global supply chains lead to tumultuous operating environment. With robust data warehousing and machine learning, organizations can start making connections and bridging gaps in efficiency from order through delivery, helping use resources more efficiently, eliminate poor performers, and have a much more detailed roadmap to product perfection and profitability.



Finding Value-Add Revenue: Products alone will not be enough to sustain a company in the digital era hallmarked with shifting customer loyalties, so a customer-first platform will be key in unlocking new service and revenue options.

Automating Repetitive Processes: Humans are the most advanced computers, but they’re still prone to making mistakes. Predictive analytics and machine learning, for example, can help chemical manufacturers automate high-volume tasks that may have a complex set of rules governing how multiple, similar tasks are processed. It can also help overcome the implicit bias of human behavior, greatly reduce risk, improve efficiency, and improve employee working conditions.

Resource Management: The old concept of “lean” is a barely-recognizable concept in the digital age. Most companies would call it “doing business.” Digital innovators can work with significantly fewer people, while at the same time shifting their personnel expenses toward more highly-skilled workers.

Summary

The old-school supply chain, partner environment and product development processes are prone to waste, a death knell for any company trying to survive in the digital age. There's no reason to expend highly valuable human labor hours processing invoices and payments that would take machine learning solutions just moments to learn and automate.

The gathering of data, and the use of predictive

analytics, can greatly improve the availability of operational insights that lead to process innovation. Technologies like the cloud and blockchain can play a strong role in the recording and sharing of data and transactional records. But most importantly, if the goal is to bring a legacy chemical company into the digital era, start with the customer in mind, and work in stages to optimize the best marriage of technology, people, and a legacy industry in need of an upgrade.

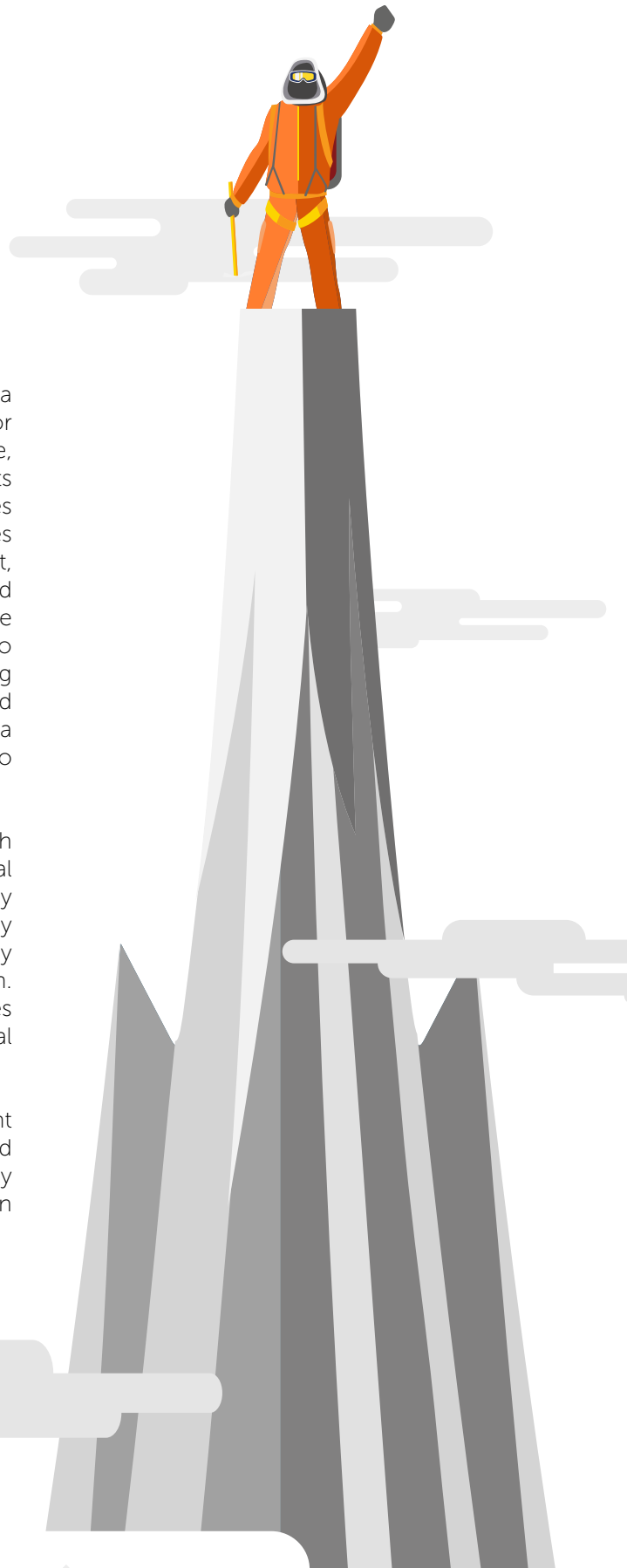


THE WINNING EDGE

Success in establishing innovation at scale isn't a given, and it doesn't necessarily come easy. For enterprises with well-established infrastructure, policies, and talent, achieving break-out results from a digital transformation initiative often requires a deliberate and proven strategy that embraces both the right technologies and the right talent, guided by a shift in operating processes designed to leverage the initiative into a successful outcome creates a system of innovation embedded into the digital business core. This includes leveraging the right experience and partners, both within and supplemental to the ecosystem, that can drive a customer-centric, design thinking approach to core business decisions.

Unfortunately, however, Futurum Research has observed that a majority of current digital transformations do not appear to be entirely successful. Innovation tactics like fail fast may be widely heralded, but they are often poorly implemented, measured, and executed upon. Understanding how emerging digital technologies can be used to enhance the success of digital innovation efforts is critical.

For those who are willing to implement the right technologies, embrace process innovations, and properly value data, the results can be both easily measured and offer the ability to scale innovation to drive core business value.



 **FUTURUM.**

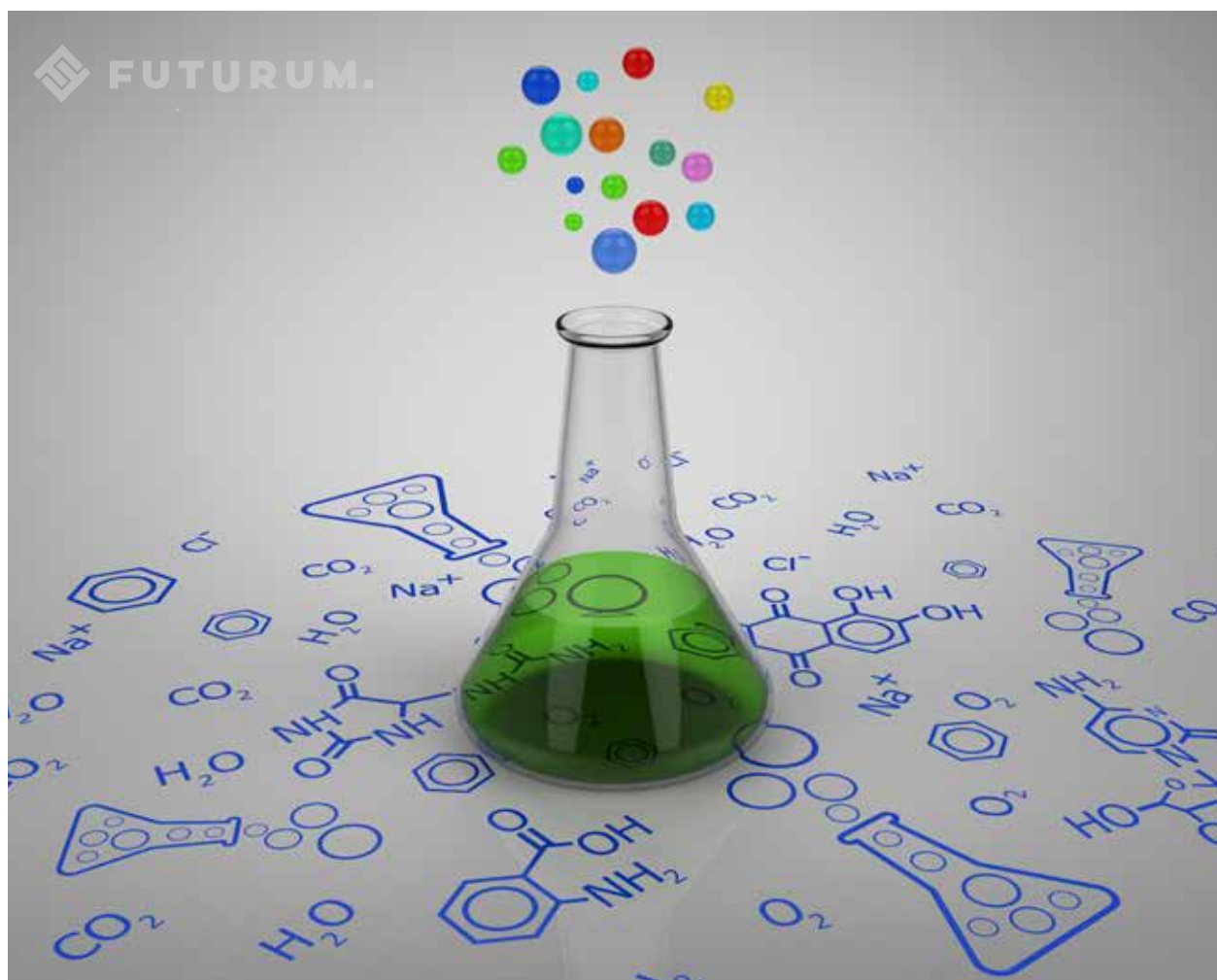
Case study: Invoicing and Payments

Challenge: A global chemicals firm was looking to automate and simplify an invoicing and payments process within an enormous and very complex supply chain. The firm was already able to automate about 70% of its invoicing with its internal software, but it was unable to adapt to different regions and environments, creating a lack of competitiveness and weakness in its market expansion.

How They Did It: The company implemented a process that captured real-time data throughout the supply chain network, touching on both internal and supplier data sources. A combination of data analytics and machine learning were able

to identify processes that could be automated, as well as isolate process improvements that could be used to simplify and better audit the invoicing and payments system.

Results: The company was able to automate close to 94% of its invoice payment system, an impressive feat for a company of 100k+ employees. The company was also able to extend its already very effective automation focus, learning how to process and automate multiple kinds of invoices from various countries as well as how to process multiple currencies, significantly reducing risk and improving accuracy and responsiveness to its supplier network.



Case study: Payroll and Onboarding

Challenge: Front office processes are often overlooked in favor of core back office operational improvements. But the value of innovation in the front office can be significant. This global company was looking to leverage its experience in supply chain operations to similarly improve and automate its employee payroll and onboarding. In this case, it was looking to improve its overall operations by bringing value to its employees.

Leveraging machine learning to improve front office processes, by using the same rule-learning capacity employed by invoicing and payments systems to automate the employee payroll and onboarding experience.

How They Did It: It was clear that data would play a central role in this effort to transform its employee

experience. Both historical and real-time data, from both staff and existing databases, was captured and analyzed to identify processes that could be automated as well as improved. Machine learning was used to improve the automation process and provide a level of effectiveness to both expected and unexpected events.

Results: The automation effort resulted in a streamlined payroll and onboarding process that was more efficient and provided more accurate services to both new and existing employees. With a significant portion of the system automated, employees realized a greater level of transparency and predictability, which ultimately led to a measurable improvement in overall employee satisfaction.



Case study: Creating Consumer Solutions

Challenge: As consumers have adopted social and digital technologies, the types of products, services, and outcomes sought have changed considerably, as has the ability for producers to reach the consumer directly. A large chemical company, specializing in paints and waterproofing products, was looking to differentiate itself in the market and open new revenue streams. The challenge was in understanding consumer requirements and adapting from a products-based company to a provider of consumer-centric services.

How They Did It: In order to understand and engage with the consumer, the company needed to transform its extended value chain and better gather and utilize internal, partner, and consumer data. Every step, from understanding consumer needs, to product development and manufacturing, to sales and consumer delivery needed to be part

of the same digital ecosystem. Leveraging a cloud-based platform, massive amounts of data from suppliers, manufacturing and IoT devices, and consumers was collected and analyzed, providing the insights the company needed to connect all stakeholders in a single digital ecosystem and drive core business innovation.

Results: By creating a shared digital ecosystem, the company was able shift from a batch product approach to a more flexible process that included both supplier and consumer requirements in real-time. By precisely targeting consumers with personalized offers, and leveraging its new connected supply chain and nationwide network of over 45,000 retailers, it was able to transform its core business from selling paints to delivering customized product and services solutions that drove specific consumer outcomes.



The Common Thread

Each of these companies addressed a targeted need with a broad-based solution that involved the application of technology and data in a targeted approach, but yielded changes in business processes that resulted in value being extended

throughout the ecosystem. With this approach, these companies were able to extend the value of innovations developed in one area to others, transforming core business operations in the process.

TAKING THE NEXT STEPS

The most intelligent adaptations are those born not just of finding the right bundle of solutions, but of applying the most cost-effective advancements in the order in which they make sense. Even in similar industries, the solutions may be different and happen at different paces. But key to all in the digital era is the ability to integrate the right technologies, a culture of innovation and business process improvement, and massive amounts of machine, market, and customer data to drive new business priorities.

With the right approach, *the system of record and system of innovation can be integrated, not run as silos.*

As chemical companies begin, or continue, the move towards a digital market, there are a series of questions that must be answered:

- What part of the business is the most core? How can that core business be improved to better differentiate the company?
- How can the business remove human bias and errors, and leverage existing data to make better products and drive smarter business decisions?
- How can running a sensor-fed virtual digital twin of equipment in the field allow for more accurate maintenance and operational modeling?
- How can a company apply design thinking to help determine where and how to invest to unlock business value?
- How can the ability to truly understand the current and emerging behaviors of customers inform the next generation of business processes?
- What is required to bring together the right mix of designers, business transformation specialists, industry experts, and technology consultants to help uncover and develop strategic opportunities for business transformation?



Perhaps the most significant question, however, involves the value of innovation—is there a mechanism to both leverage individual innovation project across the business and drive innovation and value within the core business itself?

Getting Started

For digital transformation and innovation to take place, it's critical for businesses to understand where they are on the digital innovation journey, and recognize that most innovation strategies fail if they are not on the right path at the right time. Success in digital innovation for one firm may not be the same as for another, even a direct competitor. **The question may not be one of how to begin a digital innovation strategy, but rather how to ensure your current digital innovation strategy is successful.**

Never before have there been so many promising breakthrough technologies available — and so many businesses ready to capitalize on them. From machine learning to blockchain, from cloud to the Internet of Things, smart devices, analytics, and more, business is changing slower today than it ever will and faster than it ever has been.



CONTACT INFORMATION

Futurum Research, LLC

futurumresearch.com

817-480-3038

info@futurumresearch.com

Twitter: @futurumxyz